Microplastic research in the Fahrenfeld Lab

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Can we find microplastics in fresh water?

What are the sources?

What types of polymers are prevalent?

Do the biofilm on MP present a unique hazard?
Microplastic/g

<table>
<thead>
<tr>
<th>Size Classes</th>
<th>63-125 μm</th>
<th>125-250 μm</th>
<th>250-500 μm</th>
<th>500-2000 μm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-500</td>
<td>1500-2500</td>
<td>1500-2500</td>
<td>500-2000</td>
</tr>
</tbody>
</table>

Personal care product

Image showing examples of microplastics in different size classes.
2015 Survey of the Raritan River


** p<0.01
Literature review: WWTP are removing MP, removal rates vary by processes used.

Mass balance in surface water indicate sources other than WW are relevant, but stormwater, sediments, etc. are not well studied!

Inaccuracy of visual identification motivates use of chemical methods

Single reflection diamond attenuated total reflectance (ATR)

+ fast
- can crush specimens

microFTIR in transmittance mode

+ microscope images
- slower
FT-IR analysis to confirm polymers observed

Georgia Arbuckle-Keil
Rutgers, Camden

Arbuckle-Keil and Fahrenfeld. (in prep).
1. Polymers observed in the Raritan River
250-2000µm

Water (10-40% of scans)
- Polyterpene (Rubber)
- Polyethylene
- Polyurethane
- Polystyrene

Sediment (0-35% of scans)
- Polyethylene
- Polypropylene
- Other

Parker, Sipps, Arbuckle-Keil, and Fahrenfeld. (in prep.)
II. Polymers observed in Raritan Bay
250-2000µm

Ship track, color represents surface salinity, black dots = sampling sites

Samples on mesh filter

Polyethylene co-polymer

Bailey, Chant, Saba, Arbuckle-Keil, & Fahrenfeld. (in prep.)
Using polymer IDs and particle morphology for source tracking may have promise but the lack of consistent techniques complicates cross-study conclusions.
Microplastic biofilm

Glass microbeads

Large Polyethylene

Small Polyethylene

Large Polystyrene

Small Polystyrene

qPCR for ‘pathogen’ markers

Amplicon sequencing to describe microbial community structure

WW Influent

Raritan River
No differences in ‘pathogens’ between materials or compared to filtrate

fecal indicator

Wastewater

Raritan River water

sul1 resistance gene

Community structure varied by morphology and water source > size or material

Parrish and Fahrenfeld. 2019. ESWR&T.
Learn more about our work!
Lessons learned

- Can we find microplastic in fresh water? Yes!

- What are the sources? In progress!

- What types of polymers are prevalent? PE, Other, Rubber, PP, PS…

- Do the biofilm on MP present a unique hazard? Not necessarily, maybe if transported without weathering?
Acknowledgements

Collaborators
Georgia Arbuckle Keil, Bob Chant, Grace Saba, Shannon Bartelt-Hunt, Karli Sipps

Funding
US Geological Survey NJ WRRI
Rutgers Douglass Project
Rutgers Aresty Project
Rutgers Sustainable Raritan River Initiative
NOAA NJ Sea Grant
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Microplastic biofilm communities

Wastewater
Raritan River water

Polyethylene
Large & Small

Polystyrene/Glass

Parrish and Fahrenfeld. (in review)