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USING FLOATING GPS DRIFTERS TO UNDERSTAND THE PATHWAYS AND FATE OF MACROPLASTIC DEBRIS IN SOUTH AFRICA'S UMGENI RIVER ESTUARY

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ABSTRACT

The increased levels of plastic pollution in freshwater systems have become a global concern. Nevertheless, little attention has been directed towards understanding the pathways, retention periods and fate of macroplastic debris (>5cm) in river systems. Understanding macroplastic transport dynamics in rivers provides data for global river plastic transport modelling, as well as effective waste mitigation and removal strategies. This study presents the use of floating GPS drifters to actively track and understand the pathways, retention periods and fate of macroplastic debris in the Lower Umgeni River Catchment. The study deployed 23 trackers inserted in floating 500 ml HDPE containers, each final unit with an average weight of ~472 g released across the lower Umgeni River catchment stream network draining through a highly urbanized area north of central Durban (1.3 million inhabitants). The drifters were distributed evenly across the river network within a range of 2 – 28 km away from the estuary, using the river mouth as the datum (0 km). The drifters are programmed to receive geo-location updates every 5 minutes with up to 4 metres accuracy using GPS and GSM connection. Drifters were actively connected for 1- 261 days in the river system. During the study period 34% of the drifters reached the river mouth. Most of the drifters (66%) were retained in riparian vegetated banks, rocks, weirs and mechanical litter entrapment booms at the point when they lost connection, e.g., due to battery depletion. The rate of drifters flushed away into the ocean was 28% for drifters deployed in the main Umgeni channel and 6% for drifters deployed on the tributary channels, the remaining drifters were retained upstream and at the estuary. Going forward, hydrological data (rainfall and river discharge) will be related with drifter trajectory distances and velocities in specific river stretches to highlight the influence of environmental factors on macroplastic transport. The study findings are important to understand the link between macroplastic debris transport with river system hydrodynamics and connectivity as well as for the management and reduction of macroplastic debris in freshwater systems in urban areas. This data may specifically support targeted interventions before debris is flushed downstream, thus reducing clogging risk for drainage systems and threats to the ecological integrity of the estuary and coastal habitats. The detailed description of the plant will be given, as well as the results of the first months of plant operation.

Keywords: Plastic Pollution, Rivers, Estuary, Macroplastic, GPS drifters, Transport, Accumulation, Hydrology, Urban Areas, Waste Management.