

Spatial Distribution of Plastic Pellets and Mesoplastics Along the Northern and Northwest Coastline, Sri Lanka: A Post Incident Assessment of Pellets Originated from the MSC ELSA 3

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The Liberia-flagged cargo ship MSC ELSA 3 capsized and sank off the coast of Kerala, India, spilling substantial amounts of plastic pellets (nurdles) and hazardous materials, posing significant risks to coastal ecosystems and marine biodiversity. Therefore, the present study aimed to assess the distribution of plastic pellets and mesoplastics along the Northern coastline, ten months after the MSC ELSA 3 incident. Sampling was conducted at 10 locations of the Northern and Northwest coastline in March to April 2026, using a 10 m × 1 m interrupted belt transect method across low, mid, and high tidal zones. Sand samples were collected using a 1 m² quadrat at a depth of 0–5 cm, with triplicate samples at each sampling site, to evaluate the spatial distribution of plastic pellets and mesoplastics. In addition, core samples were collected using a 1 m soil corer at depth intervals of 0–30 cm, 31–50 cm, 51–70 cm, and 71–100 cm to determine the vertical distribution of plastic pellets within the sediment profile. The results revealed the presence of two dominant colors of pellet: transparent and white and four morphologically distinct pellet types were recorded. Pellet density across all 10 coastal locations indicated clear spatial variability and a consistent increase (Low < Medium < High). The highest accumulation was recorded at the high-tide zone of Nadukuda (2850.3 ± 589.7 pellets m⁻²). The lowest counts were recorded in Velankulam, Vidatalativu and Iluppaikkadavai, which have not recorded any pellets. Core sampling revealed that plastic pellets were largely confined to the 0–30 cm sediment layer and only Nadukuda and Chilaw recorded pellet presence at 51–100 cm depth. According to the Pellet Pollution Index (PPI), only the Nadukuda location was classified as very high PPI (10.7) and other locations had moderate to very low PPI values (1.2 – 0.0). Kruskal–Wallis statistical analyses confirmed significant differences among tidal zones ($p < 0.05$). The highest mesoplastic abundance was recorded in high-tide at Kalpitiya (49.5 ± 43.6 pieces m⁻²), and the lowest count in high-tide was recorded at Velankulam, Vidathalathivu, Iluppaikkadavai and Chilaw. Overall, these findings demonstrate the long-term persistence of plastic pellet contamination along Sri Lanka's coastline, emphasizing the need for continued monitoring, targeted cleanup efforts, and management strategies to mitigate the ecological impacts of plastic pellet pollution in coastal ecosystems.

Keywords: *MSC ELSA 3, Mesoplastics, Pellets, PPI, Northern coast, Northwest coast*