



Zonation-Based Quantitative Analysis of Plastic Debris in the Kadolkele Mangrove Park, Negombo

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In Mangrove ecosystems act as natural traps for marine debris, particularly plastic litter, due to their complex root systems and proximity to coastal and lagoon environments. However, the accumulation of plastic waste in these highly productive ecosystems can negatively impact ecological health and biodiversity. Therefore, assessing the extent of plastic pollution in mangrove habitats is essential. This study aimed to quantitatively analyze plastic litter in the Kadolkele mangrove forest of Negombo Estuary over the period from 20th January to 20th April 2026. The primary objective was to evaluate the spatial distribution of plastic debris across different ecological zones. The study area was divided into three zones based on vegetation structure and distance from the lagoon: Zone 1 (seaward), dominated by *Rhizophora* species; Zone 2 (middle), mainly consisting of *Avicennia marina*; and Zone 3 (landward), dominated by *Lumnitzera racemosa*. A stratified sampling design was applied using 50 m line transects and three quadrats (5m × 2m) in each zone. All visible plastic litter items larger than 2.5 cm were collected, counted, and categorized by type. Litter density (items/m²) and percentage composition were calculated. In zone 1, the total number of plastic items found was 225 (9.6 kg) with a mean density of 3.2±1.50 items/m². Five macro polymer types were identified: Polyethylene terephthalate (PET), High-Density Polyethylene (HDPE), Low-Density Polyethylene (LDPE), Polypropylene (PP), and Polystyrene (PS). Compared with the other two zones, the most prevalent type was HDPE (46.93% of all debris), followed by PET (19.79%), LDPE (17.7%), PS (9.37%), and PP (5.2%). Compared to zone 1, a lesser number of plastics were found in zone 2 (78; 2.7 kg) and zone 3 (12; 0.2 kg). The high accumulation of plastic litter, especially HDPE, underscores the high pollution levels in the study area. These findings highlight the need for continued surveillance and targeted waste management efforts to reduce plastic pollution and safeguard mangrove biodiversity.

Keywords: Marine debris, Macroplastics, Mangrove ecosystem, Zonation