(48)

Spatial and Temporal Variation of Litter along Some Selected Beaches of the West Coast of Sri Lanka

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Abstract

Beach litter is a growing environmental issue affecting coastal ecosystems and communities. Coastlines that are influenced by monsoonal patterns, human activities, and river openings experience significant spatial and temporal variations in litter pollution. The aims of this study were to assess the litter pollution on 05 selected beaches along the west coast of Sri Lanka (*viz.* Negombo, Modara, Moratuwa, Panadura, and Kalutara beaches) and to evaluate how the beach morphology (*viz.* beach width and slope) and the season of the year (*viz.* dry season and rainy season) influence the extent of their litter pollution. The abundance of different types of beach litter including plastic items was recorded within 5m×5m quadrats established at random locations (n=5) on each beach during the dry season (e.g., 2nd week of August to 1st week of October 2023) and the rainy season (e.g., last week of December 2023 to 1st week of February 2024). The width and slope (n=5 each) of each beach were determined during both seasons using standard methods. The seasonal and spatial abundance of beach litter was analyzed using two-way ANOVA. The seasonal and spatial diversity of beach litter was analyzed using the Shannon-Weiner diversity index (H') and Pielou's evenness index (J'). The relationship between beach litter diversity and beach morphology was analyzed using regression analysis. Plastic litter in terms of total abundance (N=10551 pieces) and percentage abundance (93.76%) dominated the beach litter on all beaches during both seasons. The abundance of the large plastic category was significantly higher ($p<0.05$) during the rainy season than in the dry season. The highest and the lowest abundance of the large plastic category were recorded at Modara (N=3226) and Kalutara (N=398) beaches, respectively. Overall, the highest beach litter diversity (H' and J') was recorded at Kalutara beach during both periods. Negombo beach was the steepest and widest ($p<0.05$). Though not significant, the litter diversity showed decreasing trends with the increasing beach slope and beach width during both seasons. Plastic litter was the most abundant litter category during the rainy season, highlighting how seasonal factors influence litter accumulation on the beach. The high abundance of large plastic litter (i.e., Modara) and increased diversity of beach litter (i.e., Kalutara beach) may be attributed to the rainfall and the associated surface runoff from the nearby Kelani River (e.g., Modara beach) and Kalu River (e.g., Kalutara beach), tourism, and the absence or insufficient beach cleaning practices.

Keywords: *Beach slope, Beach width, Judgmental sampling, Plastic pollution, Seasonal variation*