Microplastic contamination in the Seine River estuary
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Microplastic contamination in the Seine River estuary


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 ans Wildlife Service Headquarters)
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)
Materials & methods

- Material
  - Plancton net modified, 300 µm mesh, collecting upper 15 cm (surface water)
  - Classic plancton net, 300 µm collecting upper 50 cm (subsurface water)

- Methods
  - 3 sampling sites
  - Ebb and rising tide
  - Tide coefficient: 71
  - Flow: 256 m$^3$.s$^{-1}$
Treatment protocol

Figure 3: samples treatment protocol (Dris, 2016)
Concentrations of microplastics in the Seine River estuary

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

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

- Concentrations in microplastics between 1.7 and 45.0 particles.m\(^{-3}\)
- 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\(^{-3}\) (Dris, 2016)
  - Tamar estuary, England: 0.74 particles.m\(^{-3}\) (Sadri et Thompson, 2014)
Size distribution of microplastics in the Seine River estuary

- High proportion of microplastics < 1 mm

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
Shape distribution of microplastics in the Seine River estuary

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

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

**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
Thank you for your attention
References

