Plastic in between rocks: A look into the spatial and temporal distribution of mesolitter and larger microlitter in the Scheldt riverbanks

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Rivers are essential pathways to transport plastic and other types of waste from the sources in population clusters to the seas and Ocean, playing a relevant role in the global plastic pollution crisis. Some plastic items and particles that enter the river will deposit on the riverbanks, where they accumulate under normal hydrometeorological conditions, until being released under extreme weather conditions. Consequently, the study of the distribution of plastics and other waste in the riverbanks leads to valuable datasets that can be used to model the river's transport processes and to develop improved solutions for the removal of the waste from the accumulation zones. To assess the litter distribution in riverbanks, different methodologies have been explored over the last decade, focusing mostly on macrolitter (> 2.5 cm). Our objective was to adapt and improve existing methodologies to assess the spatial and temporal evolution of mesolitter (5 mm - 2.5 cm) and large microlitter (1 – 5 mm) accumulation on riverbanks in a central European river. This work, done under the scope of the INSPIRE project (Innovative Solutions for Plastic Free European Rivers, funded under the call HORIZON-MISS-2022-OCEAN-01), focused on making the methodology suitable for the Scheldt River, with the prospect of replicating in other similar locations. The Scheldt riverbanks selected comprise its north riverbank in Temse and the northeast bank of Doeldok (dock in the Port of Antwerp). In Temse, the Scheldt riverbanks have tidal influence (water level, direction and flow change throughout the day), and are characterized by mud areas, reed corridors, slopes of boulders, slipways and pontoons, showing human-made interventions. In Doeldok, the riverbanks consist of artificial sloping walls composed of fine gravel, sparsely covered with short weeds. This location is an inner port dock, which is connected to the Scheldt by locks (Kieldrechtsluis and Kallosluis), therefore having reduced tidal influence. The selected methodology for these two locations consisted in the collection of samples inside 20 x 20 cm quadrats (up to 5 cm deep) distributed in 30 – 100 m transects parallel to the water line and spread in the riverbank area. For each quadrat, all the anthropogenic particles and items were collected with metal tweezers, cleaned at the laboratory, and then quantified and characterized (size, colour, transparency, shape and polymer/material). Seasonal campaigns were planned for Temse north riverbank, with three campaigns carried out in 2024. For Doeldok, one campaign was carried out in 2024. For both locations, more campaigns are planned for 2025. Preliminary results of this study show that the methodology applied is suitable to uncover different spatial trends, with the least polluted transects having on average < 100 items m^{-2}, and the most polluted reaching > 7000 items m^{-2}. Results suggest that plastic concentration is strongly impacted by seasonality in Temse, as higher numbers of litter particles were found in Summer compared to Spring for most transects. Vegetation seems to play an important role in trapping the mesolitter and large microlitter, as shown by the evolution of both vegetation growth and number of litter items/particles found throughout the seasons in Temse, and the lower numbers found in Doeldok where vegetation is scarce. Remarkably, for some of the items found, it was possible to identify its source from nearby fragmenting items, while for the others it remains unclear. This study is providing us a better understanding of the plastic pollution accumulation in the Scheldt riverbanks, having the potential to contribute to the creation of tailored strategies for monitoring and cleaning the European rivers.

Keywords
Plastic Pollution; Microplastics; Pellets; Waste; Quadrats; Transects; Sampling; Rivers