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Compherensive Study on the Impact of Microplastic's on Wildlife: A Review

Abhishek Kumar Sharma, Assistant Professor Dr Amrita Lal, Ram Deepak
Department of Environmental Studies,
Dr. Shyama Prasad Mukherjee University, Ranchi

Abstract- Micro plastics have become one of the most pressing threats to our planet's biodiversity due to their ubiquitous presence and detrimental effects on wildlife. Micro plastics are microscopic plastic fibres or fragments that can be seen in aquatic and fragile ecosystems like wetlands anywhere from polar to coastal waters. Studies show that micro plastics are ingested by various organisms and cause physical, physiological as well as teratogenic harm even as they may transfer toxins via the food web. The objectives of this research include further insight into the impacts and methods to curb micro plastic pollution on marine life. The purpose of the study is to find knowledge through a detailed analysis of the work done till date as well as through literature review on ecological impacts related to micro plastic and wildlife.

Keywords- Microplastics, Wildlife, Fibres, Toxin, Food Web, Waste Management.

I. INTRODUCTION

Plastic production and consumption have increased geometrically in the last few decades thus leading to a higher plastic pollution level across the globe. The significant raise in plastic waste has majorly become an environment concern because of the detrimental effects on the animals (Sarkar, Diab and Thompson, 2023). As per the environmental theory the plastic waste under the effect of environmental degradation and weathering over time break down into smaller fragments, these fragments are known to be as microplastics that measure less than 5mm in length are widespread in terrestrial and aquatic environments around the world including oceans, rivers, lakes and air. (Thompson et al., 2004). Two main forms of microplastics arise; they are created intentionally at the micro scale, such as the microbeads included in personal care beauty products, or they develop through the disintegration of abandoned plastic debris. But with microplastics now present in large quantities on both land and sea are an ailing topic with much recent scientific attention. The contamination is not just limited to the ecosystem or environment but it umbrellas a numerous animals sustaining in these environments. These micro plastic have wide range for the routes of exposure and have shown acute and chronic health outcomes on wildlife in our plastic - polluted globe

II. METHODOLOGY

This review paper is written by critically analysing previous studies and research articles concerning the effect of microplastics on the wildlife. The literature review was done online via databases such as Google Scholar, JSTOR, Science Direct, and PubMed. The keyword search that was used for this review include 'microplastics,' 'wildlife,' 'plastic pollution,' 'marine animals,' and 'ingestion.' The studies published within the last decade were selected in order to receive the most updated and relevant information. The reviewed mentioned studies were analysed to establish common themes and patterns that complies with the paper theme that is: "Compherensive Study on the Impact of Microplastic's on Wildlife: A Review".

III. RESULTS

1. Sources of Microplastics

Microplastics can be found in various forms, including microbeads, microfibers, and microplastic fragments. The main sources of microplastics include the depolymerisation of larger plastic items, such as bottles and bags, industrial processes, and the use of personal care products (Gall and Thompson, 2015). These microscopic to macroscopic fibres, films or fragments and foams make their way into the environment through different pathways, such as wastewater treatment plants, Agricultural runoffs, and wind dispersion as well as due to the dispersion of wild animals or their immigration or emigration into the new territory. One of the key findings suggests that the synthetic clothing such as polyester and nylon are a major contributor towards microplastics pollution in the environment. Whenever synthetic fabrics are laundered, microfibers are released into the water and may infiltrate or percolate directly into groundwater systems or travel through river systems and eventually make their way into seas and other larger bodies of water. These microfibers are microscopic in size and are often mistaken as food by marine animals, leading to ingestion. Once ingested, microfibers have the potential to bio-accumulate as well as bio-transform into more lethal form in animal tissues, causing serious health issues over time. A recent study found that a single fleece jacket can release up to 250,000 microfibers in one wash, highlighting the significant impact of synthetic clothing on the environment (Zhang et al., 2018). Another major source of microplastics pollution in oceans are abandoned, lost or discarded fishing gear, also known as "ghost gear." Such gear is constructed using nylon and polyester materials that can take hundreds of years to fully decompose or depolymerize into small fragments, fibres and beads. As ghost gear breaks down in the ocean, it releases small fragments of plastic in different morphological shapes and sizes directly into marine ecosystems. These depolymerised particles are often mistaken as food by the turtles and seals and are ingested by these marine animals, sometimes they get encapsuled by the same leading to entanglement and death from starvation (O'Neil and Kieran, 2017).

Distribution of Microplastics

The distribution of microplastics in the environment is widespread and can be found across all habitat types, including marine, freshwater, and terrestrial environments as well as blue carbon ecosystem like wetland (Zhang et al., 2023). Research conducted by (Thompson et al., 2004) estimated that there are approximately 5.25 trillion plastic particles weighing over 250,000 tons currently present in the world's oceans alone. The dispersion of microplastics throughout the environment also varies depending on the particular type and size of the particles involved. For example, microbeads are more commonly encountered in freshwater settings, whereas microfibers are prevalent in marine environments (Eerkes, Thomson and Aldridge, 2015). Meanwhile, plastic fragments dominate both terrestrial ecosystems as well as deep sediment layers.

This pollution from microplastics has raised serious concerns due to their near-permanent presence in the natural world and regular interaction with wildlife. Their small size allows microplastics to more easily enter the food chain through accidental ingestion. Further research continues to improve our understanding of both the dispersion patterns of microplastic pollution across different ecosystems and its potential impacts on environmental and human health over the long term. Improved waste management and public education initiatives represent important steps toward reducing the quantity of microplastics released into the biosphere on an annual basis.

IV. EFFECTS ON WILDLIFE

The rate of microplastics in the aquatic surrounding has been studied to be associated with negative impacts of several species of whole life (Eerkes, Thomson and Aldridge, 2015). A common effect is visible wound from entanglement while swimming into the opened fishing nets discarded in the ocean (Gall and Thompson, 2015). The most vulnerable to death among marine animals are seals and sea

turtles because they often get trapped in plastic waste causing severe injuries. The intake of these fragments of micro plastic is also a cause for a great worry since it usually causes clogging of the digestive tract, reduced nutrient absorption and most certainly death cannot be ruled out (Fackelmann et al., 2023). It has indicated in a paper by (Rochman et al.,2015) that microplastic can accumulate in the tissues of marine organism, evoking physiological and psychological negative effects on their health and survival. Microplastics have also been known to interfere with biogeochemical cycles such as nutrient cycling and it has also been proved to create problems with regard to such relations as the prey and predatory relationship, food chain, food web and energy flow. Being small, however, they are often mistaken for food by so-called filter-feeders such as zooplankton or mussels mainly belonging to the Protozoa and Bivalvia classes which picks them and that way they enter the food chain (Cole et al., 2011). Ingestion of fragments, fibres or beads also causes bioaccumulation as well as biotransformation; this is where particles accumulate in organisms' tissue with time and transform with the nutrients into more lethal compounds inside the cell altering normal body dynamics hence chronic health effects . The harmful impact of microplastics is clearly visible, in land dwelling animals like birds, worms, molluscs and various other species (Browne et al., 2008). These creatures are particularly vulnerable to pollution as they can be exposed to it through ingestion, inhalation or skin contact. The presence of these plastic particles can cause harm and damage cells in wildlife leading to problems such as blockages in the digestive system changes in nutrient absorption at the cellular level respiratory disorders and disruption of hormone regulation within their biological systems (Rochman, et al., 2015). Apart from the effects the existence of microscopic plastic particles in terrestrial environments can also have ecological consequences. Some birds and mammals have been found to incorporate these fragments and fibres of plastic into their nests. These particles may accumulate in tissues. Could even act as carriers, for harmful pollutants that can impact soil and water quality ultimately affecting entire land and ocean ecosystems (Cole et al., 2011).

V. DISCUSSION

The impact of microplastics on wildlife is a complex issue which can lead to reproductive sterility and it requires immediate attention (Jewett et al., 2022). The widespread distribution of microplastics in the environment and their harmful effects on wildlife highlight the need for urgent action to address this problem. One of the most effective solutions is to reduce the production and consumption of single-use plastic products, which are a major source of microplastics. Implementing strict regulations on the use and disposal of plastics, as well as promoting more sustainable alternatives, can help reduce the amount of plastic waste in the environment. In addition, proper waste management and recycling practices can also play a significant role in reducing the amount of plastic waste that ends up in the environment (Zheng et al., 2022). This includes increasing the awareness and education of the public on the proper disposal of plastic waste and promoting recycling programs. Furthermore, the development of innovative technologies, such as biodegradable plastics, can also help reduce the impact of microplastics on wildlife.

VI. CONCLUSION

Microplastics impact on wildlife is an extremely complicated issue and it demands attention (Susanti, Mardiastuti and Wardiatno, 2020).The widespread presence of microplastics in our environment and the disastrous effects they have on wildlife emphasize the need to do something about it (Thompson et al., 2004). One viable strategy is reducing the manufacture and utilization of single use plastic products because they majorly contribute to microplastics emission. In summary, the effects of microplastics on wildlife are a complicated and an urgent issue that should be addressed today. The fact that microplastics are everywhere in nature and the damage they do to wildlife illustrates the problem we all need to work together to solve it. Proper management of the

waste, recycling, and creation of sustainable alternatives will minimize the plastic waste in the environment and limit the effects of microplastics on wildlife. By preserving wildlife and their habitats, we aim to ensure the future of our plan (Hung et al., 2021).

Statement

During the preparation of this work the authors used CONNECTED PAPERS in order to do a thorough LITRATURE REVIEW. After using this, tool the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

REFERENCES

1. Sarkar, S., Diab, H. and Thompson, J., 2023. Microplastic Pollution: Chemical Characterization and Impact on Wildlife. International Journal of Environmental Research and Public Health, 20(3), p.1745.
2. Zhang, T., Sun, Z., Liu, Y., Song, K. and Feng, Z., 2023. Occurrence of microplastic pollution in coastal wetlands—A typical rare wildlife sanctuary in China. Regional Studies in Marine Science, 67, p.103176.
3. Cordova, M.R., Ulumuddin, Y.I., Purbonegoro, T., Puspitasari, R., Rositasari, R., Yogaswara, D., Kaisupy, M.T., Wibowo, S.P.A., Subandi, R., Sani, S.Y. and Sulistiowati, S., 2024. Abundance and characterization of microplastic pollution in the wildlife reserve, Ramsar site, recreational areas, and national park in northern Jakarta and Kepulauan Seribu, Indonesia. Chemosphere, 348, p.140761.
4. Hung, C., Klasios, N., Zhu, X., Sedlak, M., Sutton, R. and Rochman, C.M., 2021. Methods matter: methods for sampling microplastic and other anthropogenic particles and their implications for monitoring and ecological risk assessment. Integrated environmental assessment and management, 17(1), pp.282-291.
5. Fackelmann, G., Pham, C.K., Rodríguez, Y., Mallory, M.L., Provencher, J.F., Baak, J.E. and Sommer, S., 2023. Current levels of microplastic pollution impact wild seabird gut microbiomes. Nature Ecology & Evolution, 7(5), pp.698-706.
6. Wu, C., Zhang, K. and Xiong, X., 2018. Microplastic pollution in inland waters focusing on Asia. Freshwater microplastics: emerging environmental contaminants? pp.85-99.
7. Browne, M.A., Dissanayake, A., Galloway, T.S., Lowe, D.M. and Thompson, R.C., 2008. Ingested microscopic plastic translocates to the circulatory system of the mussel, Mytilus edulis (L.). Environmental science & technology, 42(13), pp.5026-5031.
8. Jewett, E., Arnott, G., Connolly, L., Vasudevan, N. and Kevei, E., 2022. Microplastics and their impact on reproduction—can we learn from the C. elegans model? Frontiers in toxicology, 4, p.748912.
9. Bilal, M., Ul Hassan, H., Taj, M., Rafiq, N., Nabi, G., Ali, A., Gabol, K., Shah, M.I.A., Ghaffar, R.A., Sohail, M. and Arai, T., 2023. Biological Magnification of Microplastics: A Look at the Induced Reproductive Toxicity from Simple Invertebrates to Complex Vertebrates. Water, 15(15), p.2831.
10. Susanti, N.K.Y., Mardiastuti, A. and Wardiatno, Y., 2020, July. Microplastics and the impact of plastic on wildlife: a literature review. In IOP Conference Series: Earth and Environmental Science (Vol. 528, No. 1, p. 012013). IOP Publishing.
11. Susanti, N.K.Y., Mardiastuti, A. and Wardiatno, Y., 2020, July. Microplastics and the impact of plastic on wildlife: a literature review. In IOP Conference Series: Earth and Environmental Science (Vol. 528, No. 1, p. 012013). IOP Publishing.
12. Zheng, X., Wu, X., Zheng, Q., Mai, B.X. and Qiu, R., 2022. Transfer of Microplastics in Terrestrial and Aquatic Food Webs: The Impact of E-Waste Debris and Ecological Traits. Environmental Science & Technology, 57(3), pp.1300-1308.
13. Badola, N., Sobhan, F. and Chauhan, J.S., 2023. Microplastics in the River Ganga and its fishes: Study of a Himalayan River. Science of The Total Environment, 901, p.165924.
14. Cole, M., Lindeque, P., Halsband, C., and Galloway, T.S. (2011) Microplastics as contaminants in the marine environment: A review. Marine Pollution Bulletin, 62(12), 2588-2597.

15. Eerkes-Medrano, D., Thompson, R.C., and Aldridge, D.C. (2015) Microplastics in freshwater systems: A review of the emerging threats, identification of knowledge gaps and prioritization of research needs. Water Research, 75, 63-82.
16. Gall, S.C., and Thompson, R.C. (2015) The impact of debris on marine life. Marine Pollution Bulletin, 92(1-2), 170-179.
17. Rochman, C.M., Hoh, E., Kurobe, T., and Teh, S.J. (2015) Ingested plastic transfers hazardous chemicals to fish and induces hepatic stress. Scientific Reports, 5(1), 1-7.
18. Thompson, R.C., Moore, C.J., Vom Saal, F.S., and Swan, S.H. (2004) Plastics, the environment and human health: Current consensus and future trends. Philosophical Transactions of The Royal Society B, 364(1526), 2153-2166.
19. O'Neil, Kieran. (2017). Bioaccumulative and Toxic Effects of Ingested Clean and PBT-Saturated Microplastics on Oryzias latipes (Japanese Medaka Fish): Method Development towards Physiological and Chemical Analysis. Sound Ideas. https://jstor.org/stable/community.36514084