The presence of plastics and microplastics-MP (very small particles up to 5 mm, resulting from plastics degradation) in natural environments, such as rivers, lakes and seas, is increasing, and along with it the worries related to their impact on the health of both the ecosystems and human beings. Research on this topic is growing, especially regarding what the presence of MP means in the food network and what it could imply for our well-being. But as this artificial material enters a river, it does not only get ingested by the species living along the water, but it is also transported with the current towards the sea, slowly depositing at its bottom, and eventually getting ingested by other species. While the fact that plastics and microplastics sink in the depth of seas, lakes and other locations where water stays still, is being actively studied in order to understand how this deposition occurs, and maybe find solutions to mitigate its effects, very few research can be found on the transport of these materials through rivers and streams. The present project aims at setting up a basis for the understanding of the MP mobilization at the river bottom, simulating in a laboratory flume when the plastic particles can be moved by water, accounting for different types of bed.

Among the aims of the research is the study of MP particles heavier than the flowing water, but lighter than the natural sediments composing the bed itself. For this case, the MP particle will be removed from its location when the hydrodynamic conditions reach the so-called critical threshold. This threshold is related to the conditions causing (re)mobilisation of MP from a loose bed and is expected to be different from the critical threshold needed for initiating the transport of natural sediments.

Laboratory experiments will be carried at the Hydrodynamics Model Laboratory of IG-PAS out to quantify the threshold conditions for a particular kind of microplastic particle, over different types of bed: starting from a non-natural one made up of plastic grains, to more natural beds made up of coarser (gravel) and finer (sand) natural sediments, up to a mixture of the two natural sediment type and MP. To estimate the flow effects on the mobilization of bed microplastic particles, experiments with different water discharges will be run, and for each one, the critical conditions will be determined with a combination of two laboratory techniques: video tracking of bed particles and acoustic measurements of the flow velocity. Video-tracking of bed particles means retrieving, from a series of consecutive images, information on different particles position and velocity, which will be related to the flow conditions in terms of velocity and stresses at the bed.

The main questions behind this research are related to the interdependencies between critical conditions of MP and type of bed:

- How is the critical threshold of the microplastic particles related to the hydraulic conditions?
- How is this threshold modified in the presence of different bed material?
- Does the content of MP in the bed modify this threshold?

The projects' results will allow broadening our understanding about the mobilization and transport of microplastics by streams and currents, with a particular focus on the conditions at which they move away from the bed and can be therefore removed. The experimental data collected in the project could serve as a benchmark for numerical models, and to develop formulations which better describe MP mobilisation and transport. Indeed, indications on how MP can be transported to the final sink are needed, for managing their pathways and reducing the presence in deep-sea sediments, where removal is hardest.

The outcomes, though specifically obtained in the field of hydrodynamics and sediment transport, have relevance in the broader subjects of Environmental Sciences and Ecology, and due to the growing MP presence in seafloors, extend, to some limit, also to Marine Sciences.