

Title: Unveiling microplastics pollution in a subtropical rural recreational lake: A novel insight

Author Names: Abu Reza Md Towfiqul Islam , Mehedi Hasan , Moriom Rahman Sadia , Al-Nure Mubin , Mir Mohammad Ali , Venkatramanan Senapathi , Abubakr M. Idris , Guilherme Malafaia

Abstract: While global attention has been primarily focused on the occurrence and persistence of microplastics (MP) in urban lakes, relatively little attention has been paid to the problem of MP pollution in rural recreational lakes. This pioneering study aims to shed light on MP size, composition, abundance, spatial distribution, and contributing factors in a rural recreational lake, 'Nikli Lake' in Kishoreganj, Bangladesh. Using density separation, MPs were extracted from 30 water and 30 sediment samples taken from ten different locations in the lake. Subsequent characterization was carried out using a combination of techniques, including a stereomicroscope, Fourier transform infrared spectroscopy (FTIR) and field emission scanning electron microscopy (FE-SEM). The results showed a significant prevalence of MPs in all samples, with an average amount of 109.667 ± 10.892 pieces/kg³ (dw) in the sediment and 98.167 ± 12.849 pieces/m³ in the water. Small MPs (<0.5 mm), fragments and transparent colored particles formed the majority, accounting for 80.2%, 64.5% and 55.3% in water and 78.9%, 66.4% and 64.3% in sediment, respectively. In line with global trends, polypropylene (PP) (53%) and polyethylene (PE) (43%) emerged as the predominant polymers within the MPs. MP contents in water and sediment showed positive correlations with outflow, while they correlated negatively with inflow and lake depth ($p > 0.05$). Local activities such as the discharge of domestic sewage, fishing waste and agricultural runoff significantly influence the distribution of polypropylene. Assessment of pollution factor, pollution risk index and pollution load index values at the sampling sites confirmed the presence of MPs, with values above 1. This study is a baseline database that provides a comprehensive understanding of MP pollution in the freshwater ecosystem of Bangladesh, particularly in a rural recreational lake. A crucial next step is to explore ecotoxicological mechanisms, legislative measures and future research challenges triggered by MP pollution.

Keywords: Microplastics (MPs) Rural Recreational Lakes Water and Sediment Pollution Fourier Transform Infrared Spectroscopy (FTIR)

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