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PLASTIC CUP

Measuring and sampling microplastic from rivers

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SUSTAINABLE DEVELOPMENT AND TECHNOLOGIES NATIONAL PROGRAMME OF MTA
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DANUBE REGION strategy
Water Quality

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iNNO SED
iNNOvative SEDiment management in the Danube River Basin

Introduction

The many ways of measuring and sampling microplastics in rivers - problem statement

What to measure? i.e. fractions	What to sample? i.e. medium	Sampling tools?	Units?
• microplastic particles • microfibres	• in natural water – close to surface/ riverbed or in the middle • in wastewater • in bottom sediment • in aquatic species	• net sampler • pump sampler • bucket sampler • grab sampler • core sampler	• nr. of particles • particle concentration • mass • mass concentration • mass load

- as water engineers, we have the toolkit to sample both fractions in water and bottom sediment, and to measure microplastic particles in the laboratory
- but for analysing microfibres, we need chemistry

Introduction

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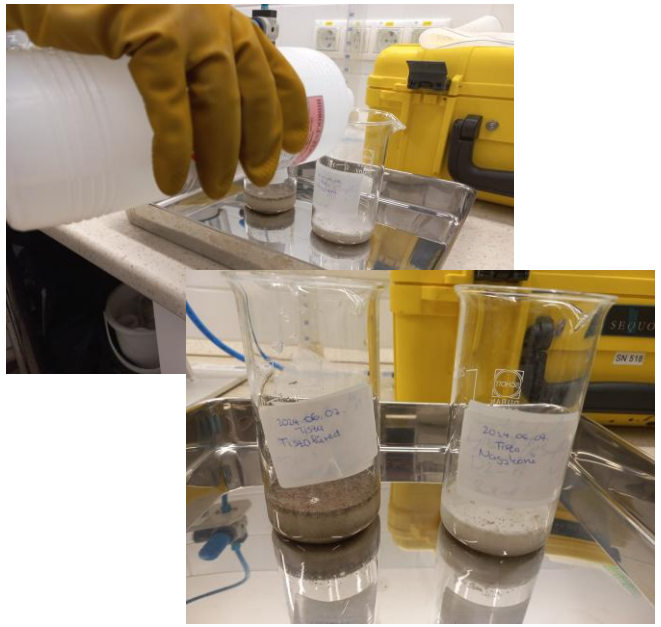
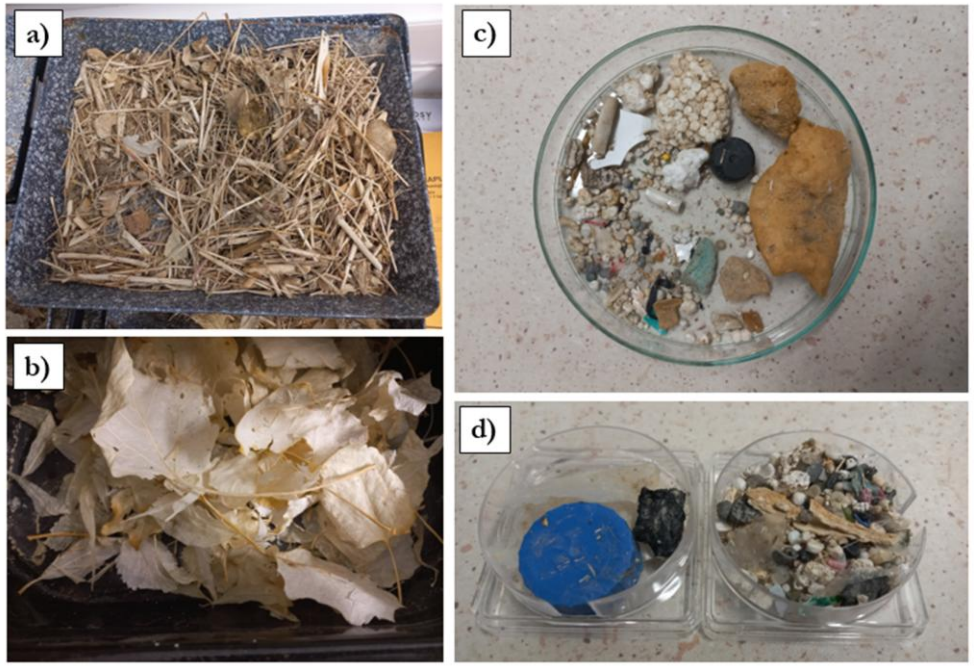
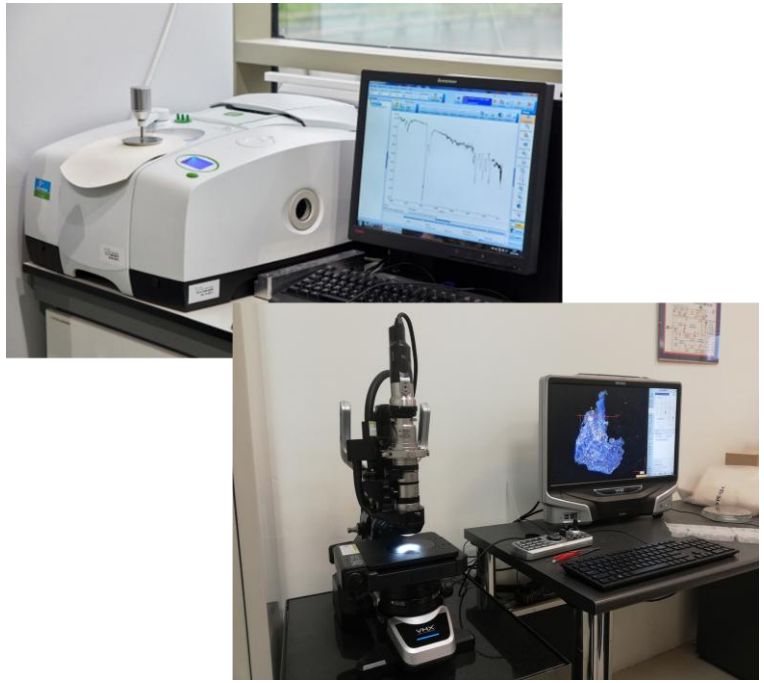
Laboratory analysis

Microplastic identification and dimensional analysis







Chemical treatment
H_2O_2 is cheap
but: health risks + not environmentally friendly

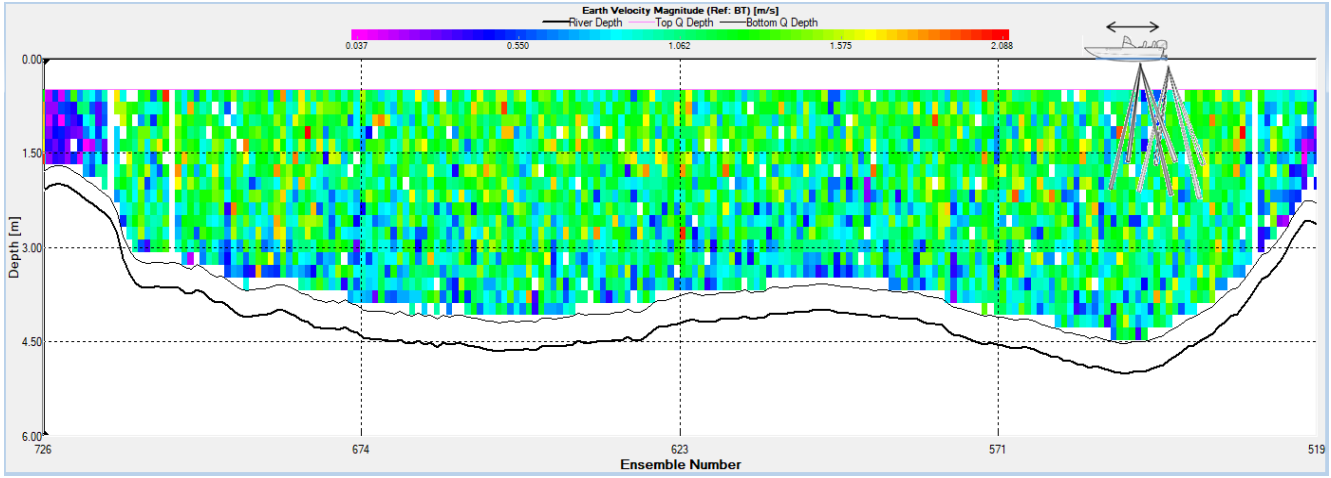
Sorting by hand
highly time-consuming
how to tell what is plastic?

FTIR analysis and imaging
+ weighing and counting MPs
overly time-consuming
degradation reduces the reliability of ID

Spatial exploration

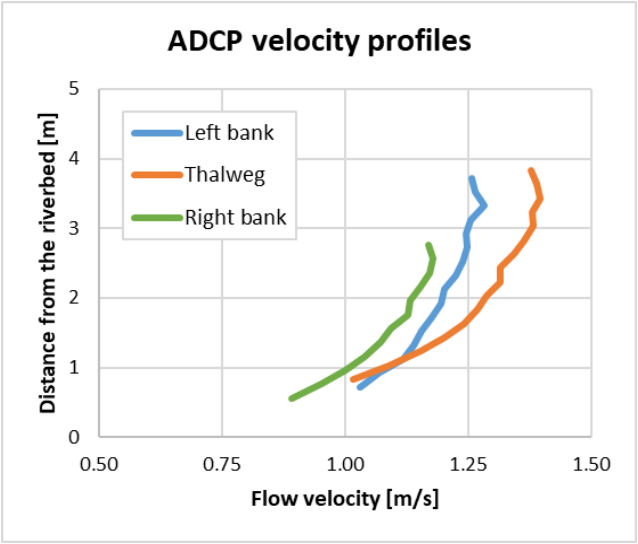
Small scale: Detailed field campaigns
– patterns of microplastic transport

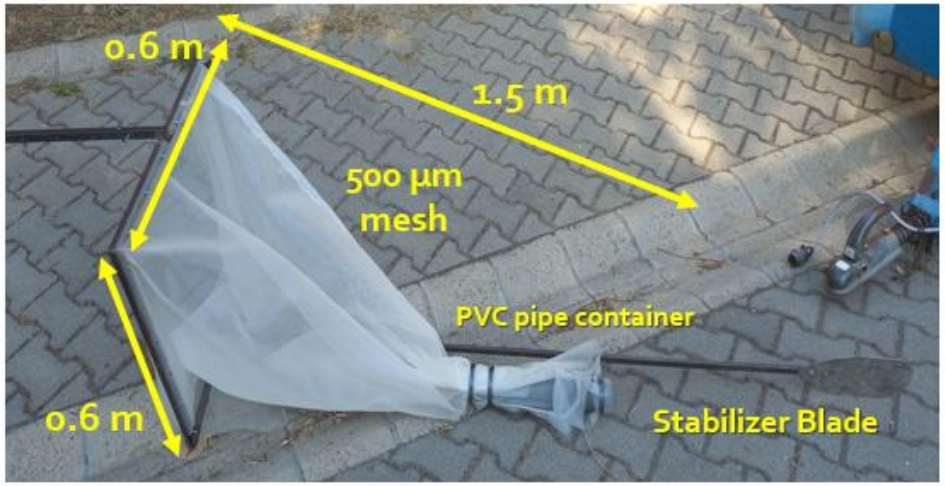
- first step: hydromorphological mapping
  → where to expect pollutants
- different densities of plastics
  → different depth of transportation
  → multi-level manta net ☺



Challenges:

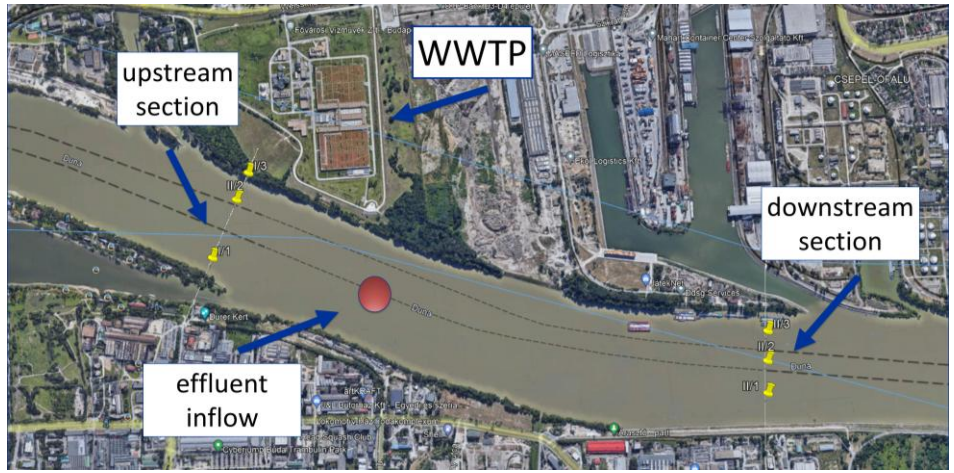
- representativeness
- adequate vessel
- sample extraction
- time requirements
- ship traffic

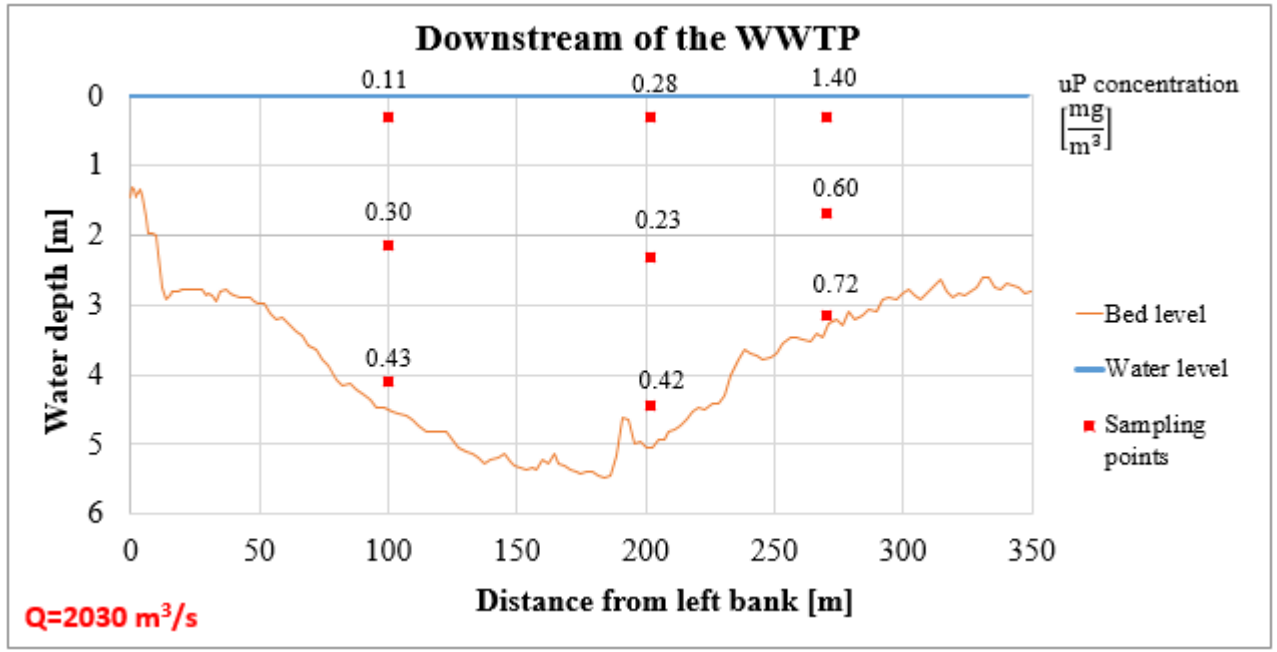


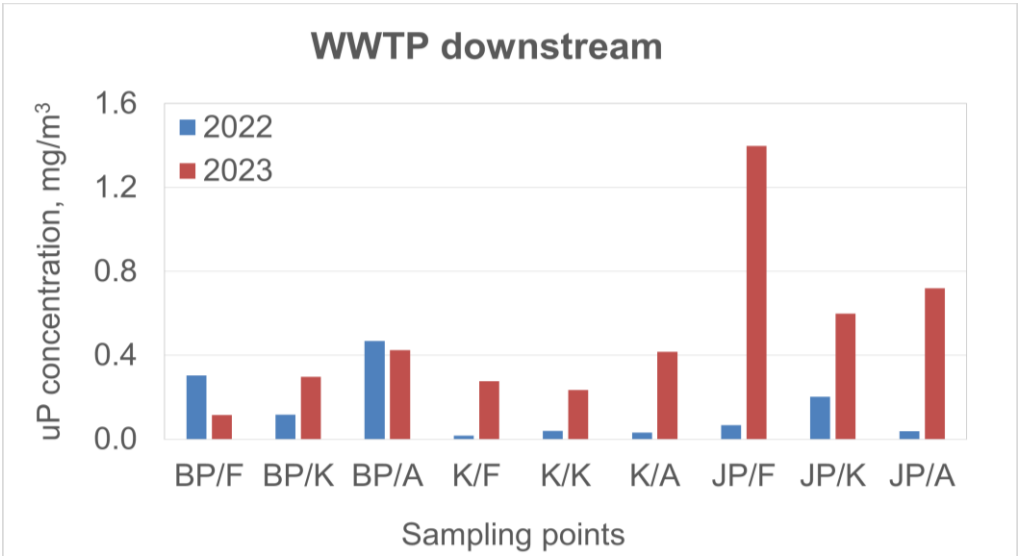


Results

Small scale: Detailed field campaigns







BP: left bank
K: middle
JP: right bank vertical;

F: top
K: middle
A: bottom sampling point

Annual average microplastic load:

~0.50 mg/m³ → ~31 t/yr

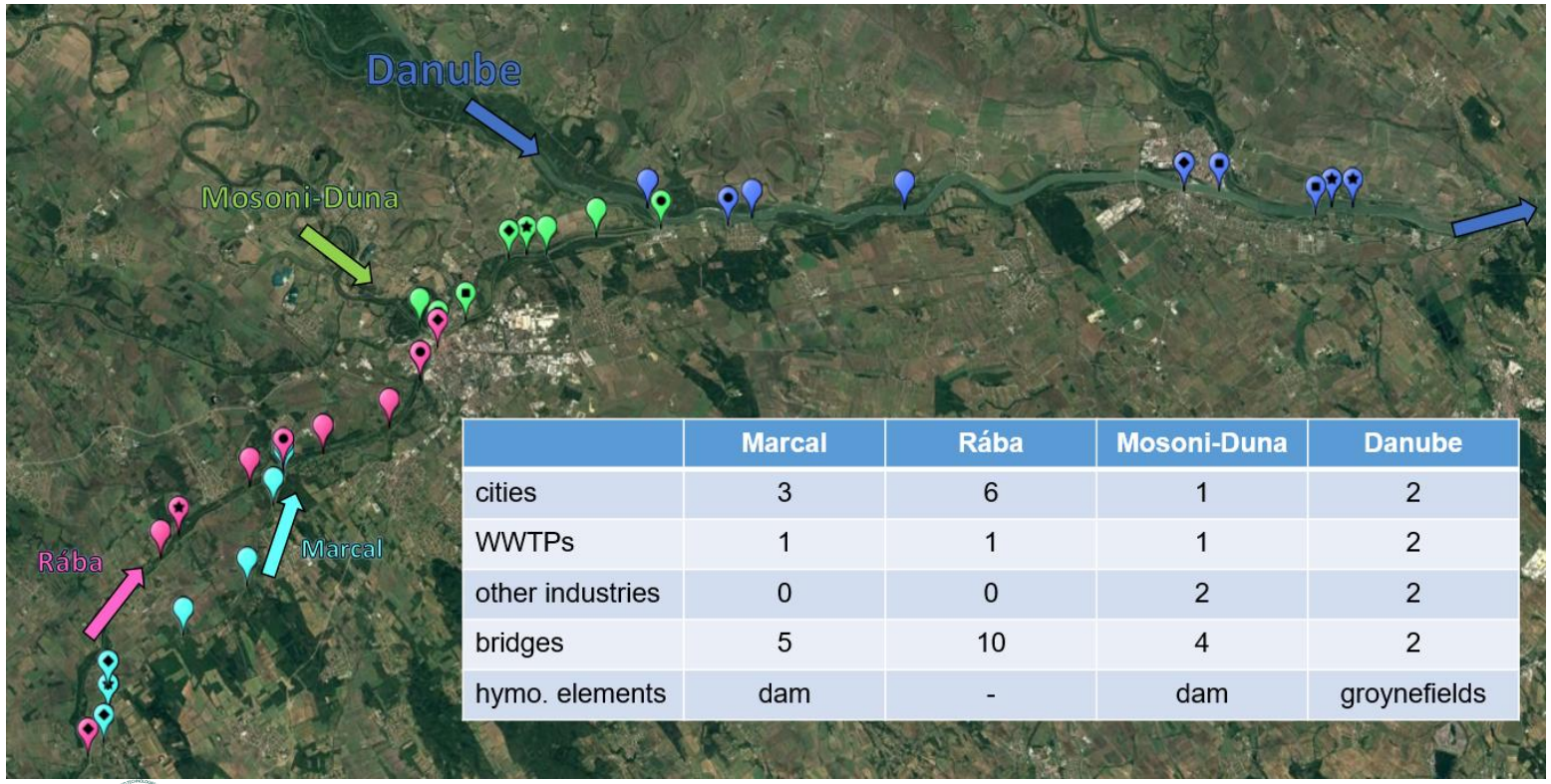
Spatial exploration

Large scale: River system-wide investigation
– natural and anthropogenic sources

- beforehand: assessment of possible impacts on microplastic transport
- careful selection of sampling sites

Challenges:

- time requirements
- representativeness
- scales
- accessibility

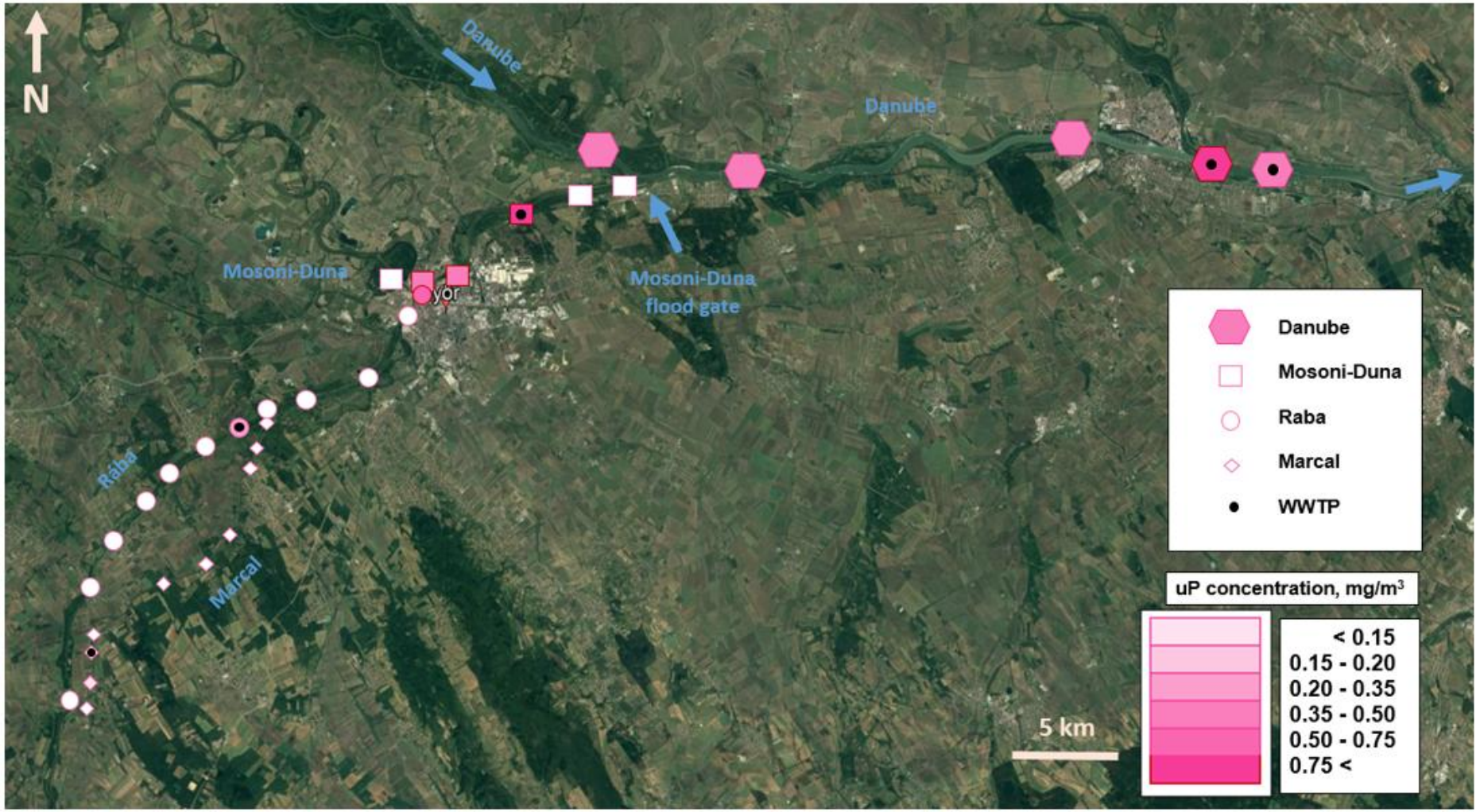


	Marcal	Rába	Mosoni-Duna	Danube
cities	3	6	1	2
WWTPs	1	1	1	2
other industries	0	0	2	2
bridges	5	10	4	2
hymo. elements	dam	-	dam	groynefields

Snapshots

Results

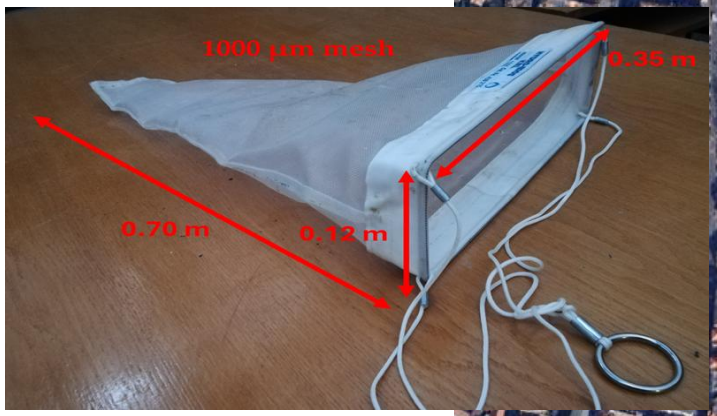
Large scale: River system-wide investigation



Temporal analysis

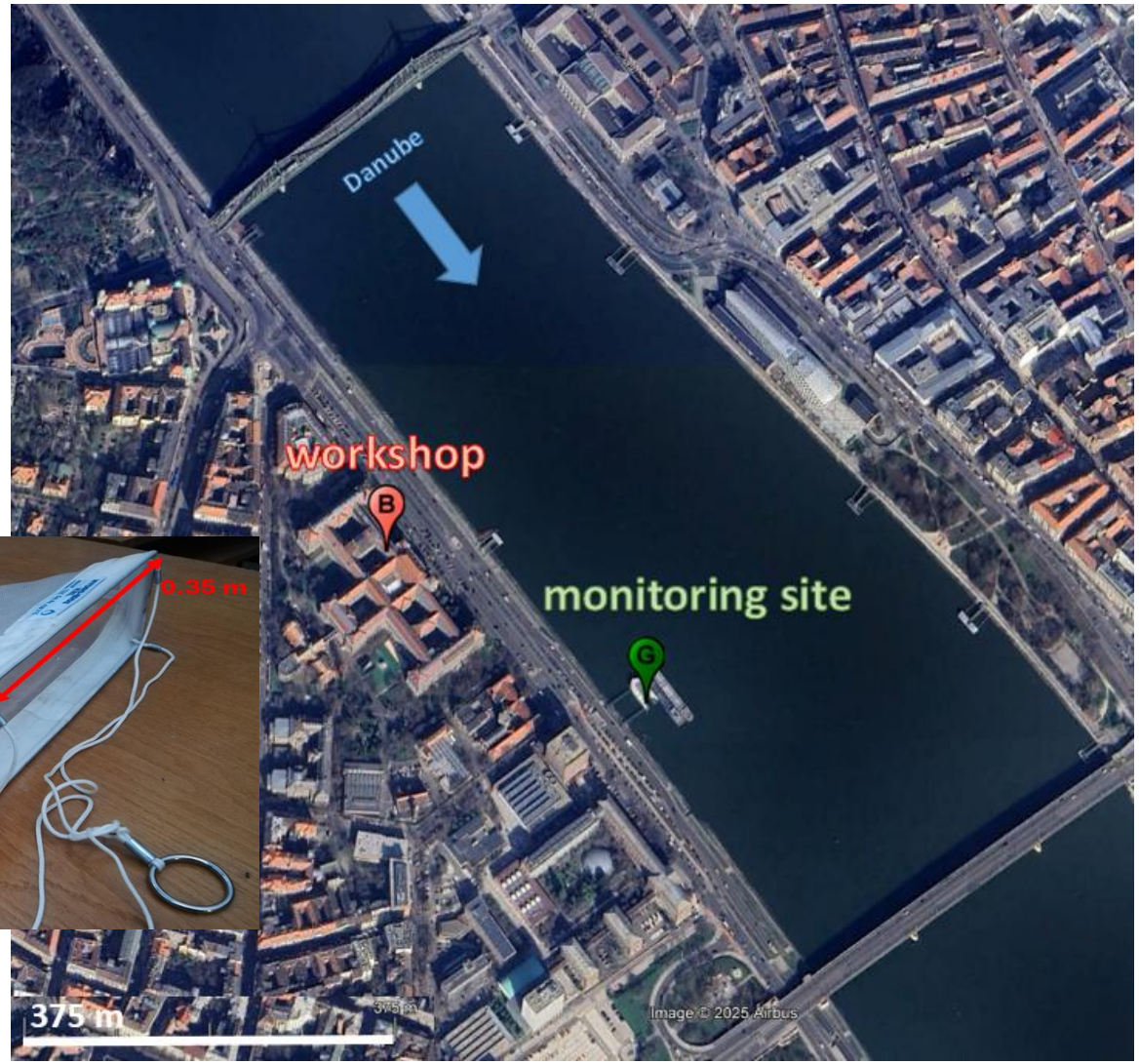
Examine transport dynamics and preparing statistics

- near-bank fixed-point sampling
- during floods → large range covered within a short period of time ☺
- high sampling frequency

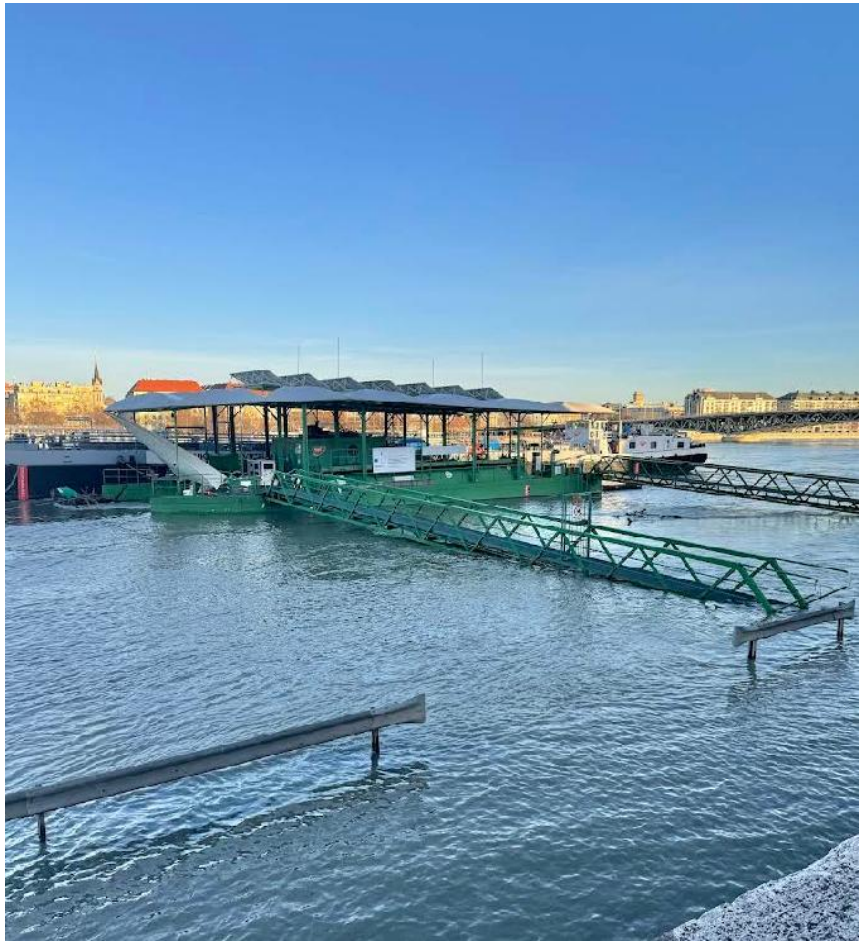


Challenges:

- location
- debris
- mesh size
- personal safety and health!

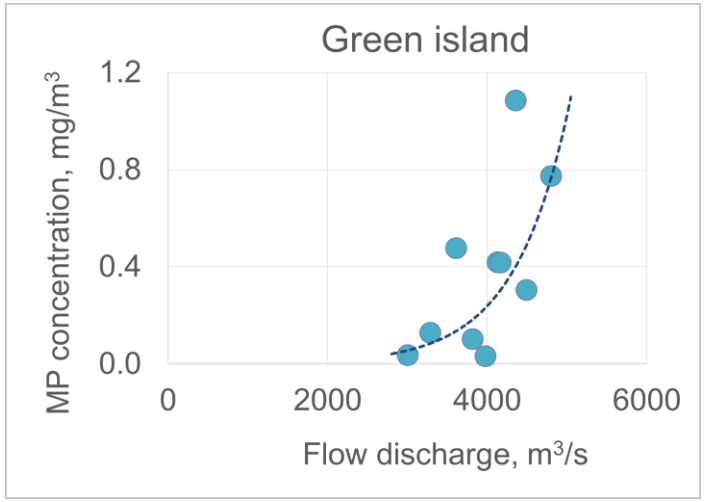


Challenges of monitoring

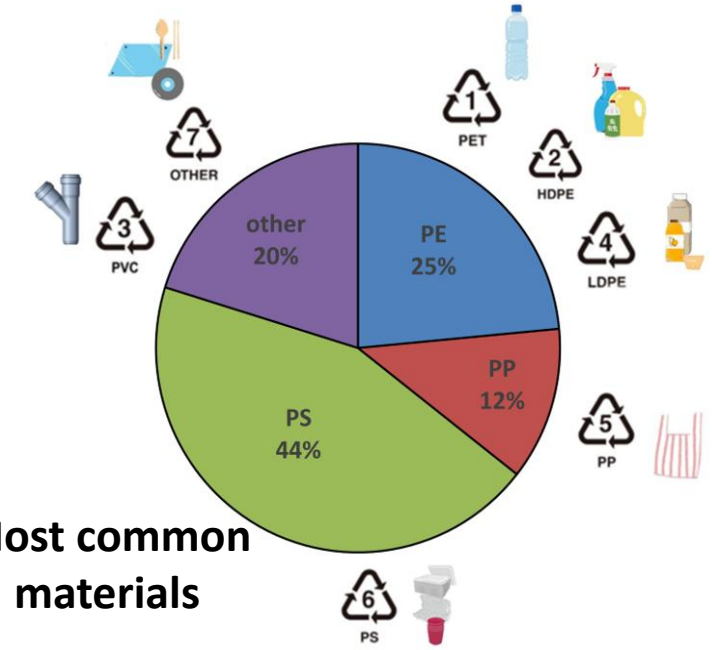


Results

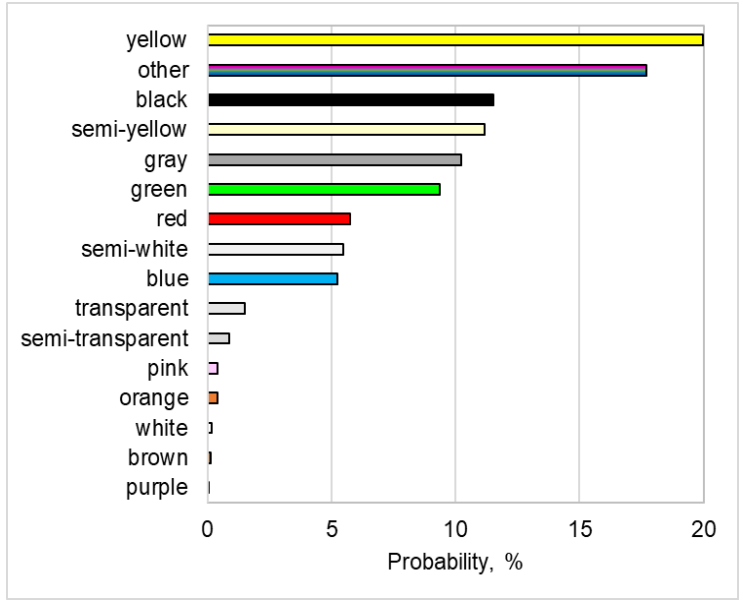
Examine transport dynamics – preparing statistics



Rating curve

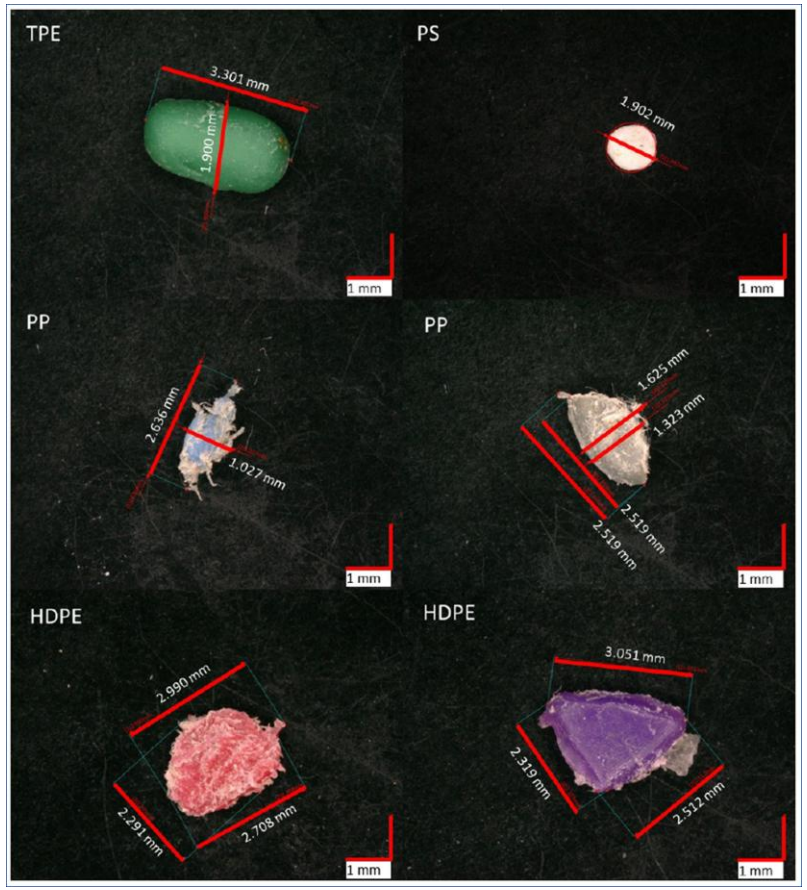


Most common materials



Colour statistics

Dimensional analysis



Conclusion and outlook

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Take-home messages

- **Know your microplastic:**
  the meaningful results come by following the suitable methodology for the microplastic pollution in question
- **Strive for harmonised data collection:**
  always include hydrological data and provide comparable units
- **Think in systems:**
  explore the potential sources of microplastic pollution – both natural and anthropogenic
- **Aim for the full picture:**
  both spatial and temporal analysis of the riverine microplastic pollution is needed in order to understand the complex phenomena
- **Question your results:**
  it is hard to account for representativeness, but always have a closer look at possible biases