Quantifying fluxes of microplastics from the Magdalena River into the Caribbean Sea

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Abstract

Land-based sources of plastic materials contribute 80% of the plastic debris reaching the world oceans, and river systems are recognized as the principal mechanism for this transfer. However, plastic floating at the ocean surface, represents only a small fraction of the estimated load discharged by rivers. The imbalance has sparked controversies on the suitability of those estimations, highlighted the need to measure actual riverine plastic fluxes in major river systems. Here we report plastic fluxes from the Magdalena River (MR), displaying the largest sediment load into the Caribbean and among the top 20 rivers with higher potential for transport of microplastics (Mps) to the sea. Between 22 and 27 October 2022 we collected 134 samples from two _˜38 km transects along and across the MR plume, at two water depths (0 and 6 m), during a research expedition aboard the German Research Vessel Maria S. Merian. The mean flux of Mps at the plume of the MR was 25,373 Mps m-3 (±3,354 SE), and Mann-Whitney U test showed no differences in Mps concentration between depths (M–W U132 = 2177.5; P = 0.788). Mps concentration (C) decreased with increasing distance (D) from the river mouth, following a logarithmic function (C = -58245 (log D) + 88886, p< 0.001), and the distribution of plastics was asymmetrical, with concentration of Mps eastward the plume reaching three times that westward. The observed flux of Mps for the MR recorded here is, according to a recent compilation in the literature, one of the highest fluxes of Mps ever recorded.

Keywords: Magdalena River, River plastic influx, microplastics, Caribbean Sea, plastic pollution

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