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Monitoring submerged riverine macroplastics using echo sounding

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Riverine plastics cause severe global problems, regarding the risk for human health and environmental damage. The major part of the plastic waste that ends up in the oceans is transported via rivers. However, estimations of global quantities of plastics entering the oceans are associated with great uncertainties due to methodological difficulties to accurately quantify land-based plastic fluxes into the ocean. Yet, there are no standard methods to determine quantities of plastics in rivers. For the sake of reducing the amount of plastic waste in the natural environment, information on plastic fluxes from rivers to seas is needed. Focussing on monitoring of the plastic litter that is transported by rivers is useful because measures can easier be implemented in rivers than in seas. Moreover, consistent measuring techniques are crucial to optimise prevention-and mitigation strategies, especially in countries with high expected river plastic emissions.

Additionally, based on plastic characteristics and turbulent river flow conditions, a considerable portion of the riverine litter can also be transported underneath the surface in the water column. Current monitoring methods regarding macro plastics are labour intensive and do not provide continuous measurements for submerged riverine plastics. Besides, most research done focussed on floating macro litter, instead of submerged plastics. The aim of this research was to find a standard method, applicable in different river systems, for detecting submerged macro plastics.

With the use of the Deeper Chirp+ fishfinder, several tests were conducted both in the Guadalete river basin in southern Spain and in the lab at the TU Delft. Spanish, and in general European rivers are estimated to transport two to three orders of magnitude below rivers in Asia (Malesia and Vietnam), and should not be neglected. The Guadalete river basin formed a suitable location to test this new method. First, monitoring in the Guadalquivir river was executed, with the use of a net to validate the readings of the sonar. Furthermore, the detecting abilities of the echosounder, in the Guadalete river basin, were tested with the use of plastic targets. The targets were released in the river and passed the sensor at a certain time. Moreover, tests in the lab at the TU Delft were conducted to investigate relations between sonar signal and flow velocity, object depth, and object

size.

The tests show that submerged macro plastics can be detected with the use of echo sounding. Moreover, a relation between the sonar signal and litter size is found. Finally, signal intensities can be related to object properties. In conclusion, the use of echo sounding has a high potential for obtaining more accurate plastic flux estimations.