Assessing of plastic and biota removal by plastic clean-up mechanisms in artificial flume settings

Leone Giulia[1,2,3], Catarino Ana I.[2], Pauwels Ine[3], Bossaer Mattias[2], Oco Conda Regine[4,5,6], Chu Chia-Yu[5], Troch Peter[7], Goethals Peter[1] and Everaert Gert[2]

[1] Research Group Aquatic Ecology, Ghent University, Coupure Links 653, 9000 Gent, Belgium
E-mail: giulia.leone@vliz.be
[2] Flanders Marine Institute (VLIZ), InnovOcean Campus, Jacobsenstraat 1, 8400 Oostende, Belgium
[3] Aquatic Management, Research Institute for Nature and Forest (INBO), Havenlaan 88, 1000 Brussel, Belgium
[4] Faculty of Science and Bioengineering Science, Vrije Universiteit Brussel (VUB), Pleinlaan 2, 1050 Elsene, Belgium
[5] Faculty of Science, Ghent University, Krijgslaan 281, 9000 Gent, Belgium
[6] Faculty of Sciences, Antwerp University, Groenenborgerlaan 171, 2020 Antwerpen, Belgium
[7] Civil Engineering, Ghent University, Technologiepark 60, 9052 Gent, Belgium

Due to mismanaged and wrongly disposed plastics, and due to the unwanted accumulation of plastic litter in multiple environments, several technologies have been designed and deployed to remove the litter from rivers, beaches, ports, lakes and coastal areas. These are novel technologies with multiple and diverse collection mechanisms to assist in removing plastic litter from aquatic systems. However, their positive and negative effects in the environment where they are deployed are, so far, largely unknown. Plastic clean-up technologies are crucial innovations aimed at mitigating plastic pollution and are referred to in the draft of the international and legally binding treaty from the United Nations Environment Assembly that aims to target plastic pollution by 2024. Therefore, empirical data is currently needed to assist the users and key stakeholders in guiding the in the deployment of these clean-up technologies. The goal of this work was to experimentally investigate the individual effect of four selected parameters, i.e., flow velocity, biota shape, plastic-type, and plastic load, on the removal of plastic and biota when interacting with plastic by two clean-up mechanisms. We independently tested two generic, non-commercial, custom- made plastic clean-up mechanisms, and without aiming at reproducing the exact design of any specific company or technology. The empirical data were gathered in a laboratory flume in which the settings of each of the selected parameters were controlled and independently assessed. For instance, four plastic categories (bottles, films, foams, and a mix of the three plastics) were separately tested, while other parameters (flow velocity, plastic load and biota shape) were kept constant. Our preliminary results suggest that the individual interaction with each of the four plastic categories (bottles, films, foams, and a mix of the three plastics) does not affect the proportion of biota removed. Empirical studies such as this allow testing the effect of each single parameter, which is important when parametrizing hydrodynamic and ecological models and set up the bases for field tests. Field studies are a necessary complement to experimental studies and are required to test each technology in each specific location.

Keywords
Plastic Pollution; Clean-up Technologies