Microplastics > 25 µm in the Seine river

Ph.D. thesis in progress

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Microplastics In Europe's Freshwater Ecosystems: from sources to solutions

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Microplastics in rivers

Microplastics (MPs) = plastic particles ≤5 mm

24%	Polyethylene (PE)
24%	Polypropylene (PP)
13%	Polystyrene (PS)
11%	Polyethylene Terephthalate (PET)
6%	Polyamide (PA)
1%	Polyvinyl chloride (PVC)

Ref: Li et al., (2020)

Photo by Cole Brookson courtesy of Rochman Lab

Plastic gyre in the Seine river
Copyright: own

Knowledge gaps:

Spatial & temporal scale

Impact of urban areas

Smaller MP sizes (<300 µm)

Research questions:

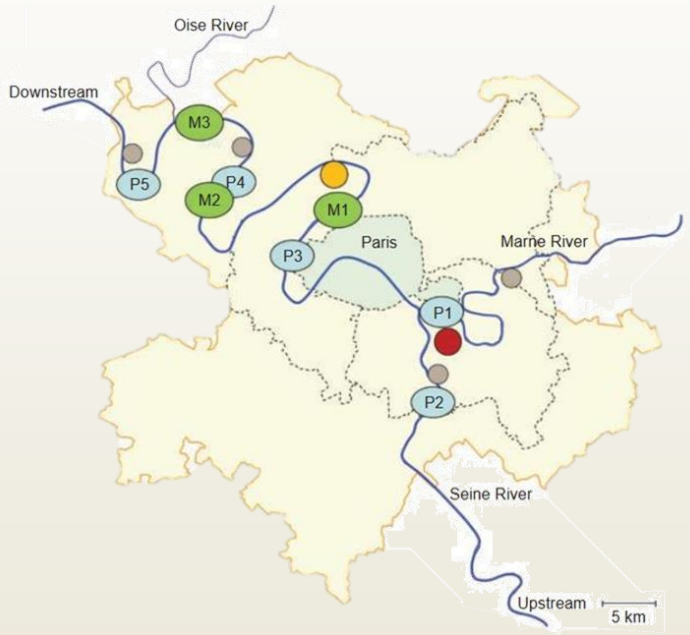
MP concentrations and variation (upstream – downstream of urban agglomeration)

MP entry points & river transport

Microplastics in the Seine river – past studies

Manta trawl (330 µm) & plankton net (80 µm)

- No upstream - downstream differences
- 4 - 108 particles m^{-3} (temporal variations)



Dris, R., Gasperi, J., Rocher, V., Saad, M., Renault, N., & Tassin, B. (2015). Microplastic contamination in an urban area: A case study in Greater Paris. *Environmental Chemistry*, *12*(5), 592. https://doi.org/10.1071/EN14167

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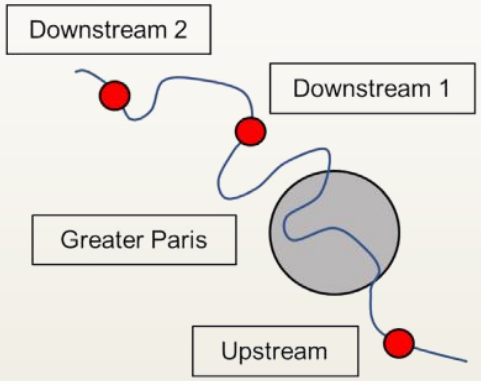
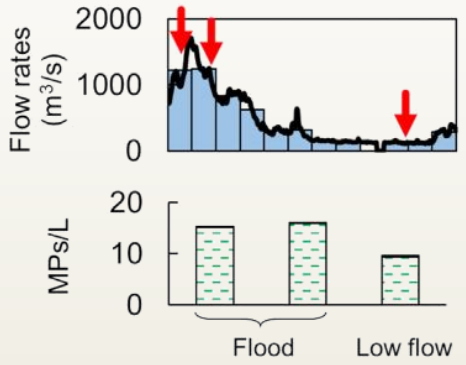
Microplastics in the Seine river – past studies

Metal bucket + plankton net (80 µm)

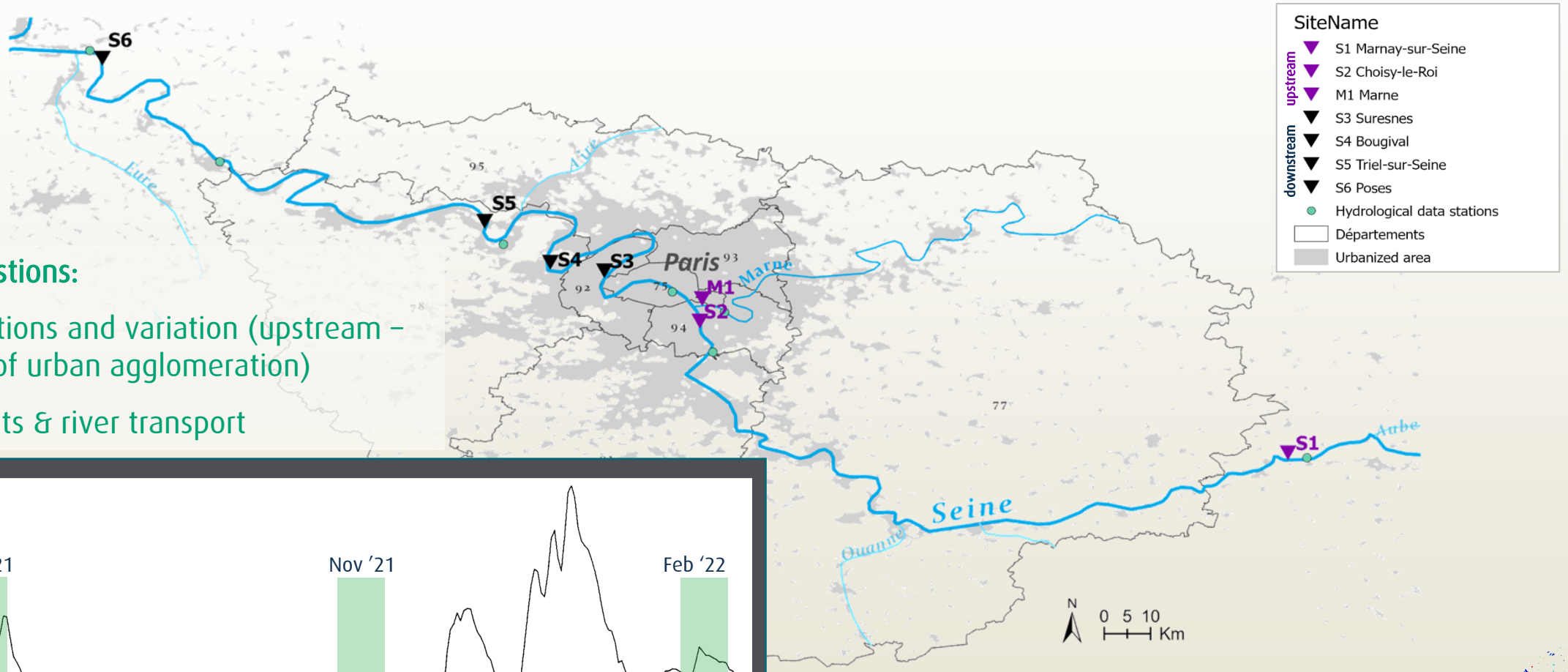
- Microplastics: median = 200 particles m^{-3} (mostly PP)
- MP fluxes increase from upstream to downstream
- Flood contributes to MP mass fluxes
- 60% of MPs < 250 µm





Treilles, R., Gasperi, J., Tramoy, R., Dris, R., Gallard, A., Partibane, C., & Tassin, B. (2022). Microplastic and microfiber fluxes in the Seine River: Flood events versus dry periods. *Science of The Total Environment*, *805*, 150123. https://doi.org/10.1016/j.scitotenv.2021.150123

Seine river – flowing through the city of lights



Research questions:

MP concentrations and variation (upstream – downstream of urban agglomeration)

MP entry points & river transport

Seine river – flowing through the city of lights

Sampling microplastics

Two size-fractions:

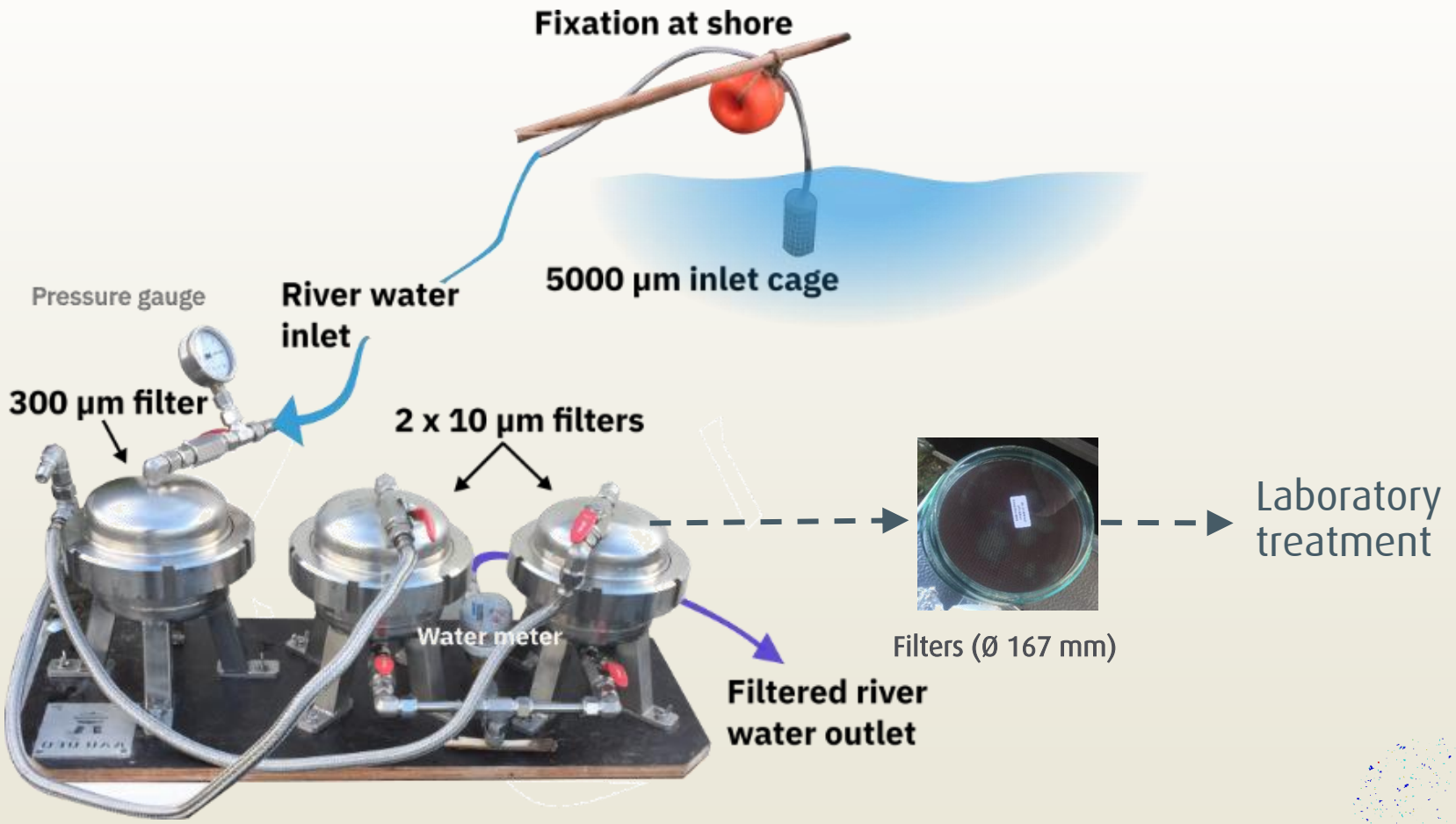
10-300 µm & 300-5000 µm

Volume:

1m^3 for >300 µm
until 2 · 2 x 10 µm filters clog

Water flow:

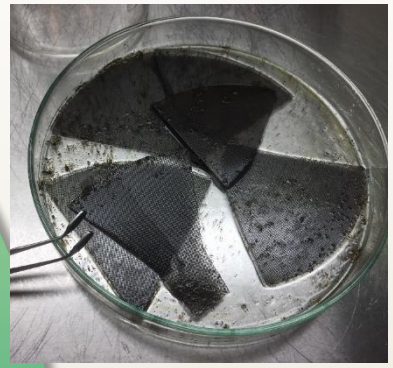
~ 7 L min^{-1}



Universal Filtration Object (UFO)

Laboratory treatment 10-300 µm fraction

1. Filter preparation

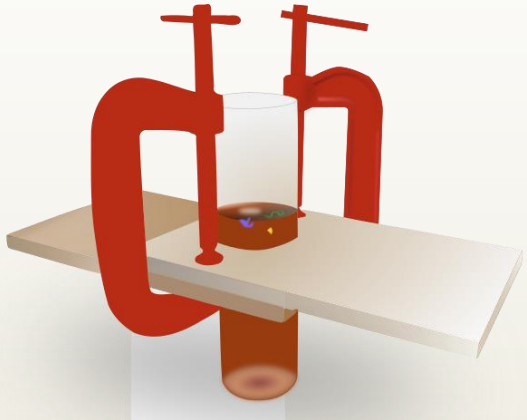


Ø 16.7 cm

2. H_2O_2 wet oxidation

H_2O_2 10 *vol-%*, 30°C, 24h

3. NaI density separation



JAMSTEC with NaI solution
δ ~ 1.65 g cm^{-3}, 24h

4. Anodisc filtration

0.2 μm alumin filter

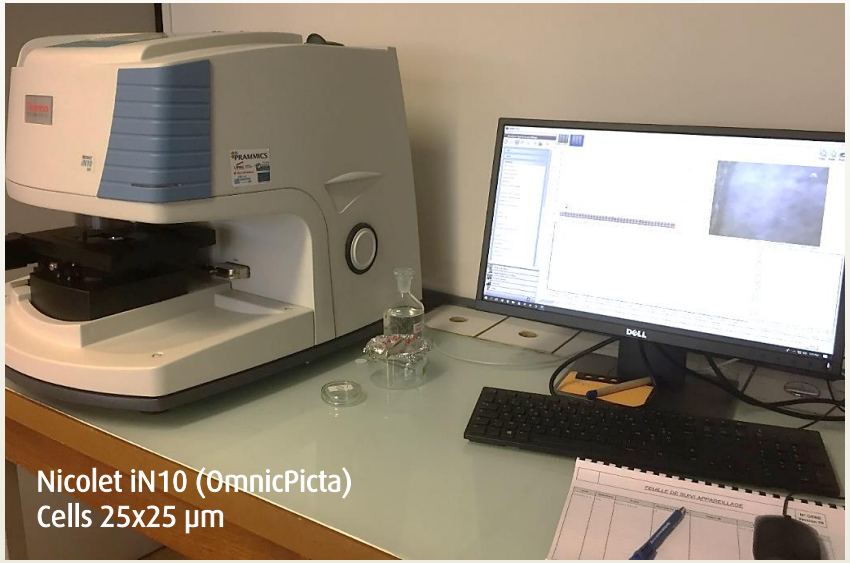
Resuspension

Resuspension

Resuspension

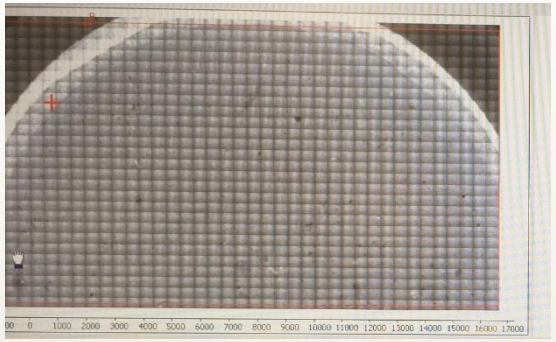
Resuspension: filtration on steel mesh, 2 min ultrasonication
Procedural blanks for each batch of samples
All solutions are 2.7 μm-pre-filtered

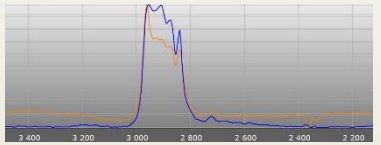
Polymer identification with µFTIR & siMPle



- Full filter mapping
- 100% of sample

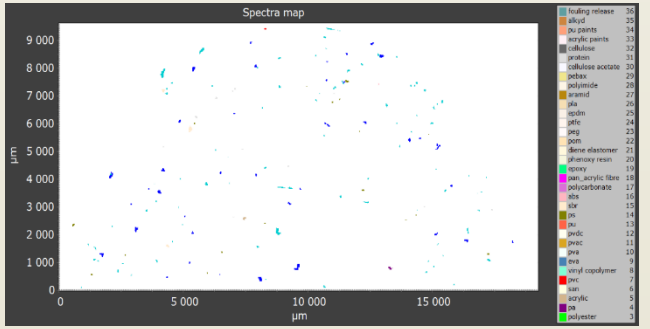
1. Spectra aquisition





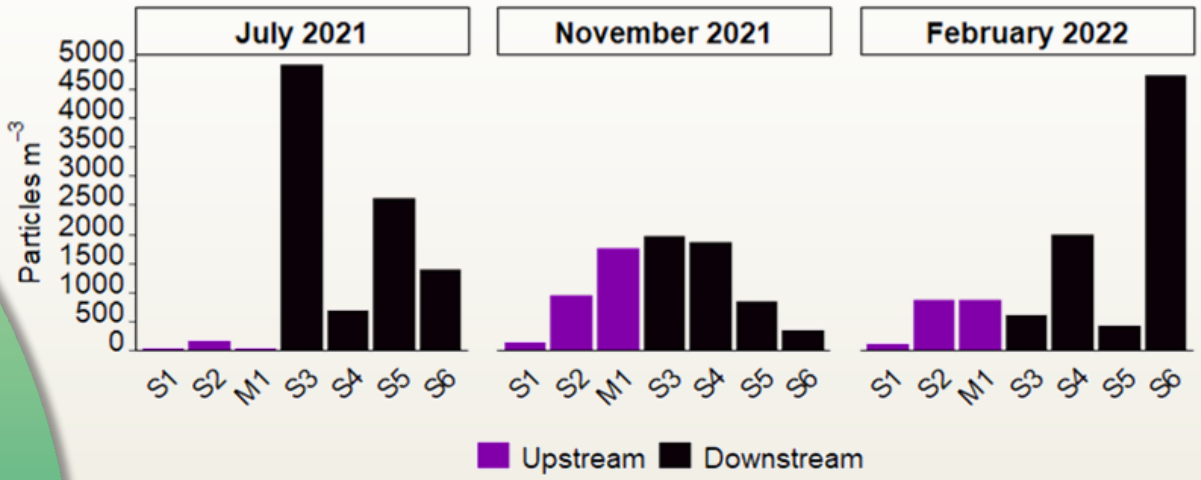
Spectra matching via a library

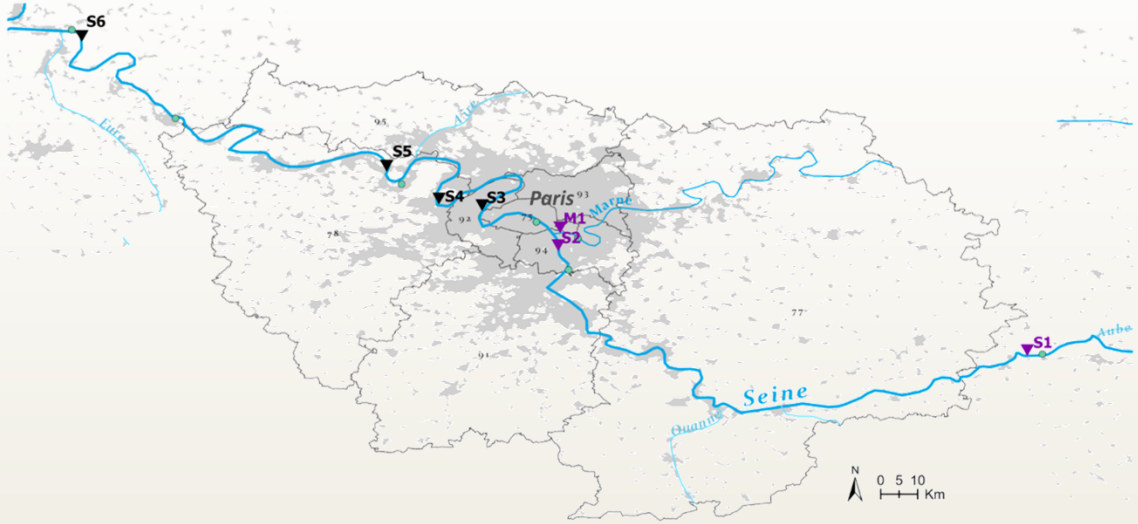
2. polymer identification



µFTIR: Microscope-coupled Fourier-Transmission Infra-Red spectrometry

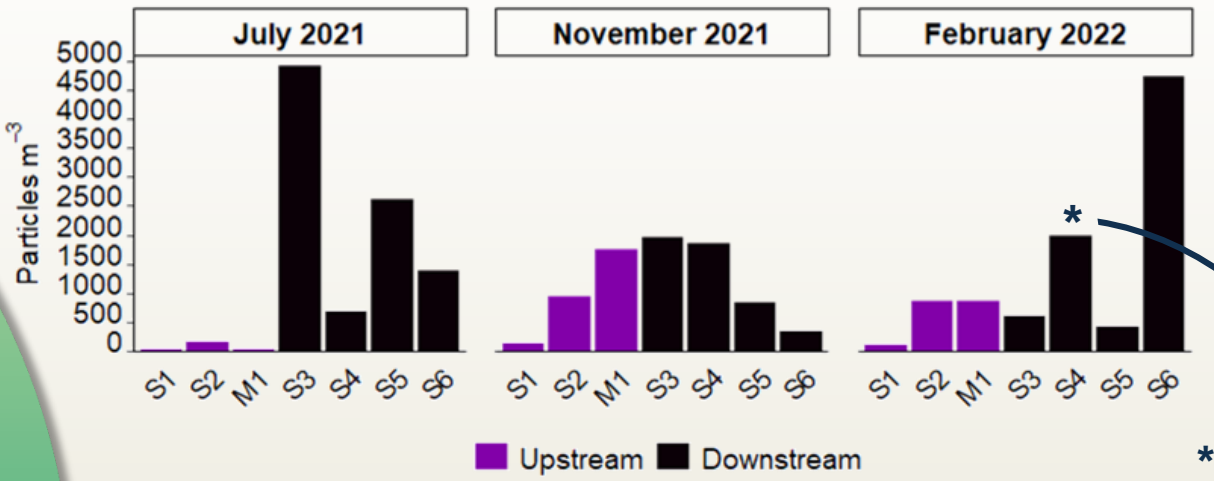
Microplastics along the urban gradient

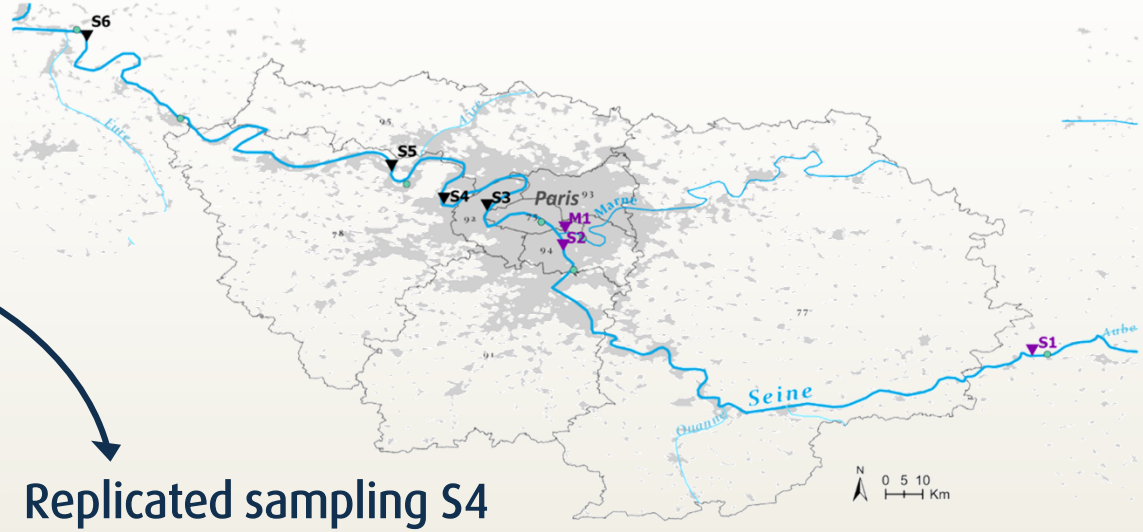




Sample volume: 73 L - 930 L

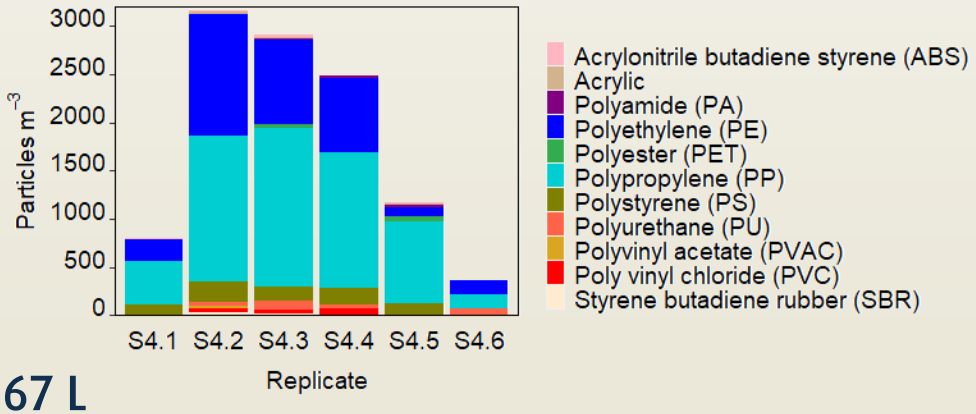
Microplastics along the urban gradient





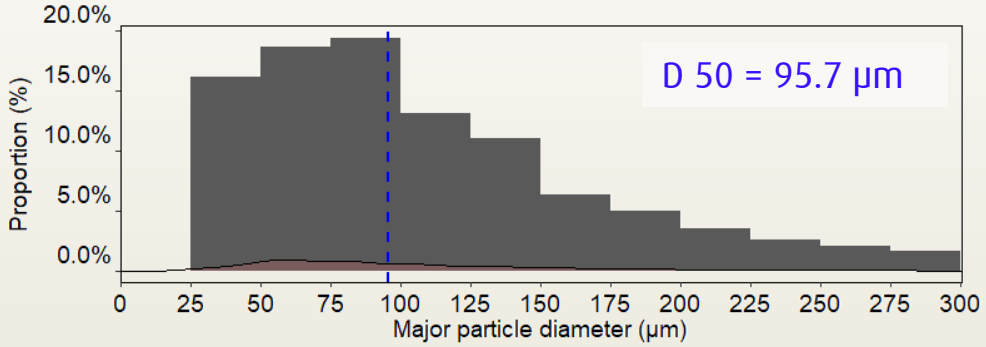
* Replicated sampling S4

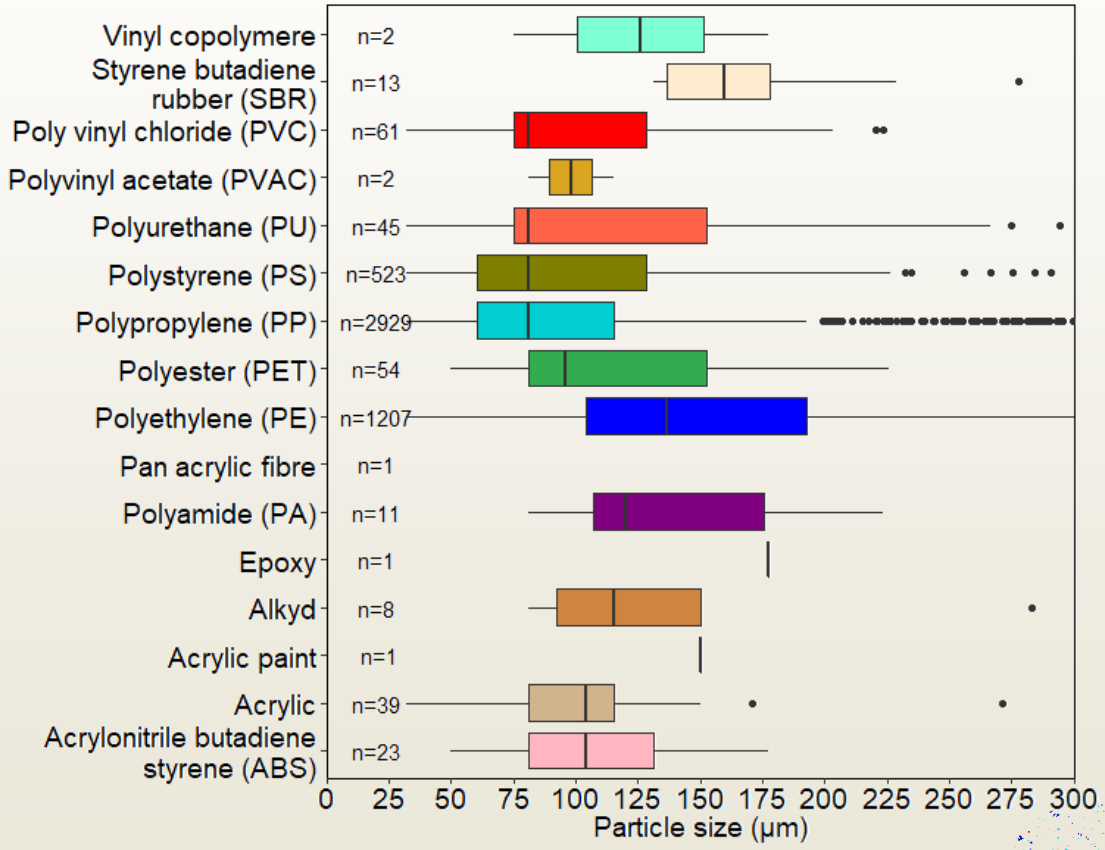
Sample volume: 73 L - 930 L



Sample volume: 59 L - 67 L

Microplastic sizes and types





Summary

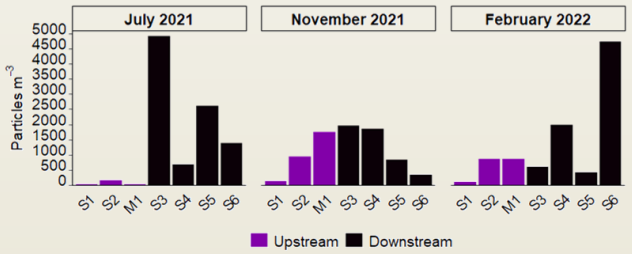
Results:

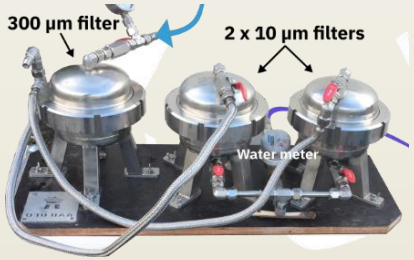
Microplastic concentrations vary

→ Urban area – high micoplastic concentrations

→ PP > PE > PS > PVC > PET > Acrylics

→ Median 95.7 µm





Outlook:

→ Fourth sampling, data analysis (water flow rate, suspended solids) & entry point assessment

Points to consider:

→ One year monitoring

→ Large volumes for 10-300 µm

→ Sampling from the shore, variations

Thank you for listening.

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PRAMMICS

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