



**Biotica
Research**

Today

**Vol 2:7 635
2020 637**

Microplastics in Seafood - A Tenet of Hazard

Lloyd Chrispin C.^{1*}, Sujithira R.² and Velmurugan P.³

¹Dept. of Fisheries Extension, Economics and Statistics, Dr. M.G.R Fisheries College and Research Institute, Ponneri, Tamil Nadu Dr. J Jayalalithaa Fisheries University, Tamil Nadu (601 204), India

²Dr. M.G.R Fisheries College and Research Institute, Ponneri, Tamil Nadu Dr. J Jayalalithaa Fisheries University, Tamil Nadu (601 204), India

³Kanniyakumari Parakkai Centre for Sustainable Aquaculture, Parakkai, Tamil Nadu Dr. J Jayalalithaa Fisheries University, Tamil Nadu (629 601), India

 Open Access

Corresponding Author

Lloyd Chrispin C
e-mail: lloyd@tnfu.ac.in

Keywords

Environment, Microplastics, Pollution, Seafood

Article History

Received in 19th July 2020

Received in revised form 25th July 2020

Accepted in final form 26th July 2020

E-mail: bioticapublications@gmail.com

How to cite this article?

Chrispin *et al.*, 2020. Microplastics in Seafood - A Tenet of Hazard. Research Today 2(7): 635-637.

Abstract

Approximately 80 million tons of plastic end up in marine ecosystem every year and cause significant damages to the organisms dependent on it for survival. These debris breakdowns into smaller particles called microplastics which are capable of absorbing high concentration of toxins. Generally, two types of microplastics namely primary and secondary are accumulating in the marine environment through terrestrial run off and coastal dumping. These microplastics when consumed by smaller organisms of the ocean move to all habitats through food web which put human and marine organisms under high risk of danger. Over a course of ten years of scientific exploration, only eleven chemical substituents are identified from the 10 million substances as the source of microplastics polluting marine environment. This article attempts to throw insight on exposure of microplastics in seafood and their consecutive impacts on humans.

Introduction

All living organism contain a large proportion of water, therefore life without water is quite unimaginable. Dumping of any kind of waste in the ocean become serious environmental concerns in all part of the ocean and terrestrial ecosystem. Ocean is playing key role in keeping all kind of ecosystem in appropriate condition. In the past few decades, elevation of microplastics contamination has spread over significantly in the marine habitat like surface water, sea floor, near beach, sediments and even throughout different levels of water column. The microplastics mainly comprise of polyvinyl chloride, polypropylene, polyvinyl alcohol, poly amide, polystyrene etc. Generally these kind of synthetic materials are more resistant to degradation by the microorganism and therefore such materials persist to exist in the aquatic environment. After breakdown of these plastics into small particles or debris are called as microplastics. Microplastics are nothing but small pieces of plastic fragments that are lesser than 5 mm length (Barnes *et al.*, 2009) they are even smaller up to 0.1 micrometer. Plastics are usually trashed on the ground and ocean where they are usually disintegrated by heat, wind and waves. They are usually of two types, primary and secondary. Primary microplastics are intentionally manufactured in industries and are used in various applications like, in factories they are used as basic materials, used in cosmetic (Leslie, 2014) and soap production. Secondary microplastics are formed by degradation and disintegration of primary microplastics. Smaller the particle, harder they are to get filtered with the treatment plants. It is a magnet for toxins, chemicals and even microorganisms. Fishes confuse them for smaller food particles and consume them as food. Through food chain, these plastics finally reach our plates. Not only through these but the water, salt, honey,

everything we intake has a small amount of microplastics in it.



Figure 1: Plastic bag entangling Green sea turtle. (Photo Courtesy: Troy Mayne / WWF)

Microplastics in Marine World

Now a day's constantly increasing and emerging pollutant is microplastic pollution and that affects sea and coastal environment. This plastic debris are found and distributed across the globe from southern hemisphere to northern hemisphere. More importantly, small particles get easily ingested by vertebrate and invertebrate, tiny organism (copepods, luck worm, zooplankton), bivalve etc. These

ingested tiny plastics can cause reproductive failure, changes in physiological function, reduced growth rate, failure in enzyme production to certain marine organisms. The contamination travels to other food webs too, resulting in a wholesome catastrophic effect in the entire marine ecosystem. It is found that 67% of plastic pollution of oceans comes from 20 famous rivers of Asia. However, the Pacific, the Bay of Bengal and the Mediterranean Sea are noted to have the highest concentrations of plastics (Sharma & Chatterjee, 2017).



Figure 2: Plastic garbage dumped in the coast.(Photo Courtesy: Sharma, S., & Chatterjee, S., 2017)

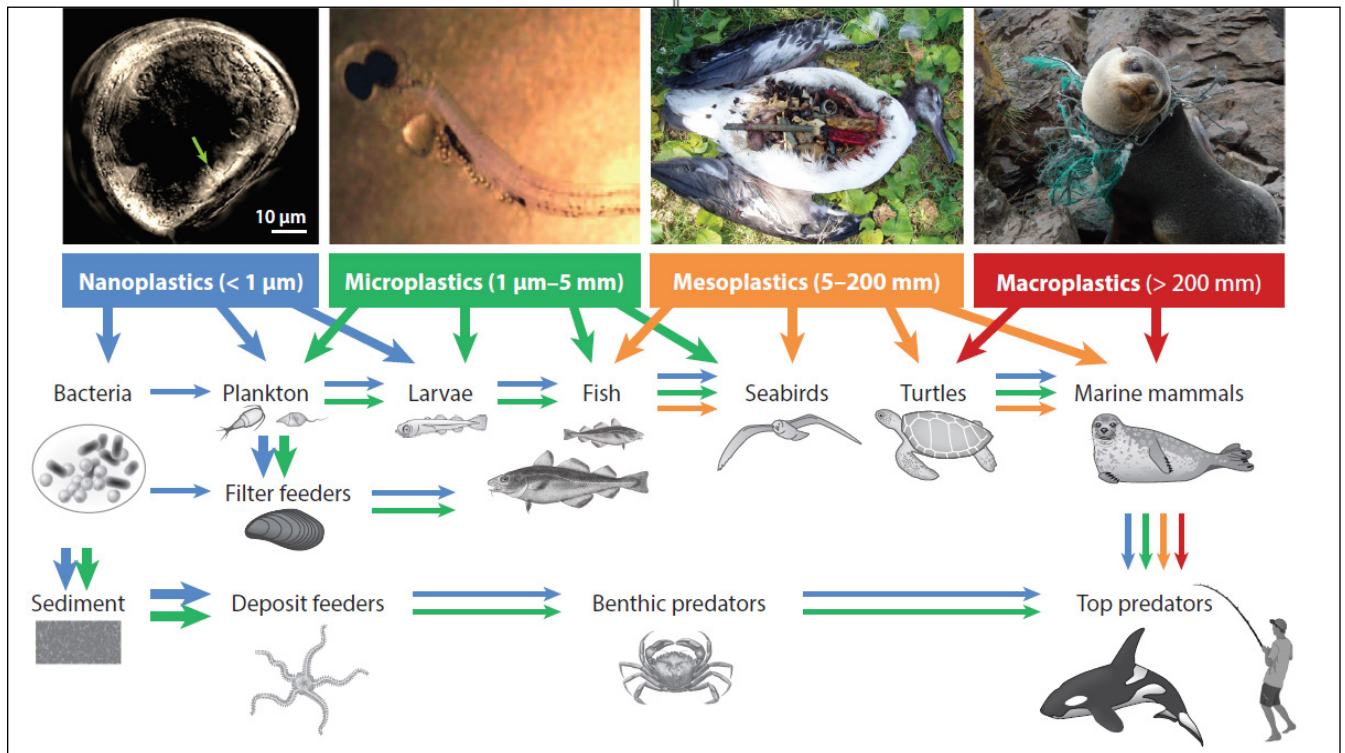


Figure 3: Trophic transfer of plastic pollutants in marine food webs.(Source: <https://doi.org/10.1146/annurev-environ-102016-060700>)

Due to poor waste management and global level failure to impose regulation for proper plastic management, microplastics get easily accumulated in various levels of different ecosystem. Especially from the beaches, these plastic stuffs are transported with currents and wind all over the world. It is estimated that about 5 trillion plastic pieces of different sizes are floating in the oceans today. Highest intake of plastics is reported in cage culture of various marine organisms. Whereas, half of the commercially important marine species (nearly 220 species) are found to intake these plastics. It has to be noted that humans are exposed to microplastics mainly through their meal. It is prominent mostly in shellfish consumers. It is proven that when we consume an average of 250 gm mussel, we consume 90 microplastic particles. If we consume 6 oysters (100 gm), we consume 50 particles.

Ingestion in Fishes

The ocean food web begins with primary producer that is plankton. Few studies reported that microplastics have been accumulated in the body of certain primary consumers (ex. Zooplankton). When the small fishes feed on these primary consumers, microplastics enter their body and there are some fishes which ingest the microplastics directly by mistakenly considering them as plankton. This rattles the entire food web. In early 1970's, fishes were observed to consume few polystyrene particles. This plastic ingestion may be intentionally (mistaken as food) or accidentally (through prey or by filter feeding). Fishes exposed to microplastics are known to have physical damage, problems in gastro intestinal tract and excretion. This affects the ability of their buoyancy control, causes internal ulceration, blockage of the digestive system resulting in starvation. Rarely, some microplastic particles move along the gastro intestinal parts and are excreted without any sign of accumulation. But some microplastics of 150 micrometer size are observed to cross the cell membrane causing internal exposure.

Effects in Humans

Presence of microplastics in human meal and even in the air we breathe is being examined by global scientific fraternity. Either by inhalation or ingestion these microplastics accumulate in our human body and exert toxicity by inducing or enhancing our immune system. Usually humans with intake of microplastic particles are seen highly prone to cancer, they get alternations in their DNA & RNA. They also have adverse effects in the human reproductive system. BisphenolA (BPA) causes cardiovascular disease, type 2 diabetes, and abnormalities in liver enzymes. TetrabromobisphenolA (TBBPA), which is used in manufacture of plastics, is found to disrupt the thyroid hormones balance, pituitary function and fertility in humans. Polyvinyl chloride (PVC) leaches out toxic chemicals

when it comes in contact with water.

Treatment for Microplastics

To achieve a plastic free environment, importance should be given to preventive measures that can decrease the marine litter and the microplastics in the ocean. Lack of adequate technology to filter such smaller particles is a challenge. Blocking the sources of plastic is also considered as an effective method. For removal of microplastics, Conventional Activate Sludge (CAS) is being practised nowadays. It includes primary and secondary treatment which also includes the biological treatment in it. This system removes 99% of the particulates in the water. High removal of plastics in small wastewater treatment plants is seen. Even high removal of plastics will cause small quantities to discharge into water bodies and they would cause harmful consequences to the environment. So it is in our hand to reduce the usage of plastics by using treatment plants before dumping it into ocean.

Conclusion

Microplastic pollutant causes significant negative impact to various aquatic animals and consequently to humans in many ways. Some of recent studies revealed that persistence of microplastic will continue to increase by the year 2050, which would lead to decrease the living resource in ocean. Prevention and possible management measurement is the need of the hour to stop the entry of plastics into aquatic environment in following ways such as reduction in usage of quantity of plastics, producing recyclable plastics and adhering to proper plastic disposal ability. More importantly, establishing exclusive research consortium on plastics to identify or recognize the original source and to isolate microorganisms (e.g. beneficial bacteria) for microplastic degradation through ecofriendly approach. In addition to the aforesaid measures, practice and adoption of '4R' principle: Reduce, Reuse, Recycle and Recover. Above all, humans should never forget that this environment is shared by other living organisms too. Therefore, the more we stress the importance of minimized plastic free environment; a healthy society can be ensured in future.

References

- Barnes, D.K.A., Walters, A., Gonçalves, L., 2010. Macroplastics at sea around Antarctica. *Marine Environmental Research* 70, 250–252.
- Leslie, H. A., 2014. Review of microplastics in cosmetics. *IVM Institute for Environmental Studies*, 476, 1-33.
- Sharma, S., Chatterjee, S., 2017. Microplastic pollution, a threat to marine ecosystem and human health: a short review. *Environmental Science and Pollution Research*, 24(27), 21530-21547.