Int.J.Curr.Microbiol.App.Sci (2019) *8*(7): 1549-1555

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 8 Number 07 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.807.184

Assessment of Marine Litter Based on Tide along Juhu Beach

S. Manickavasagam[1*], P. Chellamanimegalai[2] and M. Dhayanath[2]

[1]ESSO-Indian National Centre for Ocean Information Services, Hyderabad, India
[2]ICAR- Central Institute of Fisheries Education, Mumbai-400061, India

**Corresponding author*

Keywords

Marine litter, Plastic, Tide, Pollution

Article Info

Accepted:
12 June 2019
Available Online:
10 July 2019

A B S T R A C T

In above perspective, present study aimed to quantify the different types of litter and Juhu beach, Mumbai. Marine litter especially plastic waste collected and assessed during the months of February 2018. Quantification was done on weight basis, total quantity and the quantities of segregated plastic were recorded by weighing the material. The results showed that a significant higher number and weight of marine litter was collected during ebb tide period in comparison to flood tide. The study will provide to control future marine litter pollution in marine environment.

Introduction

Marine litter can be defined as any persistent solid material that was manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment (NOAA, 2010). Plastics make up the major proportion in the assessment of overall litter pollution in different marine regions by weight and number (Pham *et al.*, 2014; Kusui and Noda, 2003). Plastic material is recognized as distressing pollutants entering into the marine environment by International Convention on Pollution from Ships (MARPOL) and it is considered as a major global hazard with adverse impacts on marine biodiversity as well as on human livelihoods and economy (Derraik, 2002). Improper waste management in developing countries resulted in considerable quantities of plastics contaminating the beaches (Ryan *et al.*, 2009). Saline environments and low temperature of the sea reduces the degradation rate results in higher environmental persistence of plastics (Gregory, 1999; Barnes *et al.*, 2009).

Land-based sources such as municipal landfills (waste dumps) located on the coast; riverine transport of waste from landfills and other sources; discharges of untreated municipal sewage and storm water; medical waste; and tourism (recreational visitors, beach-goers) are responsible for 70–80% of the plastics in the marine environment (Sheavly, 2005; UNEP, 2005).

Production status of plastic in India is 22 MnTPA (million tons per annum) and per capita plastic consumption in India is 11kg and world is 28 kg (FICCI, 2017). Since 1964, plastics production has increased twenty-fold, reaching 311 million tons in 2014, and again in 20 years, it is expected to double and almost quadruple by 2050 (WEF, 2016). The quantification of debris on beaches is considered as the most common method of assessing the strain located on the marine environment and has been the primary tool for measuring the load of marine debris in coastal and marine systems (Kiessling, 2003).

The Bombay municipal corporation (BMC) environment Status Report for 2013-14 shows that plastic accounts for around 675 MT of the total daily waste generated in that year. For instance in 2010-11, 10 % (650 MT) of the total, 6500 MT of garbage generated was plastic which dipped the following year to 9 % or 630 MT of the 7000 MT of garbage generated. In 2013-14 plastic accounted for 9 %, it has increased in absolute terms as the total waste generated was considerably higher. These methods of sampling mainly involve the collection and quantification of the materials settled on the beach. Keeping in view of this, the objectives of the present study were to quantify the types and amounts of litter on Juhu beach of Mumbai and to determine if there are differences in the abundance and size fractions of litters. This survey also constitutes a pilot study to provide data to further studies.

Materials and Methods

Juhu beach of Mumbai having wide geographical coverage and forms a major out let for domestic sewage was selected as study area (Fig. 1). Marine litter materials having size greater than 2.5 cm were collected in plastic bags following method by Lippiatt *et al.*, (2013). In total 3 sampling was carried out during experimental period of February 2018.The sampling was carried out during the ebb tide time for easy collection of samples. The tide predictions were obtained from Maharashtra state non-major port tide tables for 2018.The collected samples were recovered, washed with freshwater to remove salt and were properly sundried.

In this study, litter collected by hand and collection and removal of plastic and marine (or riverine) debris from channel. Characterization of plastics and marine debris was done according to standard protocol of Lippiatt (2013). The quantification of various categories marine debris was done on basis of weight and numbers of individual type. The weight and length of the particulars were measured using analytical balance and scales to nearest millimeter and the longest axis was according to the structure of the particles and segregation was also carried out. The particles were classified as micro (<5mm), meso (5-20mm), macro (21-100mm) and mega (> 100mm) (Stevenson, 2011; Barnes *et al.*, 2009). The collected samples were washed with freshwater to remove salt and were properly sundried. The collected marine and plastic debris (<5mm) were dried and quantified in terms of number and weight (g). MS Excel was carried out to analyze the catchment of marine litter during ebb tide and flood tide.

Results and Discussion

Assessment of marine litter in the Juhu beach

Marine litter were collected and analyzed quantitatively for various categories of marine debris and plastic materials. The collected marine litter was segregated and classified into seven major categories namely plastic items, metal, glass, rubber items, processed lumber, cloth/fabric and miscellaneous. The seven major categories were further divided into

different sub-categories such as food wrappers, plastic containers, plastic bottle caps, thermocole (expanded polystyrene), thermocole plates (styrofoam), plastic cover/bags, plastic floats, fishing lure and lines, plastic glass/cups, plastic utensils, personal care products, glass fragments, beverage bottles, aluminium cans, metal fragments, flip flops, rubber gloves, cardboard cartons, lumber/building material, cloth, rope (non- nylon), fabric pieces, flower, home waste and others. The collected samples were recorded in terms of number of items, length and weight.

Quantification

It was observed that residential areas, near Juhu –Danda are the major sources of marine pollution. Waste materials enter into the Juhu beach through different non-point sources. The domestic sewage channels near sampling station often carry a lot of garbage in the form of plastic bottles, plastic cover/bags, fishing materials, beverage bottles and aluminum cans etc. into the channel especially during weekends.

A total of 989 pieces falling in seven major category and different sub-categories of marine debris groups were collected during first month period of sampling conducted along South Juhu water channel February 2018. The total weight of the marine debris recorded in field trial sampling was 59.98 kg.

The marine debris abundance of first, second and third sampling by count of 269, 232 and 488 and by weight of 10.09 kg, 12.23 kg and 37.65 kg, respectively. The highest abundance of marine debris by count and weight was found in third field trial sampling was 488 and 37.65 kg. The lowest abundance of marine debris by count in second field trial sampling and weight in first field trial sampling was 232 and 10.09 kg (Fig. 2).

The present study shows the quantity of marine litter along Juhu beach of Mumbai. It was observed that residential areas, fishing community near Juhu –Danda are the major sources of marine pollution. Waste materials enter into the South Juhu channel through different non-point sources. The domestic sewage channels near sampling station often carry a lot of garbage in the form of plastic bottles, plastic cover/bags, fishing materials, beverage bottles and aluminum cans etc. into the channel especially during weekends. The study encompassing the period February 2018. The total collected 989 pieces and 59.98 kg of debris from the water flowing through the channel.

The materials included larger plastics, metal, glass, rubber items, processed lumber, and cloth/fabric etc. The litter in Juhu beach in march-april also suggests the spill-out from fishing vessel during fishing operations or discharge from the jetties (Jayasiri *et al.*, 2013). Similar studies on assessment of marine litter in different beaches along Indian coastline showed higher occurrence of plastics and marine debris in low tide (Ganesapandian *et al.,* 2011; Sulochanan *et al.,* 2011; Kumar *et al.,* 2016). Plastics materials such as carry bags, milk/oil bags, plastic bottles are major non-biodegradable solid waste are reported to be cause marine pollution along the thane and vasai creek in Mumbai (Singare, 2012).

The observations suggest that marine litter showed a significant difference in number and weight during ebb tide conditions. This ultimately leads to accumulation in sea which may gradually transform to microplastics with passage of time. Similar study on quantitative analysis of plastic debris in Mumbai, India showed that highest quantity of microplastics was reported in Juhu beach (55.33%) as compared to other recreational beaches and concluded that land based sources is the major cause of pollution (Jayasri *et al.,* 2013).

Fig.1 Study area with sampling locations along the Juhu beach, Mumbai

Fig.2 Marine debris composition in terms of number of items and weight (kg) during different sampling periods

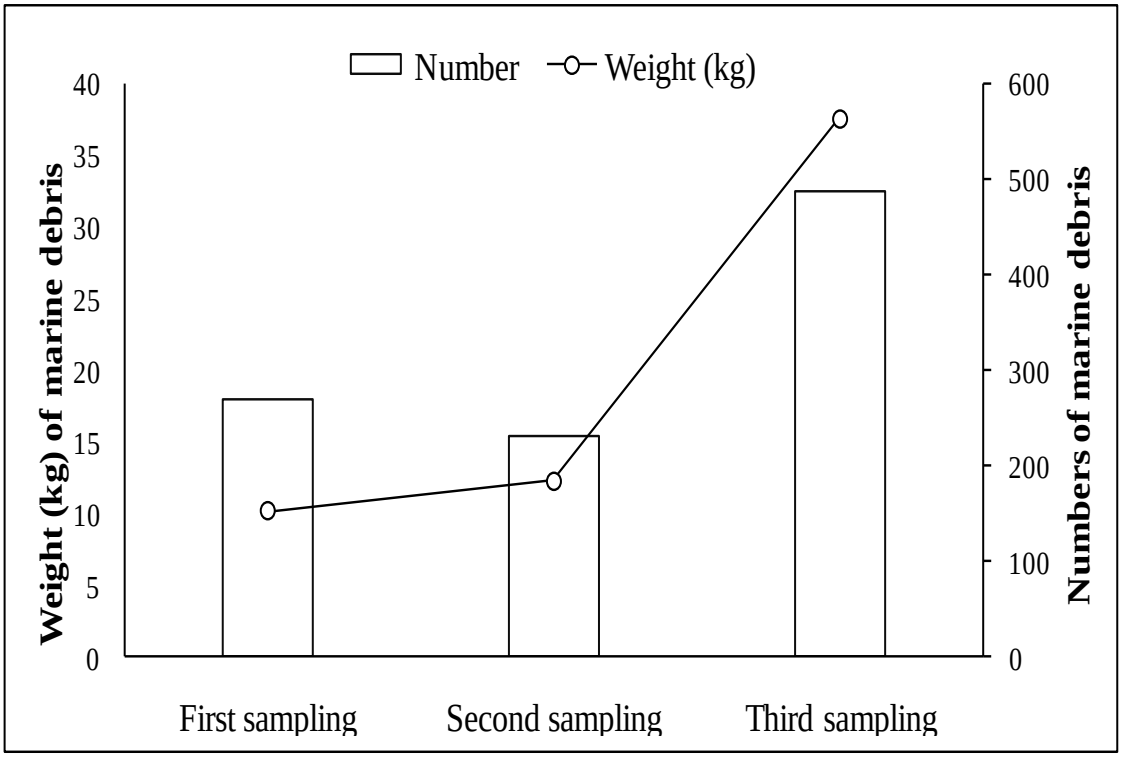

Fig.3 Marine litter collected during sampling periods

During spring tide phenomenon, that tide carry a lot of plastic debris from ocean which already entered into sea through different water channel, discarded from recreational area and discharges from fishing vessel. This happens due to earth's position between moon and sun in a straight line resulting in greatest dimension between highest high tide and lowest low tide. On the contrary, there is least distance between highest high tide and lowest low tide during neap tide due to position of sun, moon and earth at right angle to each other. Due to this, the maximum amount of debris collected during spring tide compared to neap tide.

The abundance of marine litter in marine environment is the result of excessive discharge and policy lacking. This study encompassing collection, assessment, segregation and quantification of the trash, domestic waste and plastic materials carried to the oceans. Further studies should be conducted to establish large-scale and long-term monitoring processes across several states which was closest to coastal. The data of this study will give information for future marine litter pollution control in oceans.

Acknowledgements

The authors are also thankful to Director & Vice-chancellor, ICAR-Central Institute of Fisheries Education (CIFE), Mumbai, and Head of Department, Aquatic Environment and Health Management Division, ICAR-CIFE, Mumbai for providing all possible facilities to complete this research work successfully.

References

Barnes, D. K. A., Galgani, F., Thompson, R.C. and Barlaz, M., 2009. Accumulation and fragmentation of plastic debris in global environments. *Philos. Trans. R. Soc. Lond., B, Biol. Sci.*, 364(1526): 1985–1998.

Browne, M. A., Galloway, T. S. and Thompson, R. C., 2010. Spatial patterns of plastic debris along estuarine shorelines. *Environ. Sci. Technol.*, 44(9): 3404–3409.

Derraik, J. G. B., 2002. The pollution of the marine environment by plastic debris: a review. *Mar. Pollut. Bull.*, 44(9): 842-852.

Galgani, F., Piha, H., Hanke, G., Werner, S. and GES MSFD group., 2011. Marine litter: Technical recommendations for the implementation of MSFD requirements. EUR 25009 EN, Luxembourg (Luxembourg): Publications Office of the European Union, pp. 45.

Ganesapandian, S., Manikandan, S. and Kumaraguru, A. K., 2011. Marine Litter in the Northern Part of Gulf of Mannar, Southeast Coast of India. *Int. Res. J. Environ. Sci.*, 5(5): 471-478.

Gregory, M. R., 1999. Plastics and South Pacific Island shores: environmental implications. *Ocean Coast. Manag.*, 42(6-7): 603–615.

Kaladharan, P., Vijayakumaran, K., Singh, V. V., Asha, P.S., Bindu Sulochanan, Asokan, P. K., Valsala, K. K., Veena, S., Jayasankaran, L. and Bhint, H. M., 2012. Assessment of certain Anthropogenic Interventions and their Impacts along the Indian Coastline. *Fish. Tech.*, 49: 32-37.

Karapetyan, M., 2012 Analyzing and Sampling Litter along Montlimar Canal.

Kiessling, I., 2003. Finding Solutions: Derelict Fishing Gear and Other Marine Debris in Northern Australia. A report for the National Oceans Office and Department of the Environment and Heritage, Key Centre for Tropical Wildlife Management, Charles Sturt University, pp. 58. Retrieved from http://www.environment.gov.au/system/files/resources/e4f285b6-6181-4c73-a510-8bc0ac0e2c0b/files/marine-debris-report.pdf

Kusui, T. and Noda, M., 2003. International survey on the distribution of stranded and buried litter on beaches along the Sea of Japan. *Marine Pollution Bulletin*, *47*(1-6), pp.175-179.

Lippiatt, S., Opfer, S. and Arthur, C., 2013. Marine Debris Monitoring and Assessment. NOAA Technical Memorandum NOS-OR&R-46, pp. 88.

NOAA, 2010. Information on Marine Debris. Retrieved from <http://marinedebris.noaa.gov/info/welcome.html.

Pham, C. K., Ramirez-Llodra, E., Alt, C. H. S., Amaro, T., Bergmann, M., Canals, M., Compan,y J. B., Davies, J., Duineveld, G., Galgani, F., Howell, K. L., Huvenne, V. A., Isidro, E., Jones, D. O., Lastras, G., Morato, T., Gomes-Pereira, J. N., Purser, A., Stewart, H., Tojeira, I., Tubau, X., Van Rooij, D. and Tyler, P. A., 2014. Marine litter distribution and density in European Seas, from the shelves to deep basins. *PLoS ONE*, 9(4): pp. 13.

Ryan, P. G., Moore, C. J., van Franeker, J.A. and Moloney, C.L., 2009. Monitoring the abundance of plastic debris in the marine environment. *Philos. Trans. R. Soc. Lond., B, Biol. Sci.*, 364: 1999–2012.

Singare, P.U., 2012. Study of some major non-biodegradable solid wastes along Thane Creek of Mumbai. *World Environment*, *2*(3): 24-30.

Stevenson, C., 2011. Plastic Debris in the California Marine Ecosystem: A Summary of Current Research, Solution Strategies and Data Gaps. University of Southern California Sea Grant. Synthetic Report. California Ocean Science Trust, Oakland, CA, pp. 23.

UNEP Regional Seas Programme, 2005. Marine Litter and Abandoned Fishing

Gear. Report to the Division of Ocean Affairs and the Law of the Sea, Office of Legal Affairs, UNHQ, by Regional Seas Coordinating Office, UNEP, Nairobi, Kenya, pp. 30.

Vennila, A., Jayasiri, H. B. and Pandey, P. K., 2014. Plastic debris in the coastal and marine ecosystem: a menace that needs concerted efforts. *Inter. Jour. Fisher. and Aquatic Studies*, 2(1): 24-29.

How to cite this article:

Manickavasagam, S., P. Chellamanimegalai and Dhayanath, M. 2019. Assessment of Marine Litter Based on Tide along Juhu Beach. *Int.J.Curr.Microbiol.App.Sci.* 8(07): 1549-1555.
doi: https://doi.org/10.20546/ijcmas.2019.807.184