Monitoring of microplastics in the Scheldt estuary (Belgium)

Mathilde Falcou-Préfol

Raewyn Town, Ronny Blust, Colin Janssen, Jana Asselman, Maaike Vercauteren & Tom Maris

OMES project

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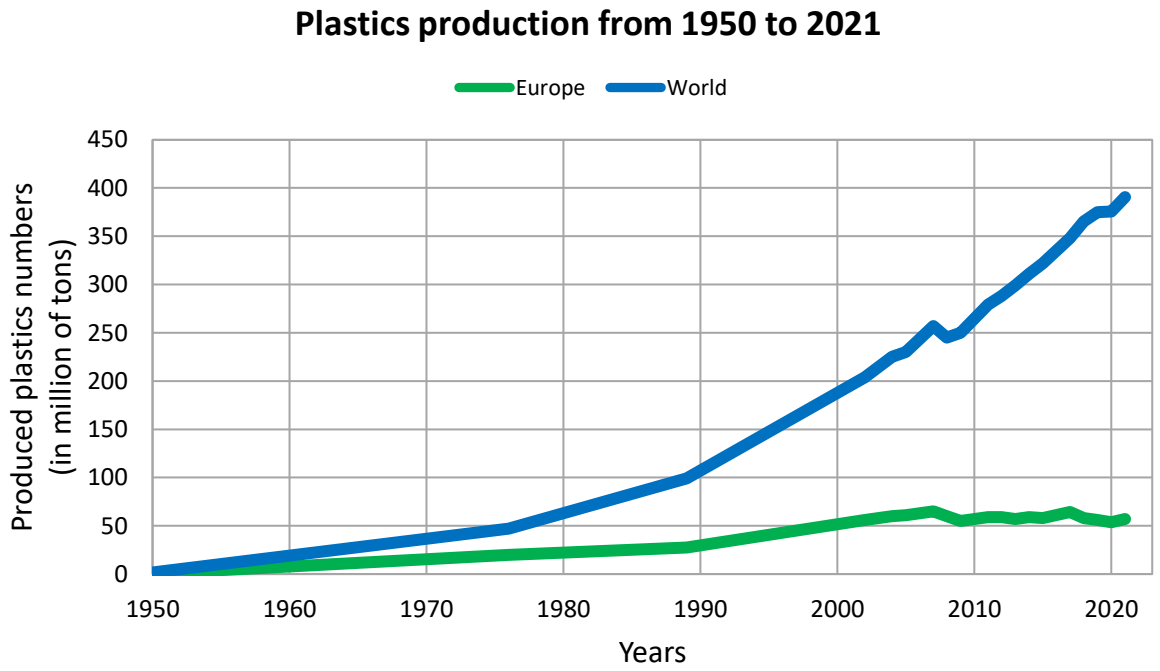
Microplastics

- **↗ plastics production**

Phys.org

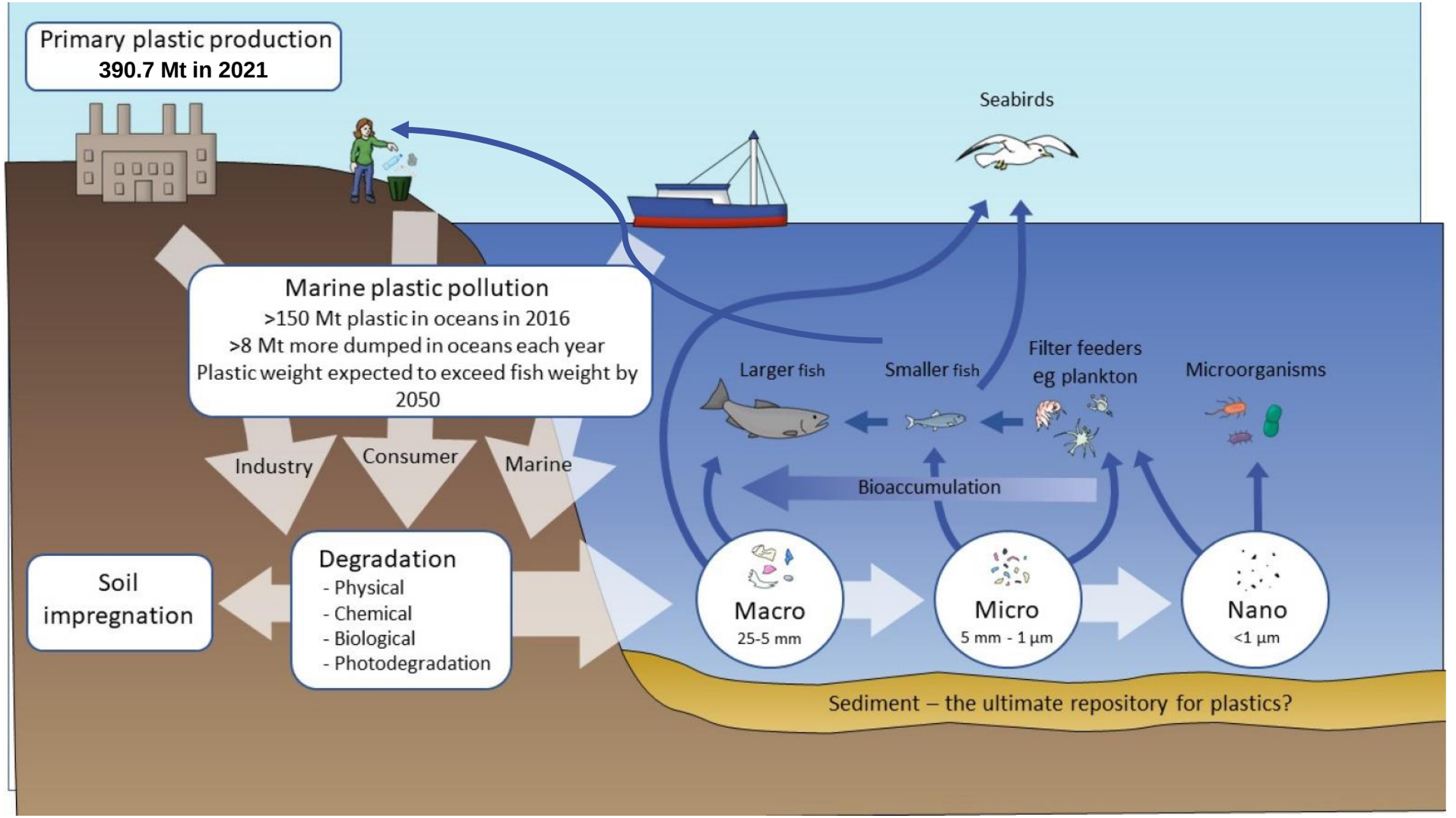
- **Plastics in the ocean**
  - 80% land-based sources
  - Ubiquitous
  - Range of polymer types, morphologies, sizes



Data from Plastics Europe Facts 2022

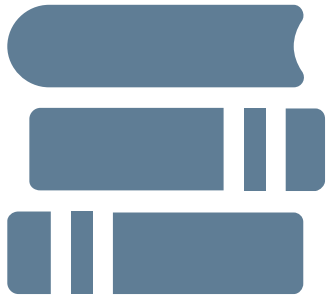
- **Microplastics = particles 1 µm - 5 mm**

Microplastics



Modified from Gangadoo *et al*, 2020

MP concentrations in the Scheldt estuary and the North Sea coast?



- **Scheldt estuary**
  - Water: 24 to 27 MP/l (Van Echelpoel, 2014; Devriese and Janssen, 2022)

    0 to 113 MP/m^3 (Liu et al, 2022)
  - Sediment: 646 to 50124 MP/kg (Van Cauwenberghe, 2015; Devriese and Janssen, 2022)

    15 to 413 MP/kg (Liu et al, 2022)

- **North sea**
  - Water: 20 to 500 MP/m^3 (De Witte et al, 2021)

    0 to 245.4 MP/m^3 (Lorenz et al, 2019)
  - Sediment: 54 to 330 MP/kg (Maes et al, 2017; Devriese and Janssen, 2022)

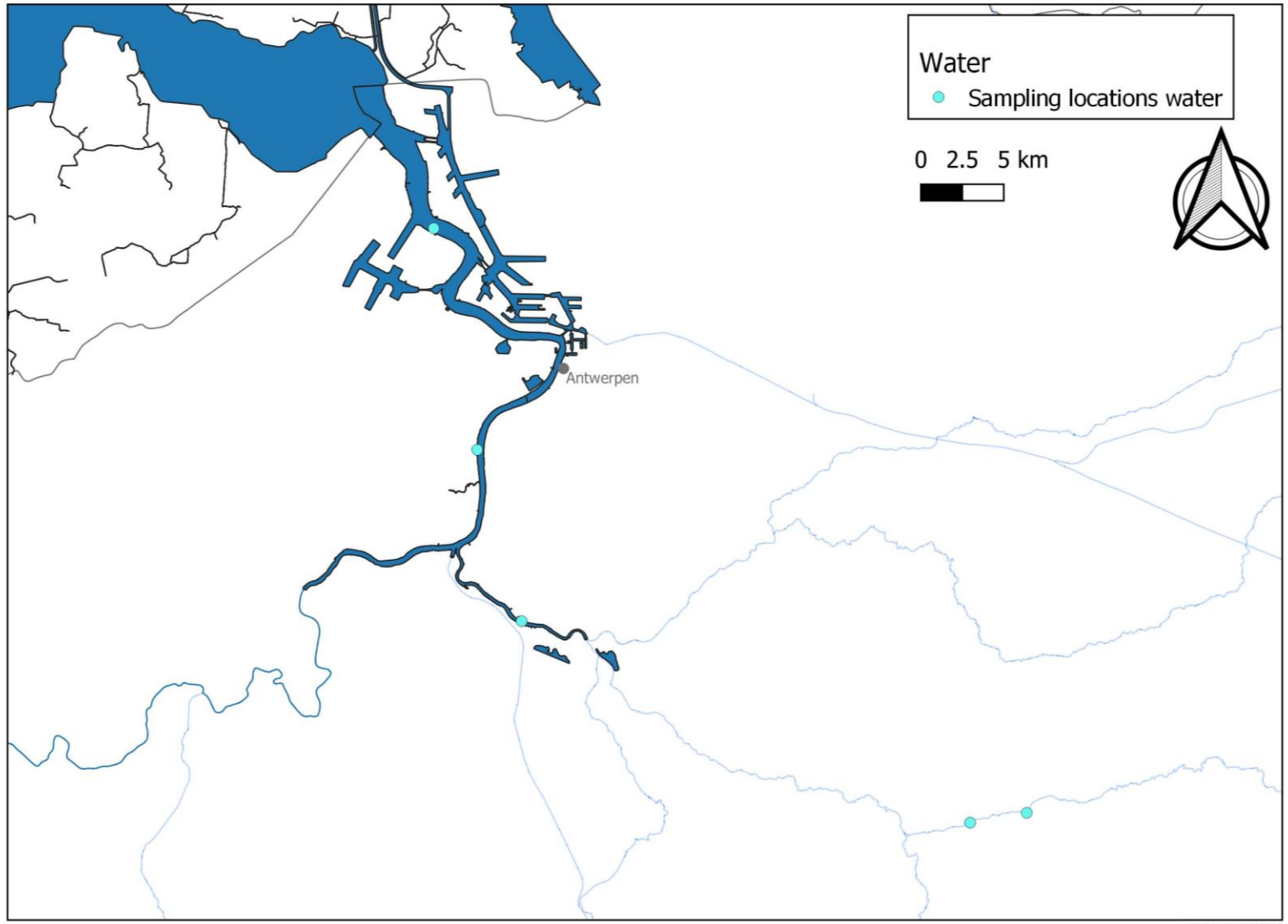
Project objectives

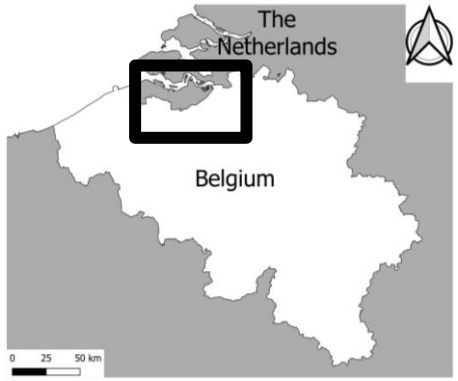
- **To develop methods for MP sampling and analysis**

- **To determine MP distribution and concentration in water and sediment matrices collected in the Scheldt estuary at same locations:**
  - Seasonal variation
  - Spatial variation

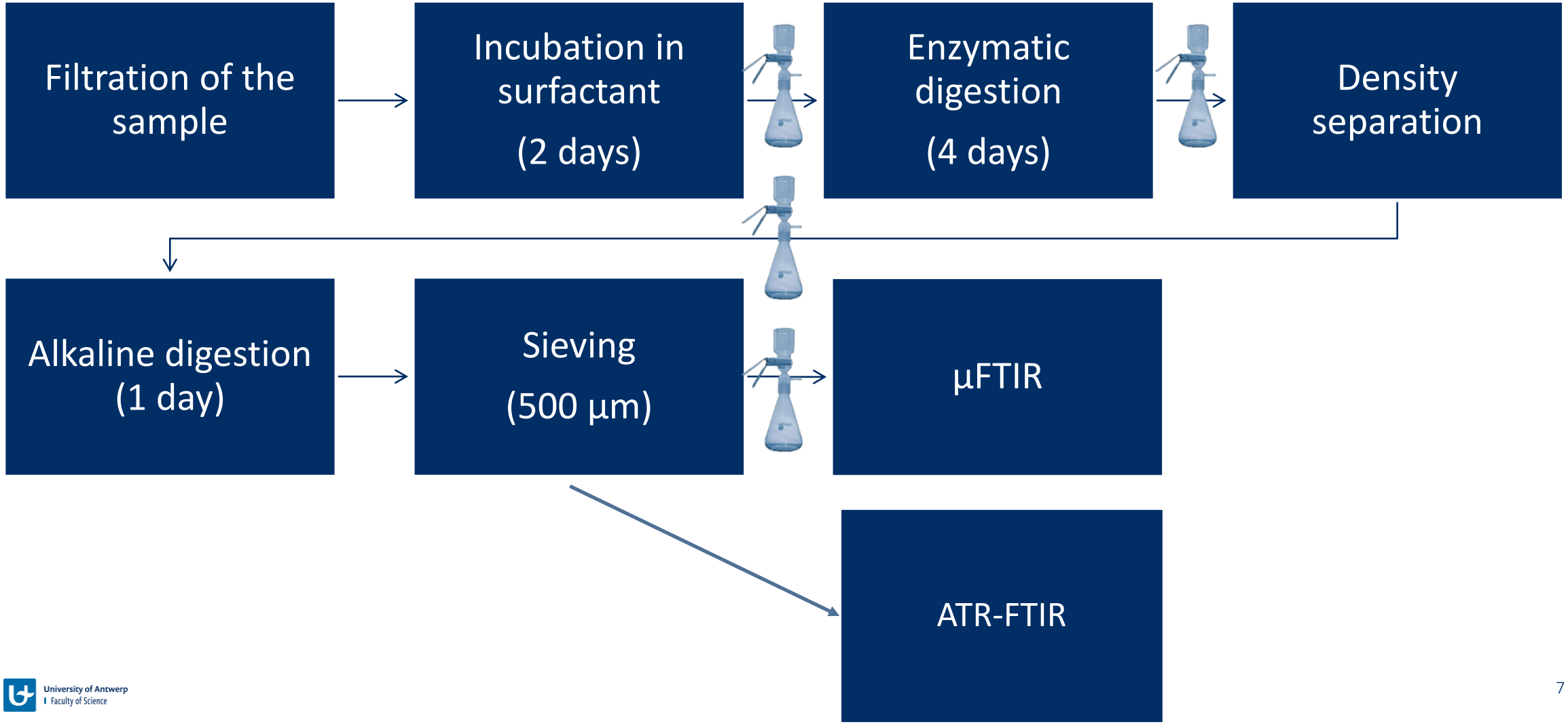
Water matrix – Sampling

3 replicates x 3 depths x 10 L



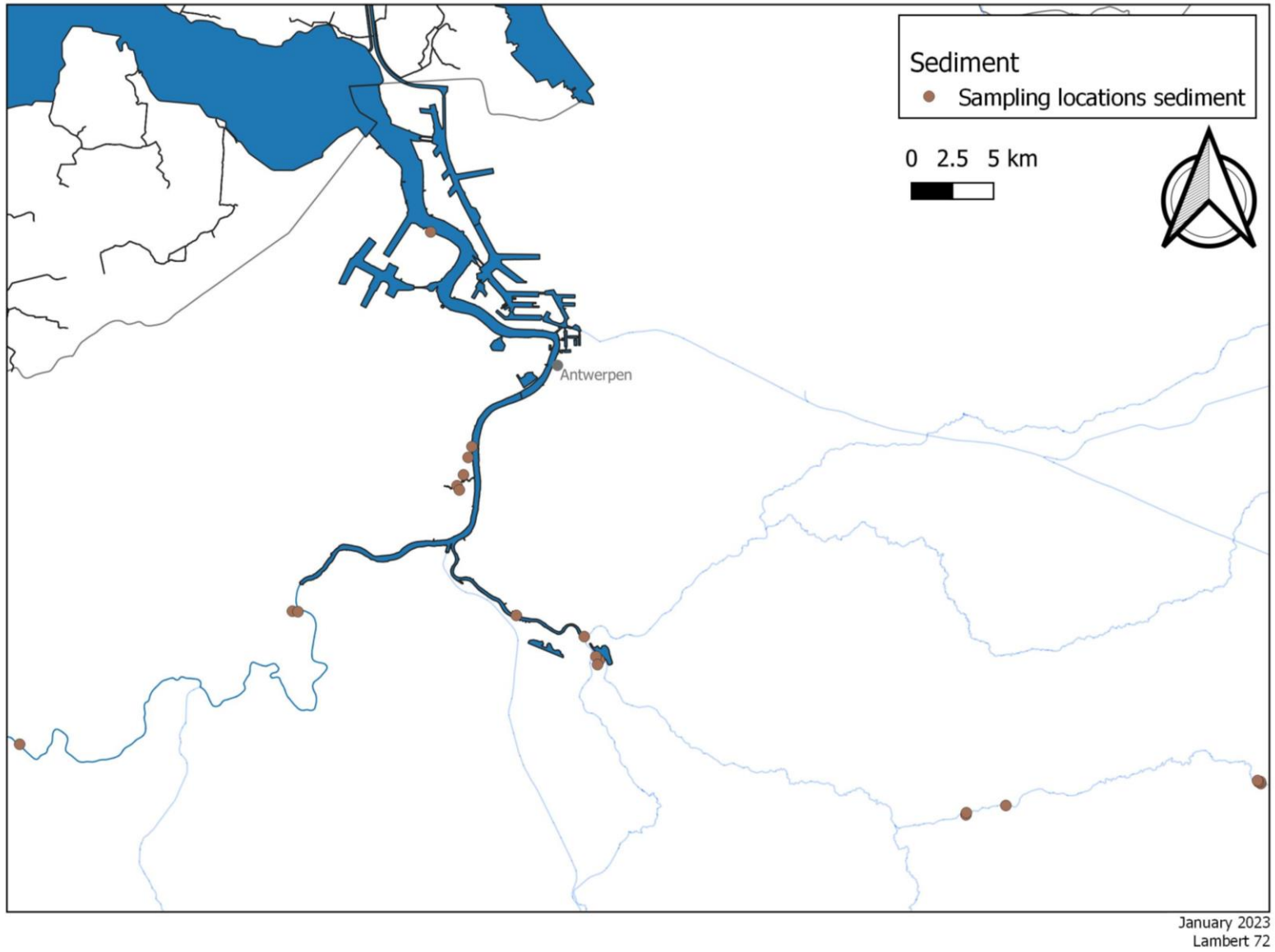


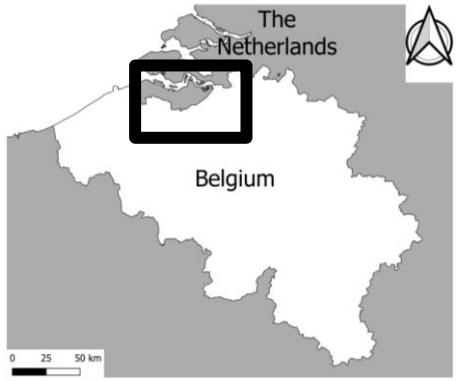
Water matrix – Preparation of the samples



Sediment matrix – Sampling

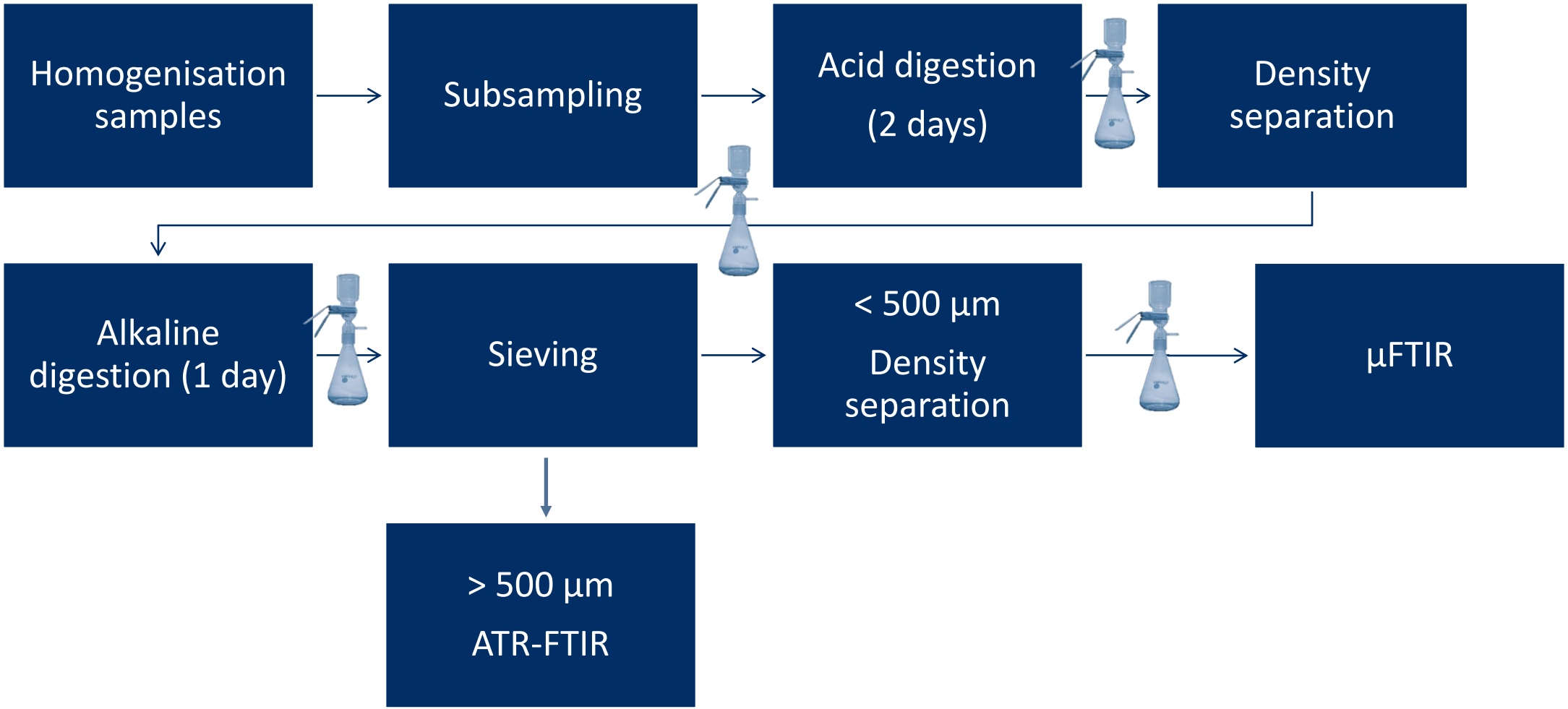
3 replicates x 3 bank positions x ~1 kg





Boom sampling site

Sediment matrix – Preparation of the samples

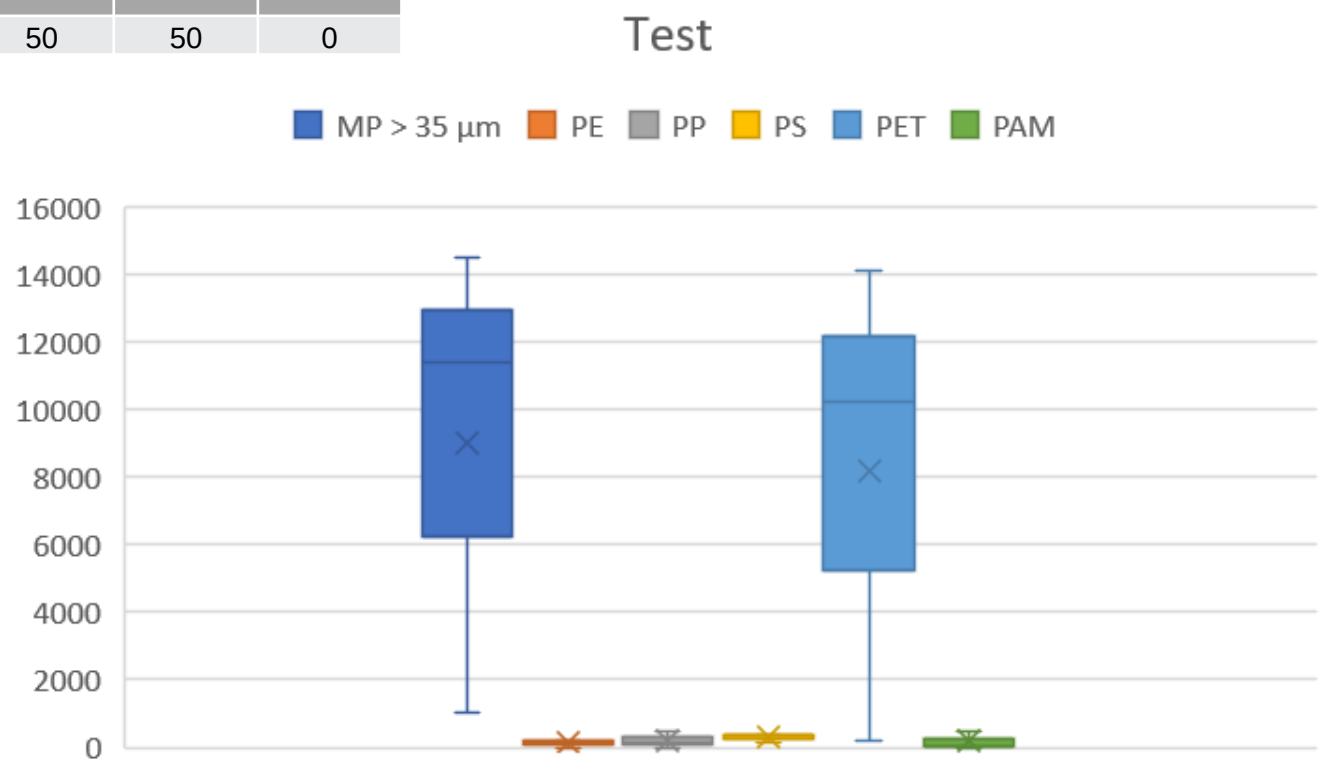


Sediment matrix – Initial results

- **Test samples**

	[MP] > 35 µm (# per kg)	PE (# per kg)	PP (# per kg)	PS (# per kg)	PET (# per kg)	PAM (# per kg)
Blank	**100**	0	0	50	50	0

No plastic particle > 500 µm



Outlook

- **Analysis of the water samples**
- **Preparation and analysis of the sediment samples**

- **Analysis of the samples for particles with size smaller 10 µm**
  - Small microplastic and nanoplastic
  - Method development

What is a NP?

- **Main properties**

Composition	Mixture of various polymers, highly weathered
Formation	Unintentional / Produced
Size	1 nm - 1μm
Size distribution	Polydisperse (continuum of size)
Shape	Asymmetrical shape; Heterogeneous
Surface charge	Uncontrolled with the presence of different species (organic and inorganic); Inhomogeneous on the particle surface
Stability	Heteroaggregation with other natural and/or anthropogenic colloids during the formation process; Depending of both nanoplastics and its surrounding media physical and chemical properties
Aggregates	Potentially, fractal aggregates form; Depending on the formation process
Porosity	Open structure; Depending on both the core material and the formation process

Modified from Gigault *et al*, 2018

Different to MP

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Nanoplastic?

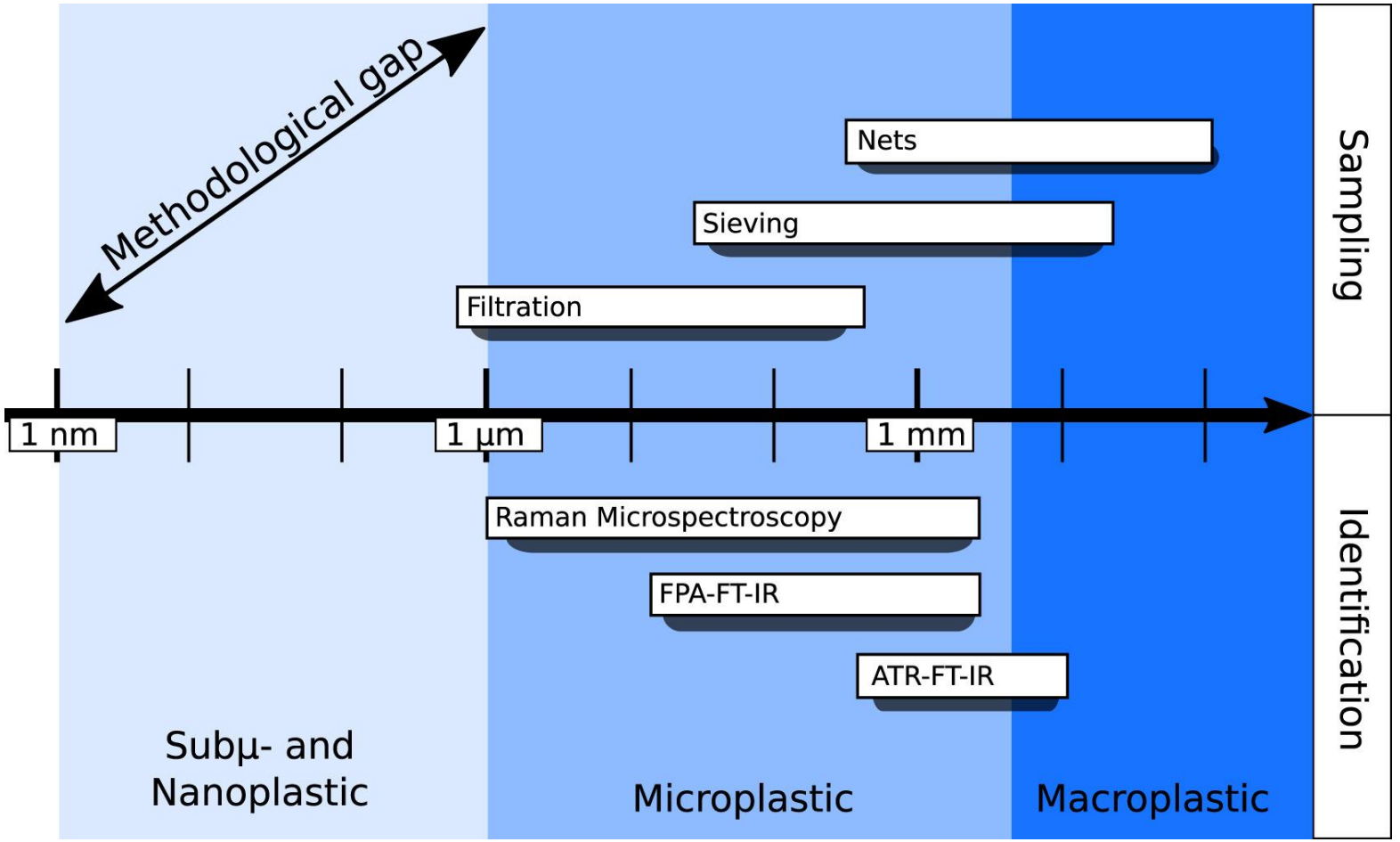
Model estimates x10^{14}

Mass conservation principles

+ fragmentation of spherical particles

(Besseling et al, 2019)

Common methods to analyse MP and NP



Schwaferts *et al*, 2019

Why study NP in the environment?

Lack of methods for detection of these particles in environmental matrices

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Lack of environmental concentration values

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Characteristics of used particles?

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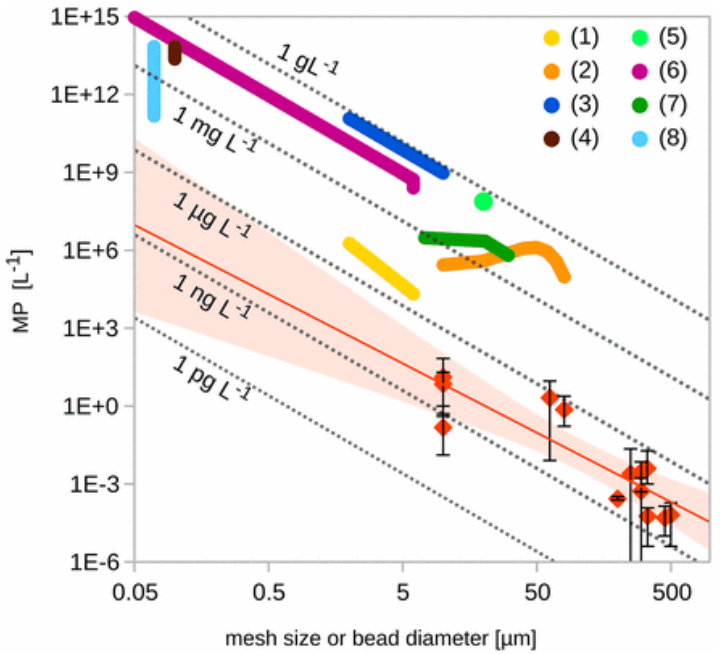
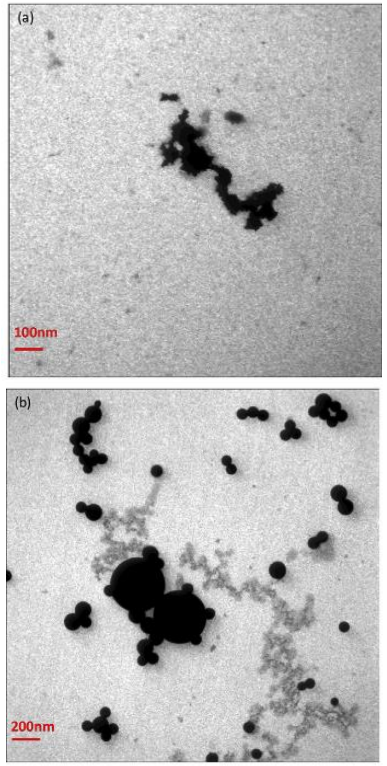
Lack of relevant risk assessment

Ecotoxicology studies



Lenz *et al*, 2016



Gigault *et al*, 2018

Thank you for your attention!

Mathilde Falcou-Préfol
PhD student

Mathilde.Falcou-Prefol@uantwerpen.be
Mathilde.FalcouPrefol@ugent.be