MSc Thesis Project Idea

Tackling uncertainty: how do microplastic pollution estimates differ with sampling method?

Background

Environmental pollution with plastics, especially microplastics (1-5000 µm), has attracted considerable interest from the research community as well as the wider public. This interest resulted in a dedicated effort to examine, quantify, and describe the occurrence of plastic pollution around the globe. Significant progress has been made in understanding the levels of microplastic pollution in our oceans, how the mass of the plastic is distributed (i.e., 59-62% at the ocean surface, 36-39% in the deeper ocean, up to 1.9% on beaches), and how long plastics reside on ocean surfaces (Kaandorp et al., 2023). The worlds ecosystems are not insulated from each other however, and if the topic is approached from a global environmental plastic cycle, then several scientific blind spots emerge (Stubbins et al., 2021). For instance, rivers have long been recognized as important factors enabling plastics to travel between different environmental plastic pools, but recent debates about how much plastic exactly is transported by these rivers highlights how the lack of reliable data still hampers attempts of modeling annual river plastic emissions (Lebreton et al., 2017; Weiss et al., 2021).

One persisting source of uncertainty arises from the use of several different sampling methods, such as manta nets for surface waters, and in situ filtration, sedimentation traps, or flowthrough centrifugation for the water column (fig. 1; Liu et al., 2020). While all methods have got their merits, they often target different size ranges of the microplastics size distribution. In addition, different research groups employ varying sample processing methods, which taken together complicates comparisons across studies.

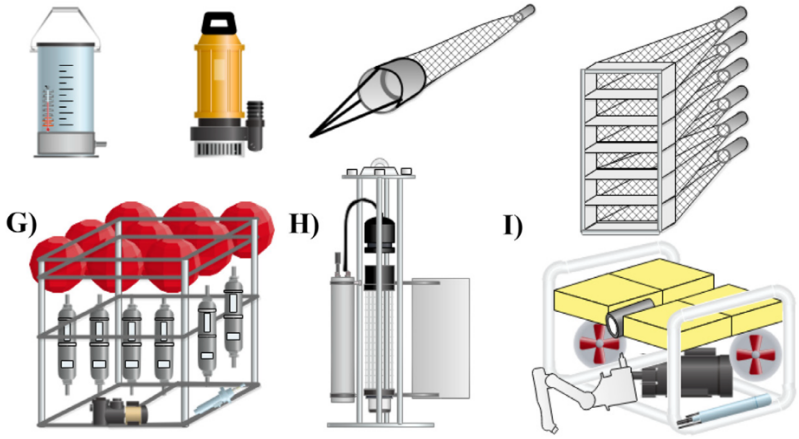

Figure 1. Different sampling tools have been used to sample the water column for microplastics. Source: (Liu et al., 2020)

Aims

The idea behind this project is to sample the Rhine River simultaneously at a given position with different methods, e.g., manta net, net in the water column, flow-through centrifuge, and sedimentation box. These will likely lead to different estimates of microplastic pollution, and thus a potential deliverable of this project would be to provide correction factors for translating between different methods. Such results would also facilitate future extrapolations of microplastic pollution to the entire river water column, even though sampling was only conducted with one method. This project leverages the installations and expertise at the Rhine Monitoring Station (Weil am Rhein), a key stakeholder with keen interest in this topic. Ultimately, the project will lead to a better understanding of the microplastic particle distribution in the river water column.

Procedures and Methods

Depending on the exact design of the study, involved procedures and methods will encompass planning, testing for, and executing field work in collaboration with the Rhine Monitoring Station. Gathered sample material will be analyzed in the laboratory at the MGU, which involves several steps to purify the samples, and Fourier-transform infrared spectroscopy (FTIR) to identify the chemical identity of the isolated potential microplastics.

What we offer

To fulfill the proposed project, the prospective student is offered close mentoring and inclusion into an interdisciplinary team. The team has a track record in working with microplastics in the Rhine River (e.g., Bosshart et al., 2020; Mani et al., 2015; Mani and Burkhardt-Holm, 2020), as well as FTIR (see further research: https://mgu.unibas.ch/en/research/anthropogenic-pollution-of-the-environment/). Access to necessary facilities, including office space and computer, field material, as well as laboratory will be provided. Upon successful completion of the project, we also strongly support the student to publish their research in an academic journal, thus bolstering the student's career prospects in academia.

Your profile

Even though a background in natural sciences is not necessary, such a background would be an asset. You should further enjoy working both, in the field, as well as systematically and carefully in the laboratory. eager to explore the scientific literature on the topic and acquire knowledge independently. Please also consider that the project involves experiments with animals, and you should be willing to carry these out.

If your interest is peaked, please contact:

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References

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