

11/12/2020

# Café Science

## Microplastic in the Seine --- Le début du projet ---

*Cleo Ninja Stratmann (PhD student at Leesu, ENPC)*

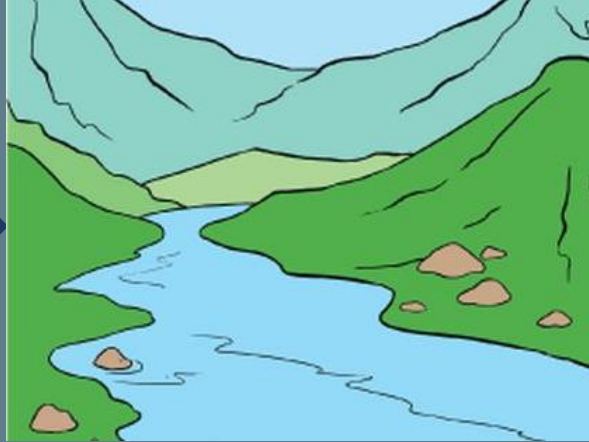
*Supervisors: Bruno Tassin, Johnny Gasperi, Rachid Dris*

*Limnoplast project (MSCA-ITN) 2020-2023*



**Present  
myself**

**The project**



**Questions &  
ideas**



# About

## Study: 2012 & 2016

### Bachelor and Master in Environmental Science and Technology

- Urban ecology
- Waste treatment
- Environmental microbiology
- Limnology, wastewater process engineering

## Work: 2017 - 2019

### Research assistant, Leibniz-IGB

- Enzyme assays, mesocosm experiments
- Urban water sampling campaign in Berlin

### Early-stage researcher, Netherlands Institute of Ecology

- Extreme weather impacts on lake rehabilitation

### Urban Algae project 2018-2020

- European Federation for Freshwater Sciences (EFFS)

### Project coordination course & Entrepreneur networking

# About



*September 2020*  
PhD – LimnoPlast  
Ecole Nationale des Ponts et Chaussées  
LEESU

- Limnoplant:
- Marie Sklodowska Curie Action (MSCA-ITN)
  - Team of 15 PhDs

Working in an engineer project/ NGO project and open a scientific environmental engineering office  
– Plastic in aquatic ecosystems (monitoring, modelling, impacts, removal, solutions)

**Goal: Expert for microplastics, litter pollution and management in aquatic ecosystems.**

**Office at the sea side 😊**

Cleo Stratmann  
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Project: Limnoplast (MSCA-ITN)



# Monitoring and Modelling Microplastic in the Greater Paris Catchment and the Seine River

Where?

How?  $\frac{dy}{dx} = \dots$

What does it cost? €



## Sources and fate of microplastic in the Seine:

- Upstream vs. downstream
- Agricultural influence (Petit Morin / Orgeval)
- Sediment-near processes

## Modelling (source-flux / deterministic)

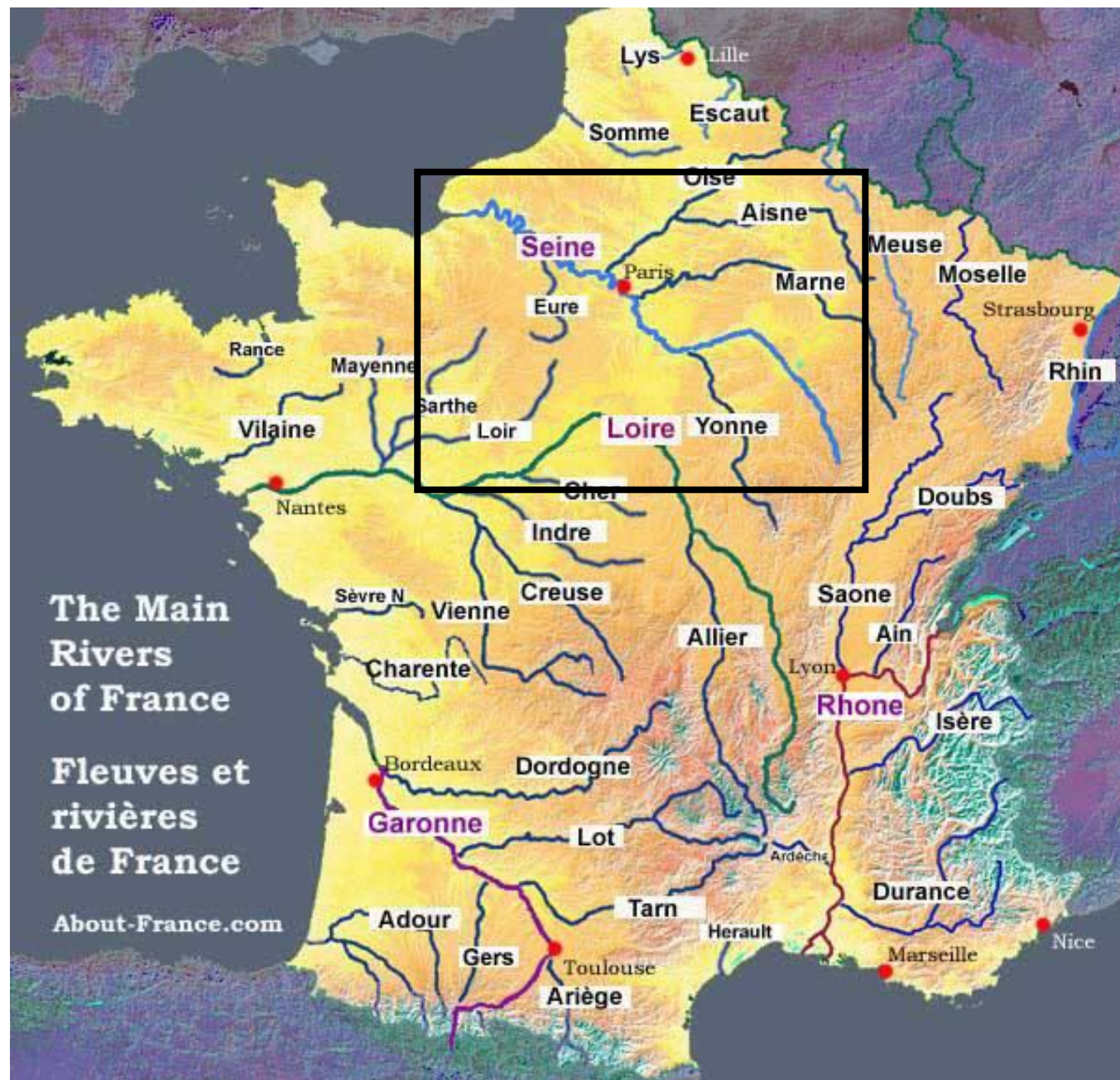


## Economic value of preventing microplastic pollution



**Paris:  
2.2 mio  
inhabitants**

**Greater Paris  
(IDF):  
12 mio  
inhabitants**





# Monitoring and Modelling Microplastic in the Greater Paris Catchment and the Seine River

Where?



## Sources and fate of microplastic in the Seine:

- Upstream vs. downstream
- Agricultural influence (Petit Morin / Orgeval)
- Sediment-near processes

- Literature review, laboratory tests
- MP sampling (pump and sediment traps), Sample processing, MP identification (spectrometric analyses, FTIR)
- 4 sampling campaigns in Seine
- 1-2 sampling campaigns in Orgeval (agricultural influence)

# STANDARD OPERATION PROCEDURES (SOPs) FOR MICROPLASTIC (MP) SAMPLING AND ANALYSIS

MP ASSESSMENT IN FRESHWATERS (DELIVERABLE 2.1)

Main Author: Ecole Nationale des Ponts et Chaussées (ENPC)

Date: 11/11/2020

Public

Project LimnoPlast – Microplastics in Europe's freshwater ecosystems: From source to solutions

Grant Agreement no. 860720

H2020-MSCA-ITN-2019

LimnoPlast: Microplastics in Europe's Freshwater Ecosystems: from sources to solutions  
(Coordinator: Universität Bayreuth | Contact: [EU-LimnoPlast@uni-bayreuth.de](mailto:EU-LimnoPlast@uni-bayreuth.de) | Homepage: [www.limnoplast-itn.eu](http://www.limnoplast-itn.eu))



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 860720

Disclaimer excluding Agency responsibility  
Responsibility for the information and views set out in this document lies entirely with the authors

## Report on microplastic methods

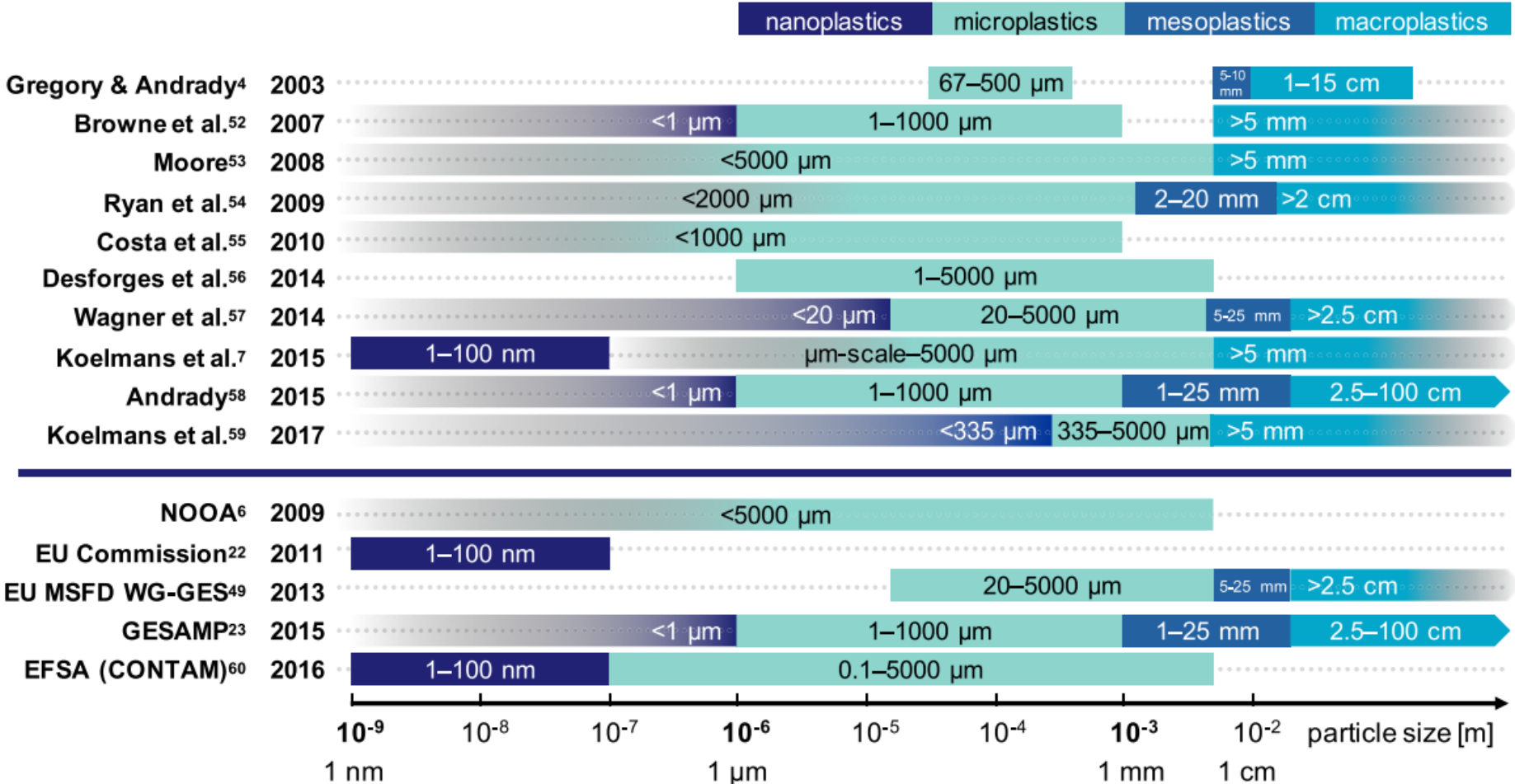
- Freshwater
- Water and sediment samples
- State-of-the-art methods
- Pros and Cons
- Contamination potential
- Recommendations

Will be open access at EC website  
(in a few months)



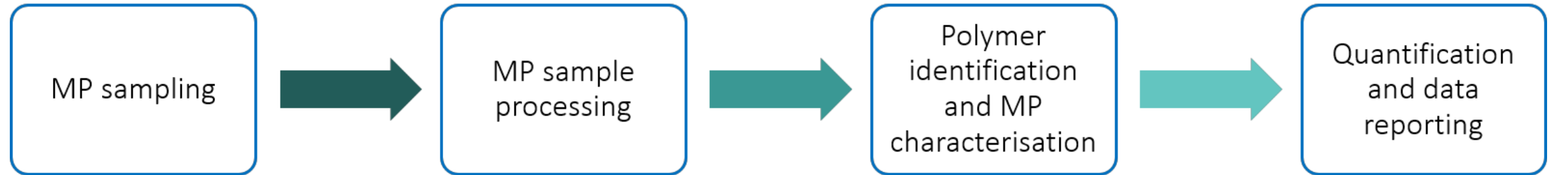
# Definition of microplastic

Mostly agreed upon:  $\leq 0,5$  cm

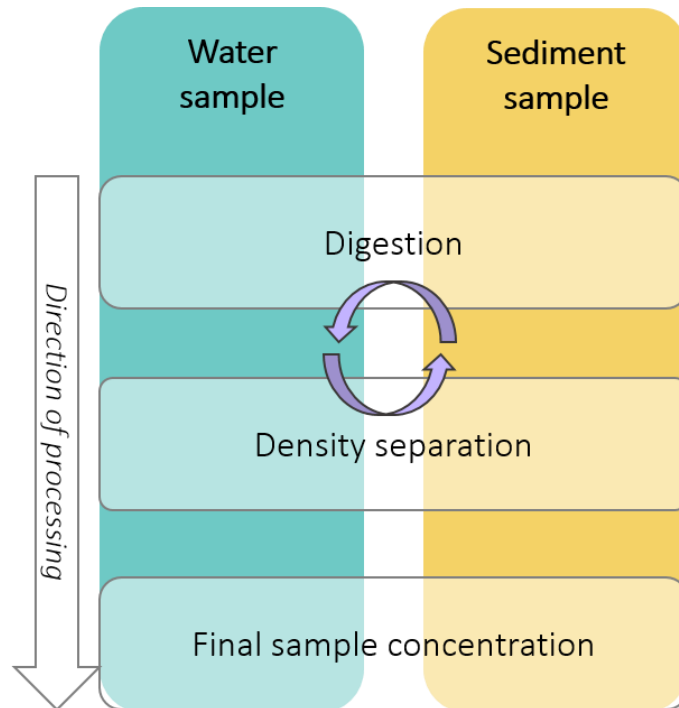


Hartmann, Nanna B., Thorsten Hüffer, Richard C. Thompson, Martin Hassellöv, Anja Verschoor, Anders E. Daugaard, Sinja Rist, et al. « Are We Speaking the Same Language? Recommendations for a Definition and Categorization Framework for Plastic Debris ». *Environmental Science & Technology* 53, n° 3 (5 février 2019): 1039-47. <https://doi.org/10.1021/acs.est.8b05297>.

# Report on microplastic methods



- **Nets (trawls)**
- **Pumps**
- **Automated**
- **Manually**
- **Grabbers**
- **Cores**

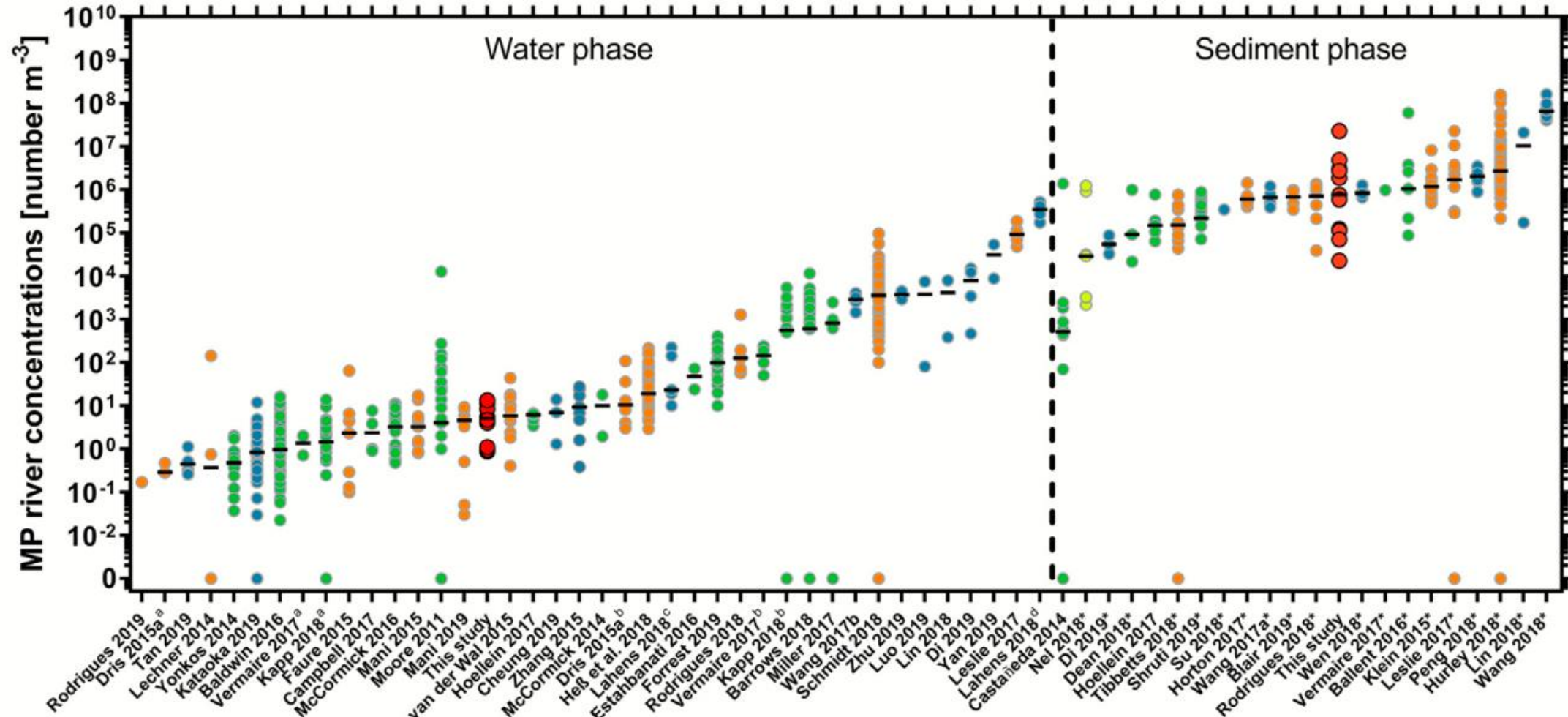


- **Optical or scanning electron microscopy**
- **FTIR and  $\mu$ FTIR spectrometry**
- **Raman and  $\mu$ Raman spectroscopy**
- **GC-MS-coupled methods**
- ***Polymer identification with reference databases***

- **Particle size and dimensions**
- **Concentration**
- **Colour**
- **Shape**
- **Mass**
- **Polymer type**
- **Blanks**
- **No-Gos**
- **Uncertainties**

# Methodologies differ & concentrations differ

MP concentrations in rivers Europe, America, Asia



# Sediments

## Grab sampling



Van-Veen grab



Ekman grab

## Core sampling



Sediment corer



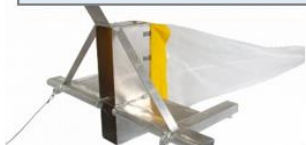
Box corer

# Sampling methods

*I will use a pump with filter cascade system for my studies*

# Water

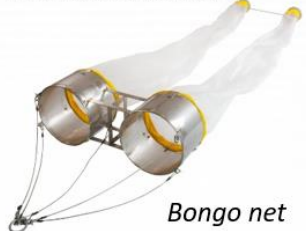
## Net/trawl sampling



Vertical Manta trawl



Manta trawl



Bongo net



Zooplankton net

## Pump sampling



Filter-cascade water pump

## Automated sampling



Multi-bottle automated sampler



Automated fluid injection sampler

## Manual grab/scoop sampling



Glass bottle

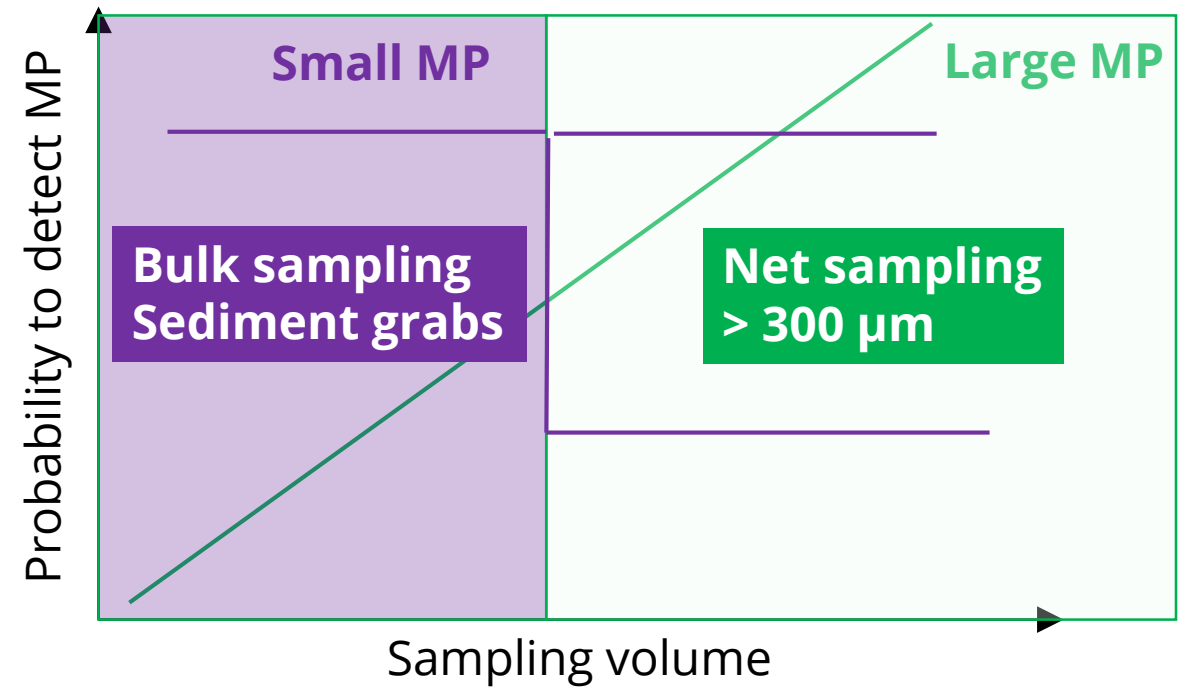
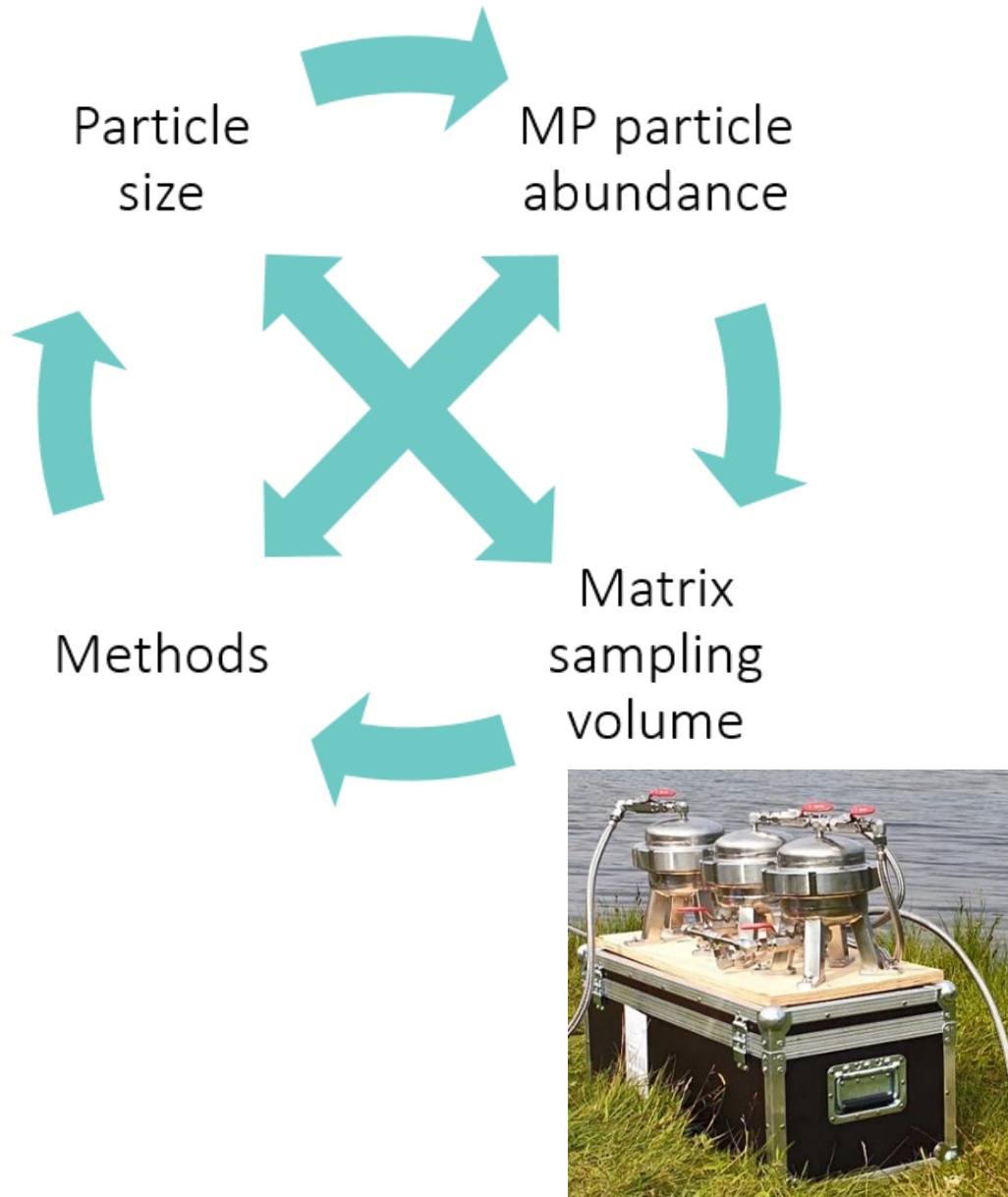


Van-Door sampler



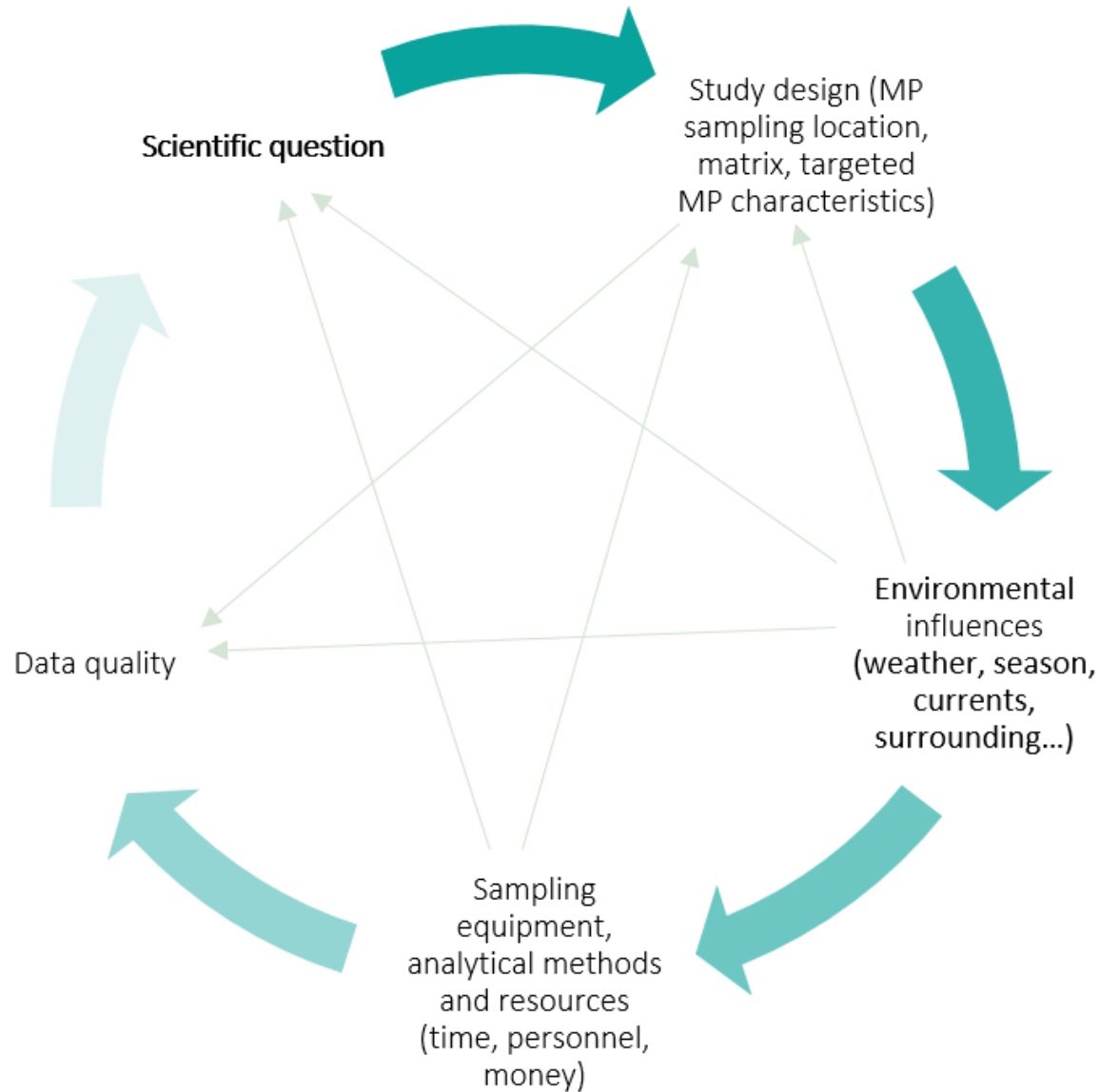
Niskin sampler

# Representativeness of sampling

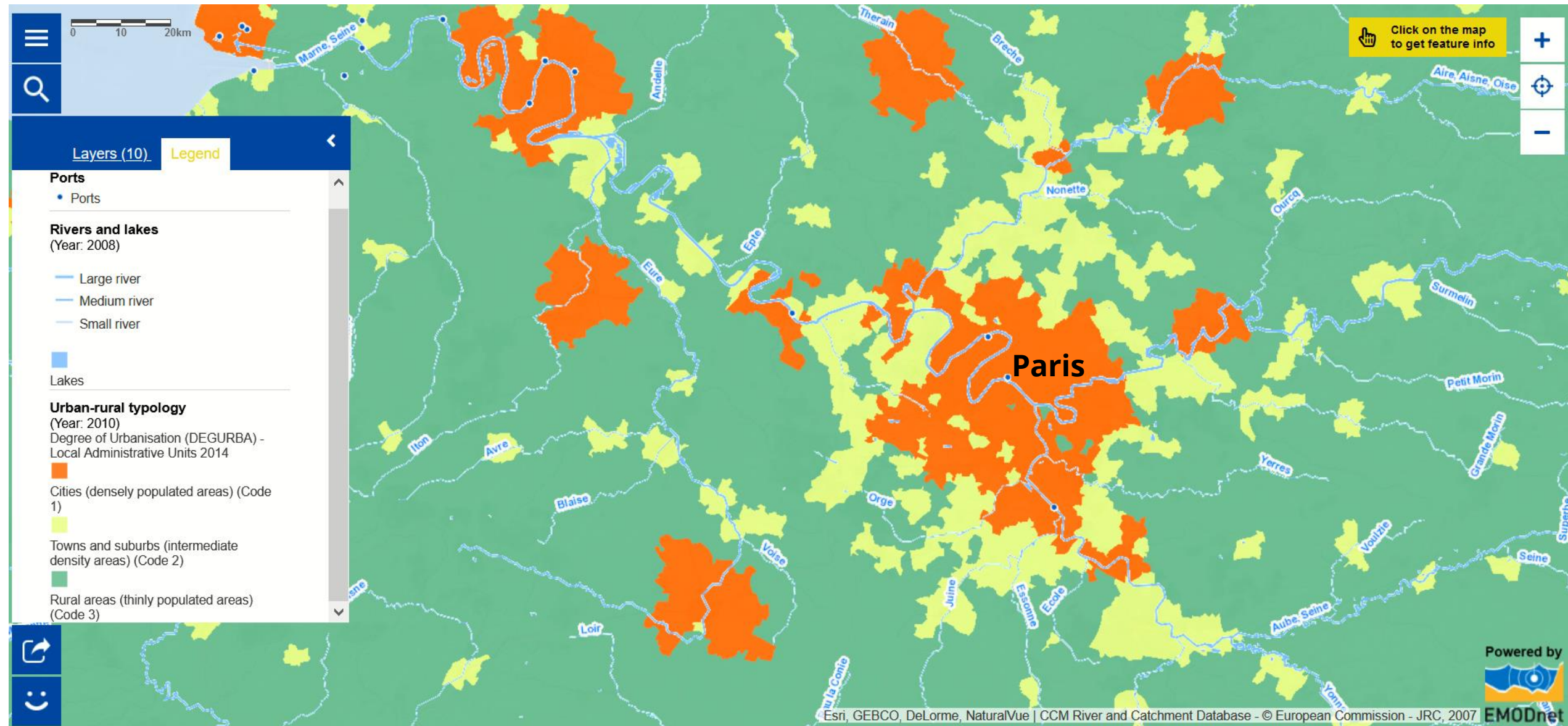




# Interdependencies ... affect the design of my PhD



- **Sampling locations**
- **Time of sampling**
- **Sampling methods**
- **Equipment needed**



Esri, GEBCO, DeLorme, NaturalVue | CCM River and Catchment Database - © European Commission - JRC, 2007 **EMODnet** Powered by



*video*

# Seine river



Yes

## Is there plastic in the Seine ?

Van Emmerick et al. (2019)

- **Macroplastic** 10x higher in high flow period
- Higher downstream than upstream (Paris!)
- Triel-sur-Seine: 160 items/hour September (low flow) vs. 602 items/hour March (high flow)

Treilles et al. (2018)

- **Microplastic**, trawl sampling 80  $\mu\text{m}$  mesh
- Marnay-sur-Seine (upstream):  $\sim 2$  particles/ $\text{m}^3$  vs. Bougival (downstream):  $\sim 14$  particles/ $\text{m}^3$

Dris et al. (2015)

- **Microplastic**, plankton net 80  $\mu\text{m}$  mesh + manta trawl 330  $\mu\text{m}$  mesh (upstream and downstream)
- Range plankton net: 4-108 particles/ $\text{m}^3$  vs. Range manta: 0.28 to 0.47 particles  $\text{m}^3$



# Potential sampling sites Seine

*My focus probably on the green-marked sites*

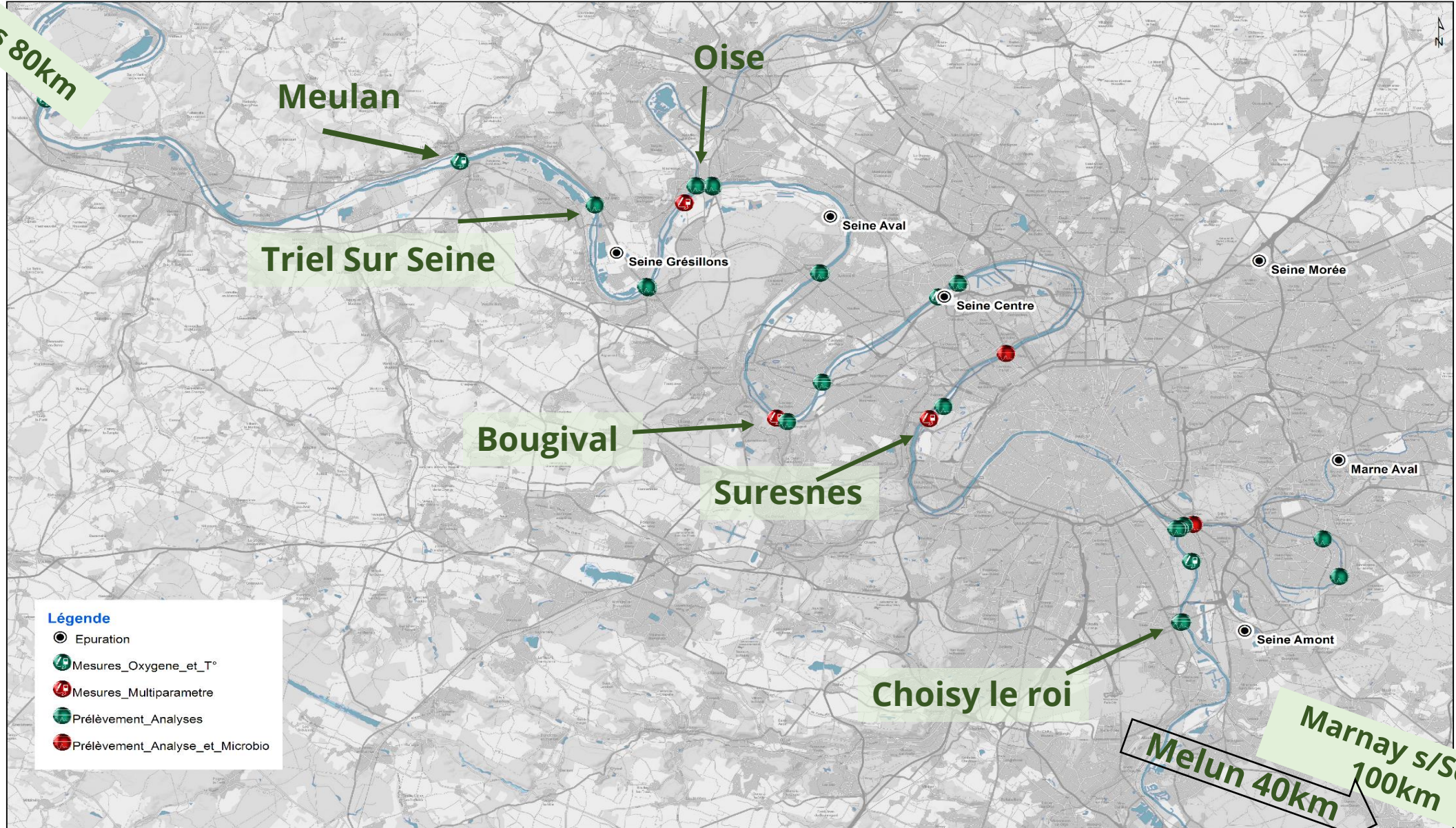
## Low flow and high flow periods (temporal variation)

- very low flow  $\sim 80-100\text{m}^3/\text{s}$  (Mar/Apr – Sept)
- high flow  $\sim 1000\text{m}^3/\text{s}$  (Sept/Oct/Nov) – Mar)

Site	Location
Orgeval *	upstream (Grand Morin/ Marne)*
Marnay-sur-Seine	upstream
Melun	upstream
Choisy-le-Roi	upstream SIAAP
Oise	upstream
Suresnes	downstream SIAAP
Bougival	downstream SIAAP
Oise	downstream
Triel-sur-Seine	downstream SIAAP
Meulan	downstream
Poses	downstream



Poses 80km



**Légende**

- Epuration
- Mesures\_Oxygene\_et\_T°
- Mesures\_Multiparametre
- Prélèvement\_Analyses
- Prélèvement\_Analyse\_et\_Microbio

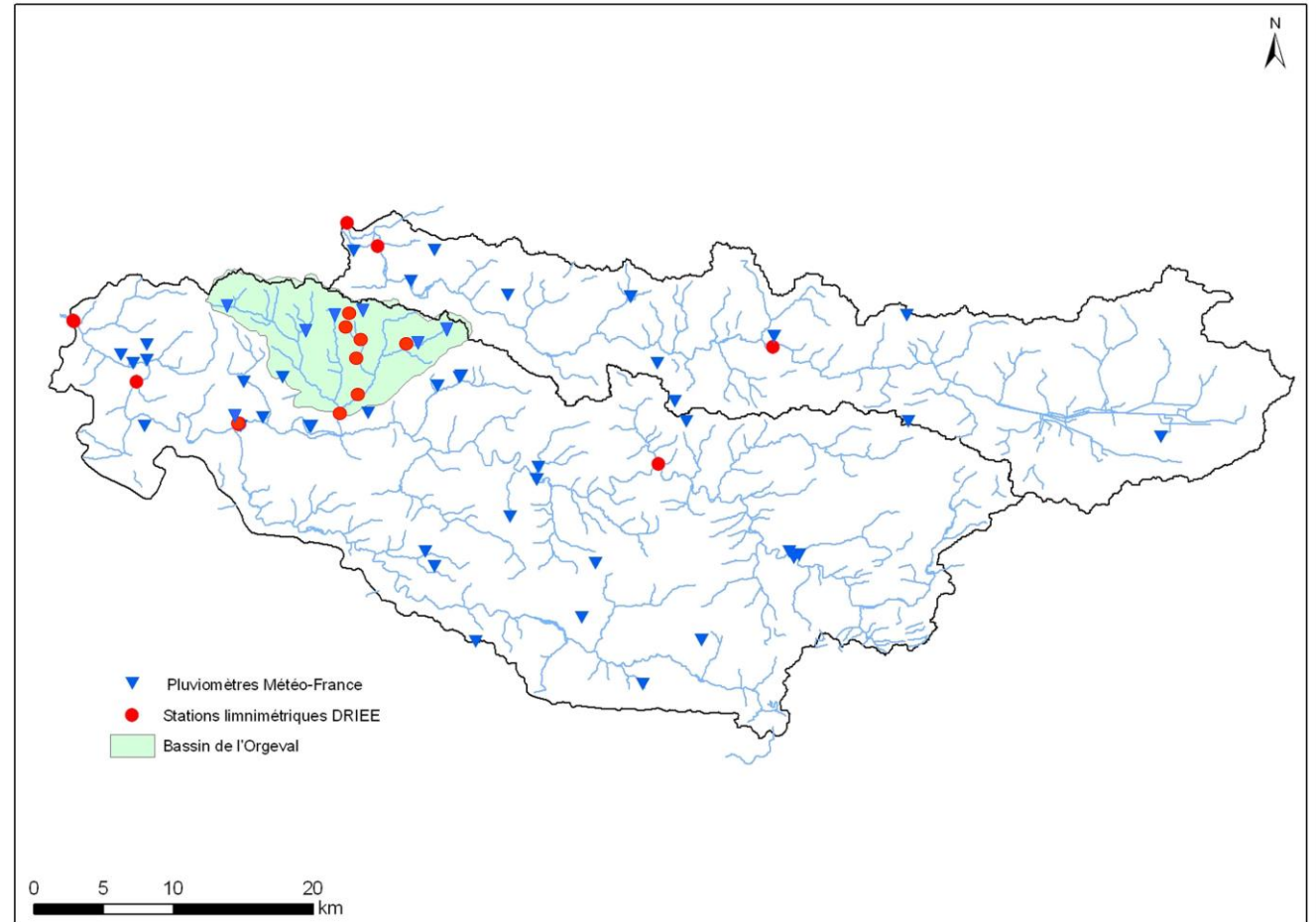




## Sampling sites Orgeval (agricultural influence)

- agricultural drain (organic)
- agricultural drain (classical)
- tributary in an upstream forest catchment
- outlet of the catchment

☐ between November and February  
flowing streams but dry in summer →  
January campaign





# Monitoring and Modelling Microplastic in the Greater Paris Catchment and the Seine River

Where?



## Sources and fate of microplastic in the Seine:

- Upstream vs. downstream
- Agricultural influence (Petit Morin / Orgeval)
- Sediment-near processes

## To Do:

- Test pump and prepare methods
- Develop hypotheses
- Plan sampling campaigns (Seine, Orgeval)

What are your experiences, ideas, suggestions?



# Monitoring and Modelling Microplastic in the Greater Paris Catchment and the Seine River

- Teaching courses by DELTARES (Limnoplant partner)
- Suspended solids correlation with microplastic particles?
- Data collection, results from the sampling campaign, mathematical equations to describe MP, source fluxes analysis

$$\frac{dy}{dx} = \dots$$

Modelling (source-flux / deterministic)





# Monitoring and Modelling Microplastic in the Greater Paris Catchment and the Seine River

- Secondment in Leipzig (Germany): 6 month
- Business school HHL (Limnoplast partner)
- Potential collaborations with French company INERIS
- Literature study, stakeholder interviews, concept development



Economic value of preventing microplastic pollution



# Thank you for listening!



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UNIVERSITÉ  
PARIS-EST CRÉTEIL  
VAL DE MARNE



# Literature sources



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