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# Microplastic contamination in the Seine River estuary

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Cachot J., Gasperi J.

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PLASTIC-SEINE PROJECT (2017-2020), FUNDED BY GIP SEINE-AVAL



## The microplastic problem



- First article on plastic debris in 1972 (Carpenter et al., 1972)
- 2009: Microplastics = particles < 5 mm
- Fragmentation mechanism:
  - Mechanical erosion
  - Photo-degradation
  - biodegradation
- First studies on marine environment then on continental waters
- Now : growing interest for estuaries



(Cole et al., 2013)



Chris Jordan (via U.S. Fish and Wildlife Service Headquarters)



# Ifremer

# Plastic-Seine project

- Project aims:
  - Status of abiotic compartment contamination on the Seine continuum
  - Inventory of the contamination of the food network in the Seine River estuary
  
- Seine River estuary :
  - From Poses to Le Havre
  - Semi-diurnal tides
  - Salinity gradient & hydrodynamics
  - Possible microplastics transfer area from fresh water to marine environment

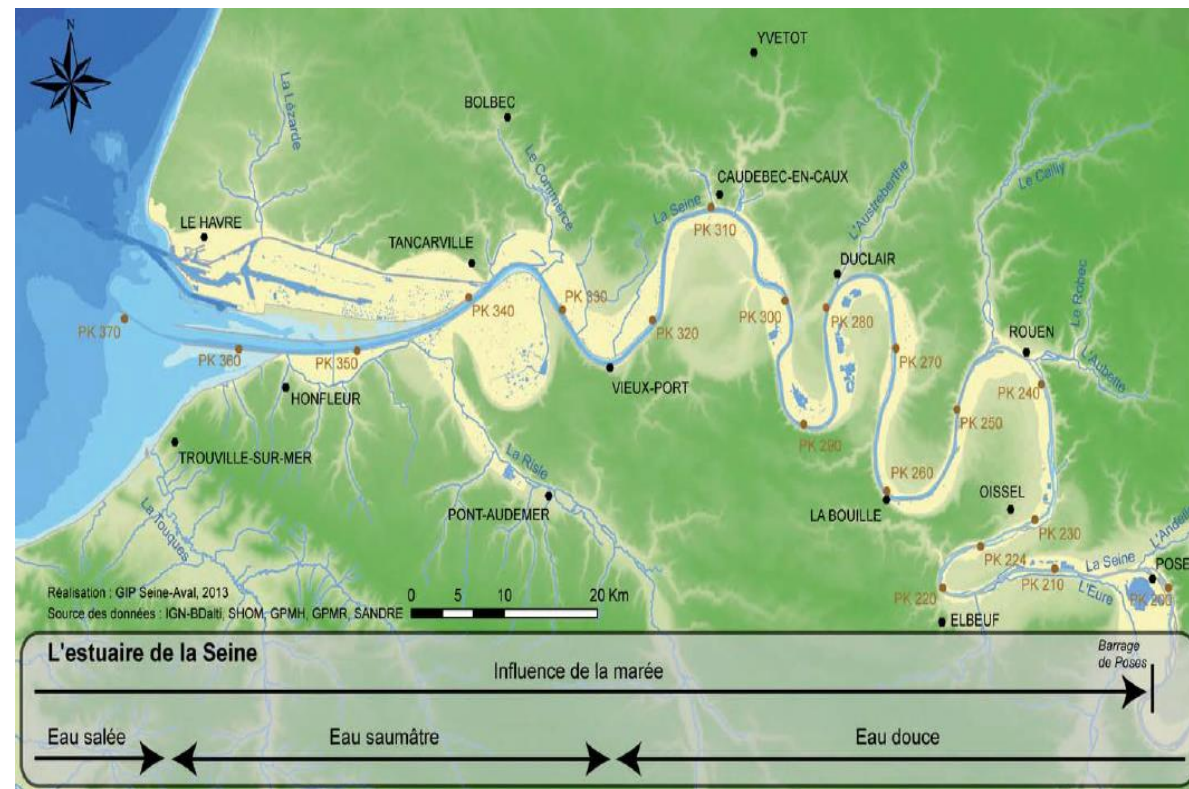


Figure 1: limit of the Seine River estuary (Fisson et al., 2014)

- Material
  - Plancton net modified, 300  $\mu\text{m}$  mesh, collecting upper 15 cm (surface water)
  - Classic plancton net, 300  $\mu\text{m}$  collecting upper 50 cm (subsurface water)

- Methods
  - 3 sampling sites
  - Ebb and rising tide
  - Tide coefficient: 71
  - Flow:  $256 \text{ m}^3 \cdot \text{s}^{-1}$

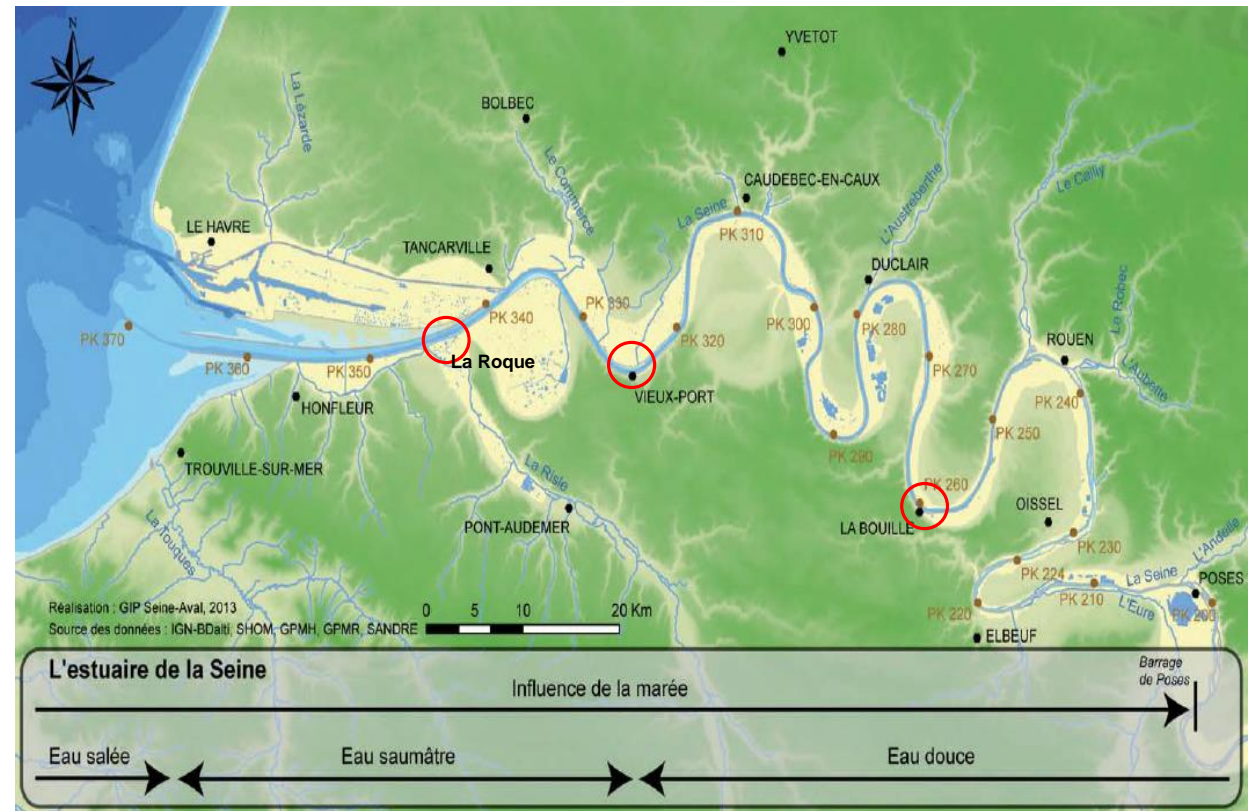


Figure 2 : sampling points (Fisson et al., 2014)

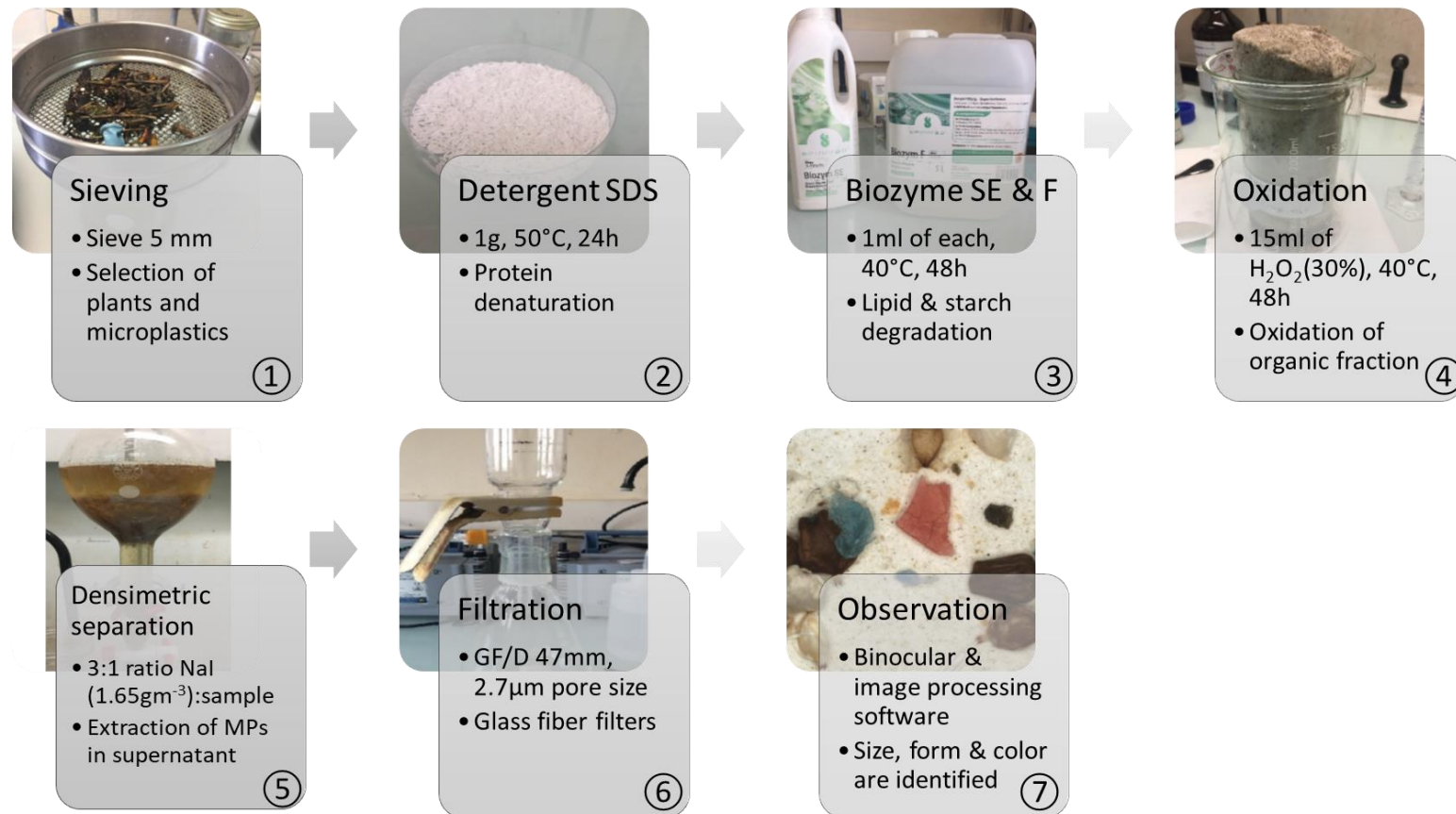
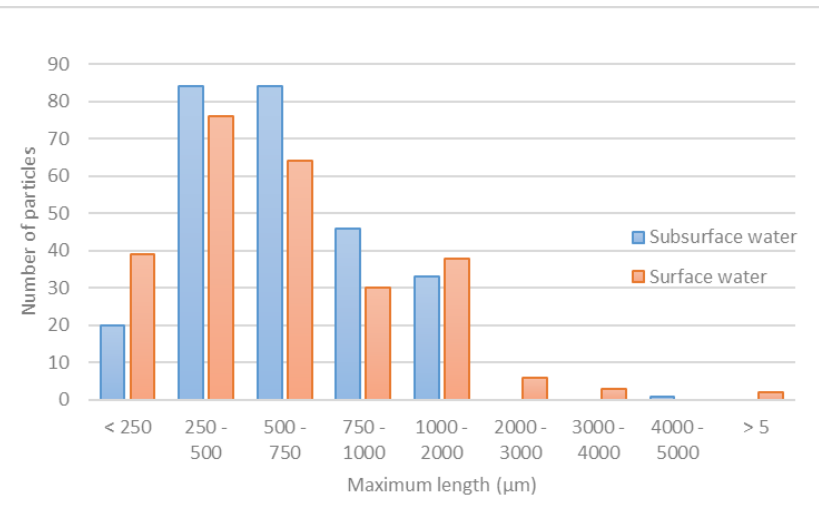


Figure 3: samples treatment protocol (Dris, 2016)

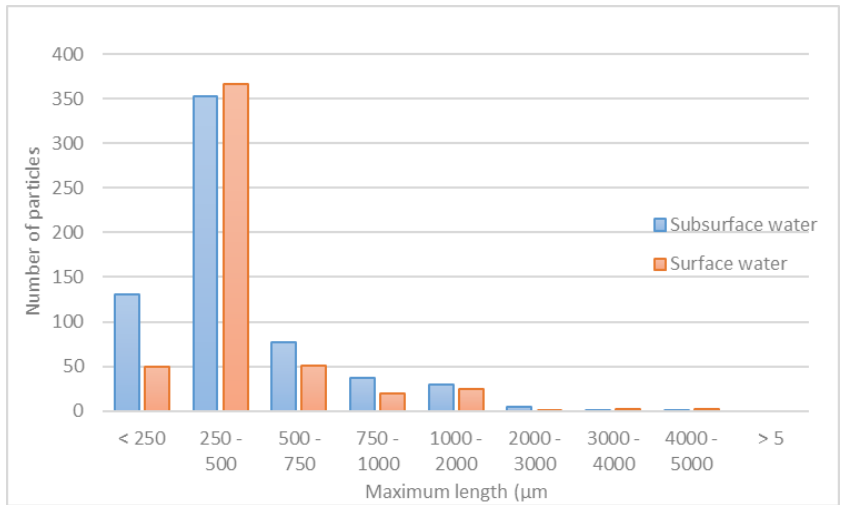
**Table 1: estimations of microplastics concentrations in the Seine River estuary**

	Tide	Time (s)	Current speed (m.s <sup>-1</sup> )	Collected Volume (m <sup>3</sup> )	Particles number	Levels (particles.m <sup>-3</sup> )
La Roque Surface water	Ebb tide	367	1.3	91	258	<b>2.8</b>
La Roque Subsurface water		483	1.5	38	268	<b>7.1</b>
Vieux-Port Surface water	Rising tide	364	1.04	74	639	<b>8.6</b>
Vieux-Port Subsurface water		481	0.55	14	619	<b>45.0</b>
La Bouille Surface water	Ebb tide	367	0.46	5	55	<b>1.7</b>
La Bouille Subsurface water		476	0.48	20	24	<b>2.0</b>

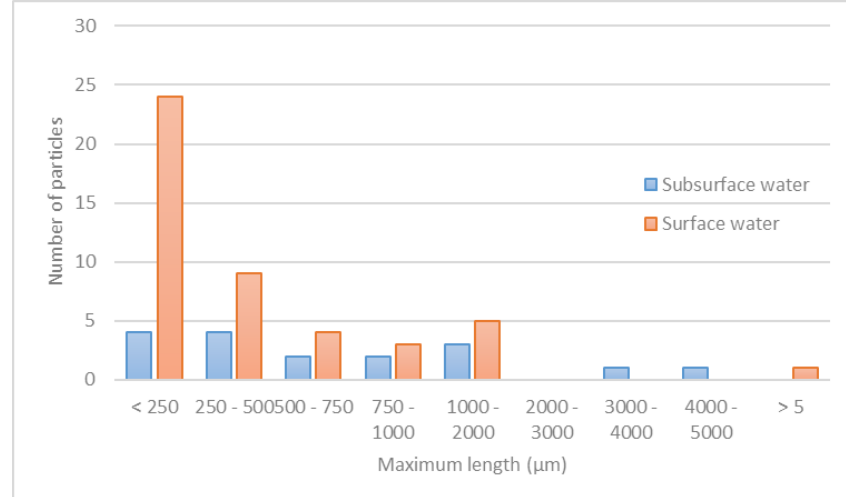
- Concentrations in microplastics between 1.7 and 45.0 particles.m<sup>-3</sup>
- High variability of current speed and volume collected
- Maximum concentrations at Vieux-Port
- Compare to literature:
  - Greater Paris area → 0.88 to 1.57 particles.m<sup>-3</sup> (Dris, 2016)
  - Tamar estuary, England: 0.74 particles.m<sup>-3</sup> (Sadri et Thompson, 2014)



**Figure 4: Maximum length of particles (µm) at La Roque**



**Figure 5: Maximum length of particles (µm) at Vieux-Port**



**Figure 6: Maximum length of particles (µm) at La Bouille**

○ High proportion of microplastics < 1 mm



# Shape distribution of microplastics in the Seine River estuary

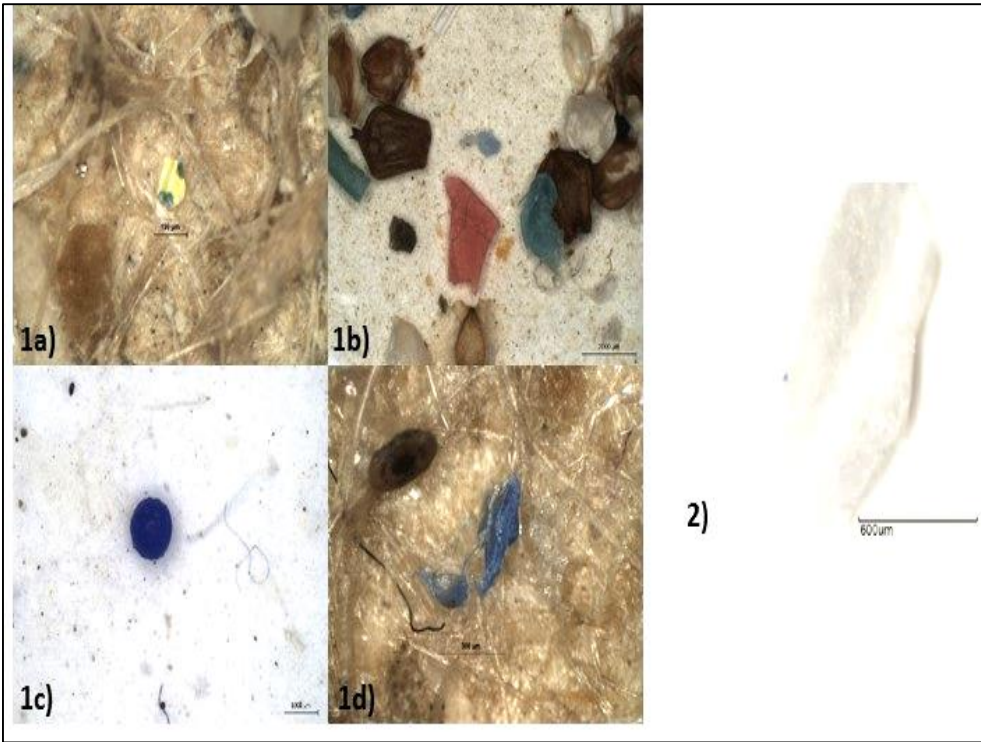


Figure 7: shapes of microplastics 1a) & 1b) fragment; 1c) sphere ; 1d) film ; 2) foam (Marine & Environmental Research Institute)

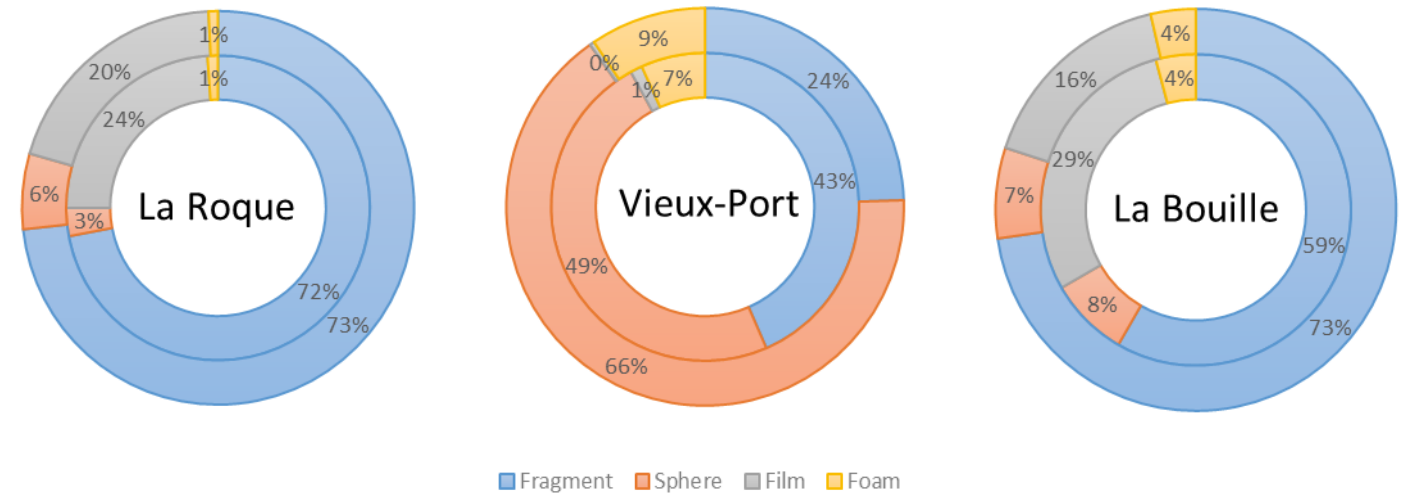


Figure 8: Shape distribution of particles sampled in May 2017, exterior: surface water, interior: subsurface water.

- Dominance of spheres at Vieux-Port → casual pollution ?
- Prevalance of fragments at La Roque and La Bouille
- Twice as many films in subsurface water at La Bouille

## CONCLUSIONS

- Levels of contamination higher than in the literature
- High proportion of particles < 1 mm
- Potential heterogeneity in shape distribution depending on depth

## PROSPECTS

- Characterization of particles is in progress
- Confirm/infirm shape distribution heterogeneity
- Evaluation of the potential role of the salinity gradient on the distribution dynamics of microplastics in the water column

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Thank you for your attention

# References

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*Dris, R. (2016). First assessment of sources and fate of macro- and micro- plastics in urban hydrosystems: Case of Paris megacity. Thèse de doctorat en Sciences et Techniques de l'Environnement. Université Paris Est Créteil.*

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