

Unveiling Microplastic Pollution in Tropical Estuarine Waters: A Study from Negombo Estuary, Sri Lanka

N.M.I.U. Gunarathna^{1*}, S.R.C.N.K. Narangoda², W.M.D.N. Wijeyaratne¹

¹*Department of Zoology and Environmental Management, Faculty of Science, University of Kelaniya, Kelaniya, Sri Lanka.*

²*Environmental Studies Division, National Aquatic Resources Research and Development Agency (NARA), Crow Island, Colombo 01500, Sri Lanka.*

**ishani1999nm@gmail.com*

Microplastic (MP) pollution has emerged as a critical environmental concern, particularly in estuarine ecosystems due to their role as convergence zones for land-based, freshwater, and coastal inputs. This study assessed the abundance and diversity of MPs in surface water in Negombo Estuary, Sri Lanka. Water samples were collected from five selected sites representing different anthropogenic influence zones during two sampling events. Microplastics were extracted through digestion, density separation, and filtration, followed by visual identification under a stereomicroscope to characterize the MPs based on their abundance, size, shape, and colour. Two-way ANOVA followed by Tukey's test were performed to evaluate spatial and temporal variations. Results exhibited a widespread presence of MPs in all sampling locations, and significant temporal variation observed between two sampling rounds. However, no significant spatial variation was detected in overall abundance. The highest MP concentrations were recorded at Katunayake (210.0 ± 69.3 MPs/L) and at Dungalpitiya (138.30 ± 14.20 MPs/L) during the first and second sampling events respectively. These sites are subjected to intensive anthropogenic activities such as industrial effluent discharge, urban runoff, fishing activities, and tourism. Kadol Kale exhibited the lowest MPs abundance in both first (130.00 ± 23.60 MPs/L) and second (81.70 ± 11.70 MPs/L) sampling events. Fibers were the dominant microplastic shape, followed by fragments and films, indicating multiple pollution sources. The 1–3 mm size fraction was the most abundant category, indicating possible hydrodynamic influences. A variety of colours including black, blue, and red were observed, representing an array of sources, including urban waste and fishing applications. Overall, the findings highlight the dynamic nature of microplastic distribution in estuarine systems and emphasize the need for continuous and long-term monitoring and effective management strategies to mitigate plastic pollution.

Keywords: *Microplastics, Surface water, Negombo estuary, Spatiotemporal variation, Estuarine pollution*