Vertical Distribution and Characteristics of Soil Microplastics at the Accelerated Natural Regeneration of Mangroves (ANRM) Site in Anawilundawa, Sri Lanka

A.D.G. Hewage[1], P.M.W.S.R. Tissera[2], M.G.Y.L. Mahagamage[3], S. Jayakody[1], M.S. Ekanayake[1*]

[1]*Department of Aquaculture & Fisheries, Faculty of Livestock, Fisheries & Nutrition, Wayamba University of Sri Lanka, Gonawila (NWP), Sri Lanka.*
[2]*Wild Life and Nature Protection Society, Baththaramulla, Sri Lanka.*
[3]*Centre for Environmental Studies & Sustainable Development, The Open University of Sri Lanka, Nawala, Nugegoda, Sri Lanka.*
*manavi@wyb.ac.lk

Microplastic (MP) pollution is an emerging concern due to its persistence and ecological impacts. Mangroves are particularly vulnerable because of their dense roots, high sediment retention, and proximity to human activities. However, information on vertical MPs distribution in Sri Lankan mangroves are limited. This study assessed the abundance, vertical distribution, and morphology of MPs in soils from restored, degraded, and natural environments at the Accelerated Natural Regeneration of Mangroves (ANRM) site at Anawilundawa, Sri Lanka., Soil samples were collected at 10 locations, with triplicate samples at four depth intervals viz., (0-15, 15-30, 30-50, and 50-100 cm). MPs were extracted using density separation (NaCl), organic matter digestion (10 % KOH and 30% H_2O_2). Particles were identified and quantified using a stereomicroscope. Soil physicochemical properties: pH, bulk density, salinity, electrical conductivity (EC), temperature, and soil colour were recorded following standard procedures. The highest MP proportion was recorded in the 0-15 cm layer (39.68 ± 19.0 particles l^{-1}), while the lowest occurred at 50-100 cm (25.18±13.36 particles l^{-1}), revealing a significant decline with increasing depth. MP abundance differed significantly among sampling locations ($p < 0.001$), with canal-associated restored areas showing the highest contamination (36.0±16.8 particles l^{-1}) followed by other environments. Fibers were the dominant morphotype (96.7%), followed by films, fragments, foams, and pellets. Blue fibers constituted the highest proportion (39.6%) among other fiber colours. The results indicate that mangrove soils at Anawilundawa function as sinks for MPs, with surface accumulation and evidence of vertical transport into deeper soil layers. These findings highlight the influence of hydrodynamic processes, particularly canal water flow, on MP distribution and emphasize the need for improved waste management.

Keywords: *Mangrove ecosystem, Microplastic contamination, Soil pollution, Vertical distribution*