



## **Coastal accumulation mapping of microplastic particles emitted from the Po River, Italy: Integrating remote sensing, in situ sample collections and ocean current modelling**

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Plastic pollution in inland waters and the open ocean is a long recognized problem for marine wildlife, coral reefs, the fishing industry and shipping transport safety. Microplastics, defined as particles < 5 mm, form a considerable portion of this pollution and have increasingly received public attention following recent discoveries that not only can these particles be ingested by planktonic animals, but also outnumber natural food items in some ocean areas. Microplastic research has mainly concentrated on open seas, while riverine plumes and coastal areas remain largely unexplored despite their hypothesized importance as microplastic sources. This work models coastal accumulation along the Adriatic coastline of microplastic particles (1-5 mm) emitted by the Po River, northern Italy, over 1.5 years. We hypothesize that river-induced microplastic accumulation on adjacent coasts can be predicted using (1) hydrodynamic-based and (2) remote sensing-based modelling. Model accumulation maps were validated against sampling at nine beaches (analyzed particle size range: 1-5 mm), with sediment microplastic concentrations up to 78 particles/kg (dry weight). Hydrodynamic modelling revealed that discharged particle amount is only semi-coupled to beaching rates, which are strongly river mouth dependent and occur primarily within the first ten days after discharge. Particles which did not beach within this period, representing more than 80% of all modelled particles, were transported offshore and remained offshore. Remote sensing modelling was found to better capture river mouth relative strength, and accumulation patterns were found largely consistent with hydrodynamic modelling. Comparison with remote sensing based accumulation maps and validation against in situ beach sampling are discussed. Suggestions are presented for future development of an operational monitoring system to assess microplastic pollution being emitted by a major river and its distribution along adjacent coastlines as well as into the open ocean.