

Improving stormwater quality for microplastics (25 - 106 μm) using a bioretention cell

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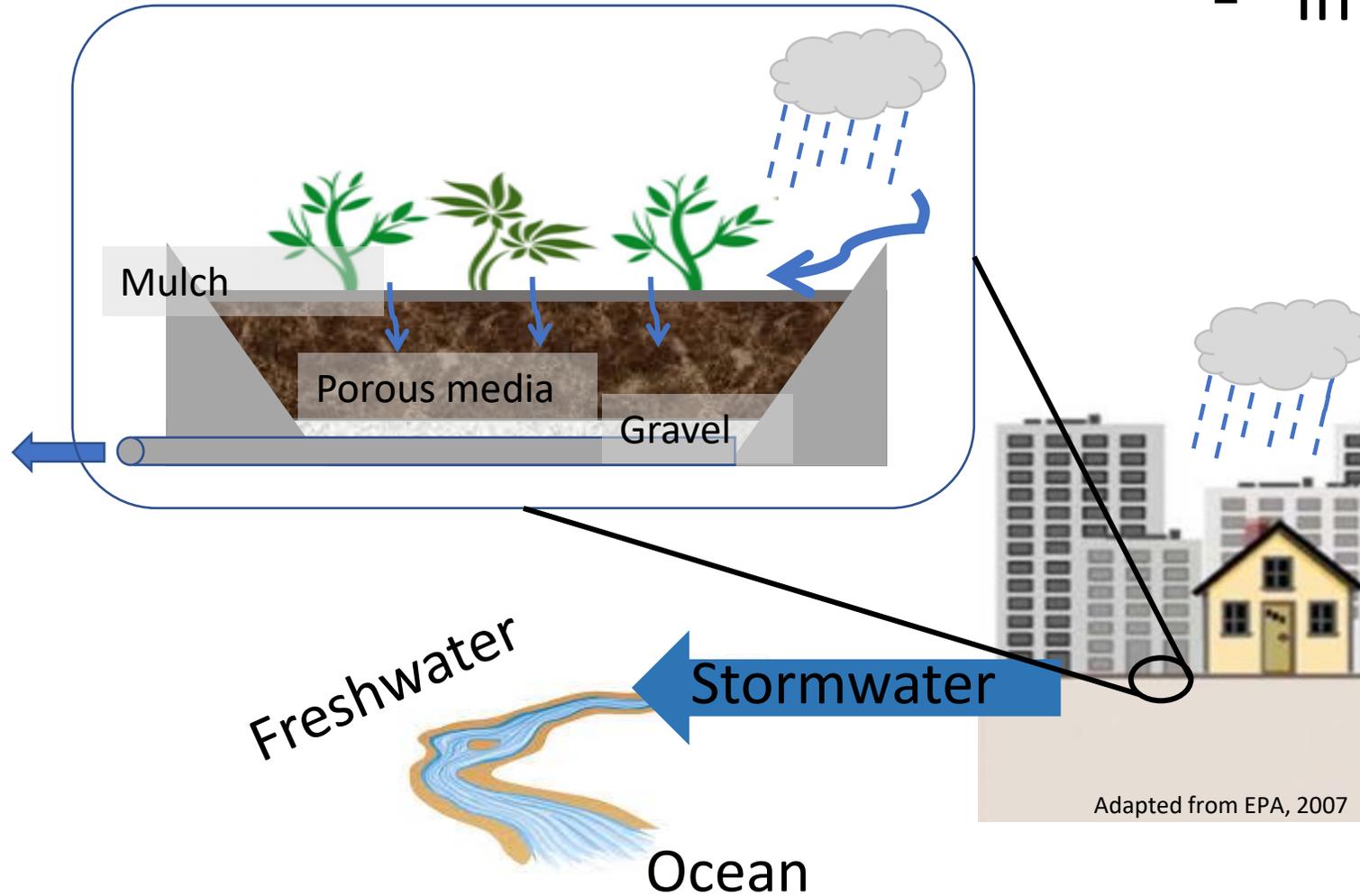
Outline

1. Background
2. Methods
3. Results
4. Conclusions

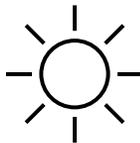
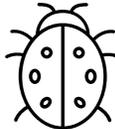


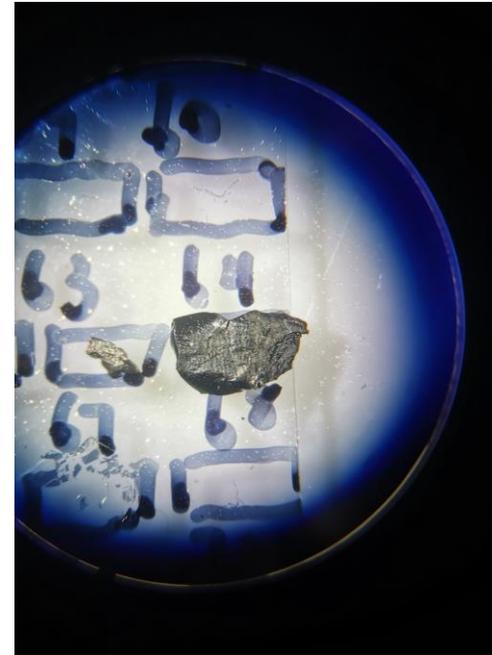
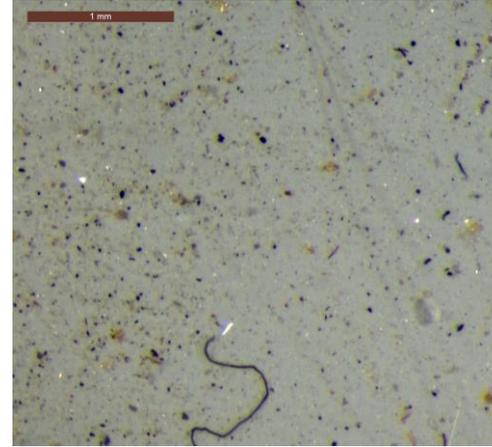
Bioretention cell

- Reduce urban flooding
- Improve water quality



Microplastics

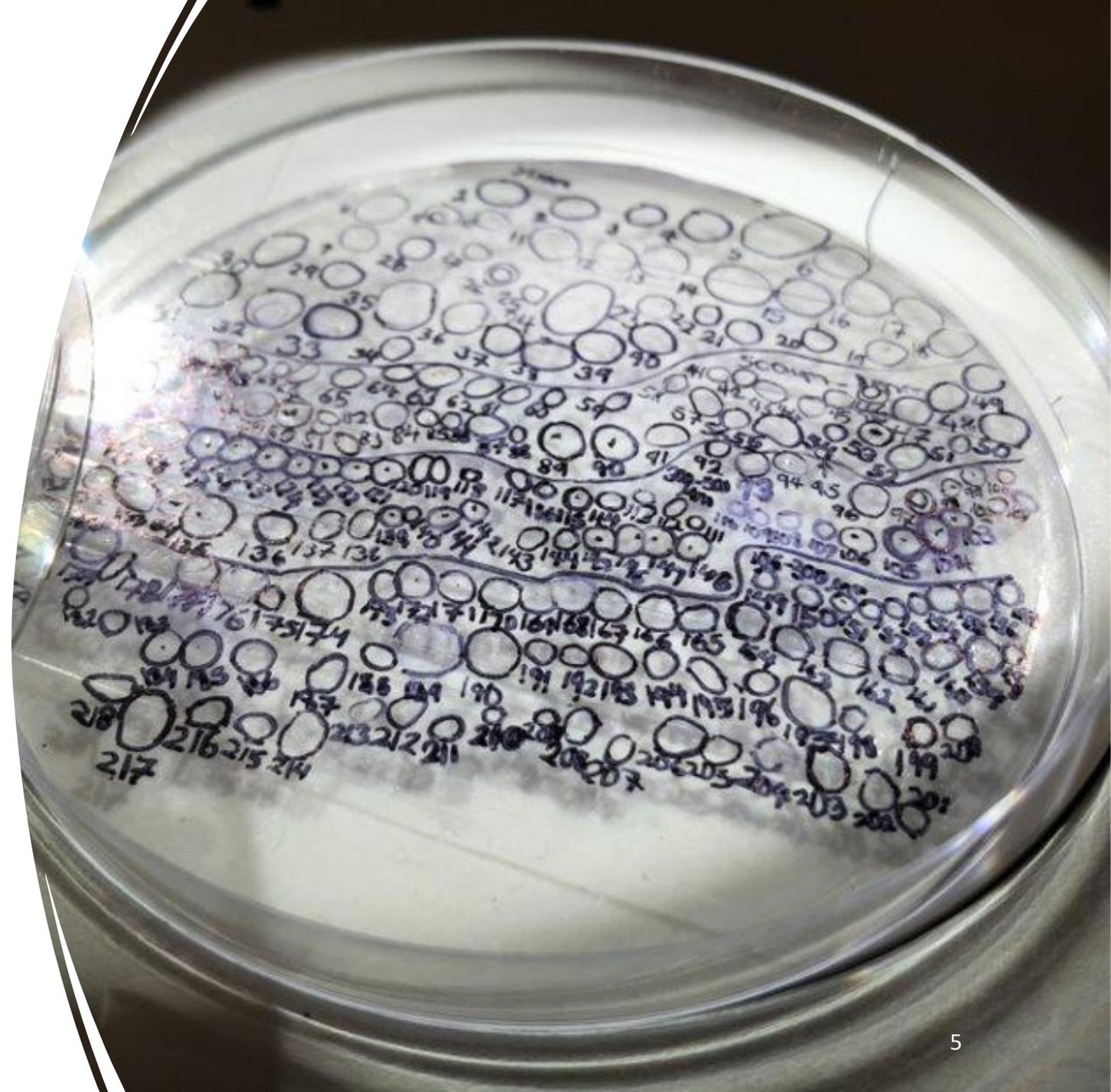
- 1 μm - 5 mm
- Primary studies: marine & freshwater. Limited removal solutions studied.
- Fragmentation   
- Decreasing size => increasing transfer risk in environment

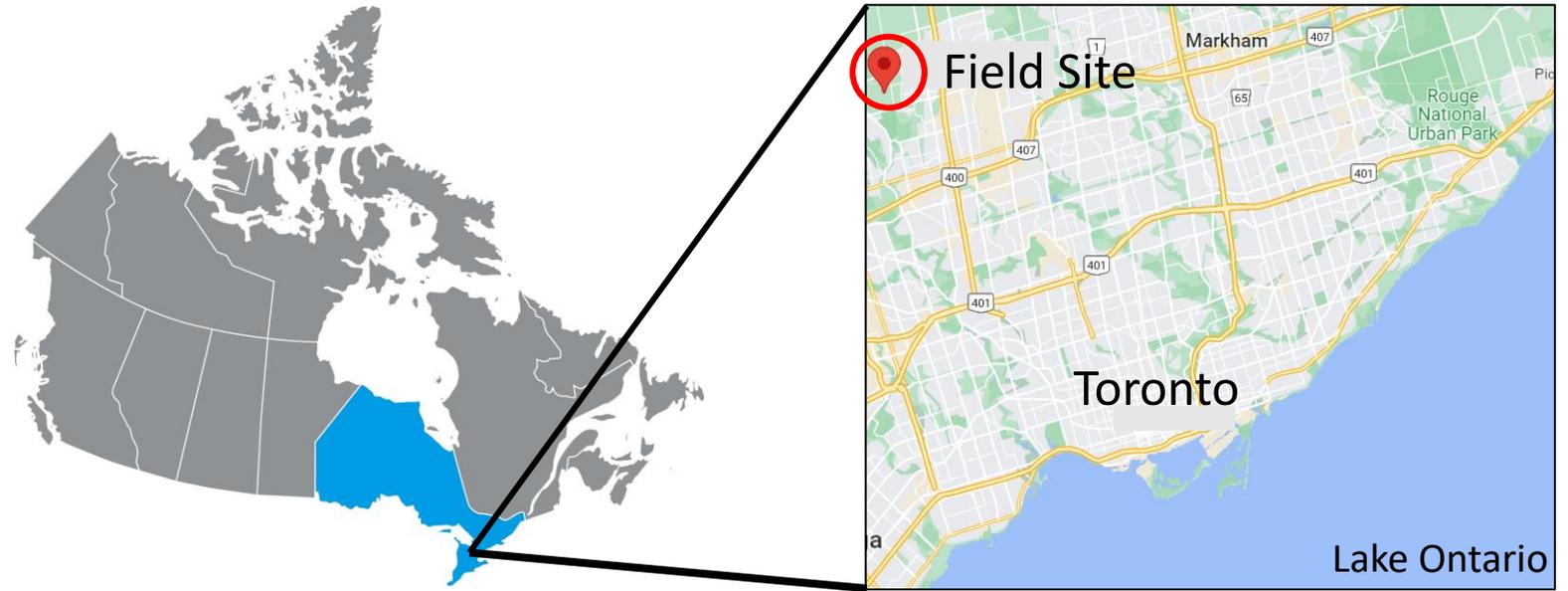


Previous Work

Evaluated a bioretention cell for removal capacity for microplastics (106 μm – 5 mm)

- 84% removal



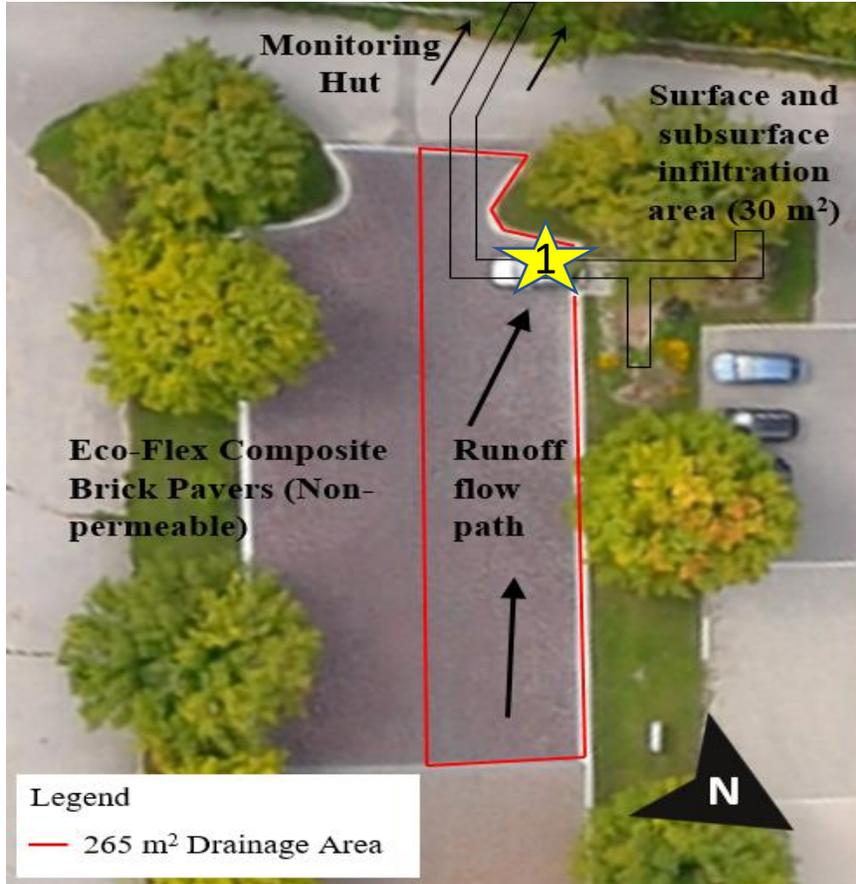


Objectives

1. Evaluate a bioretention cell's capacity to remove microplastics (25 – 106 μm) from stormwater
2. Characterize microplastics in stormwater



Field Site



Catchment area

-  Inlet
-  Outlet



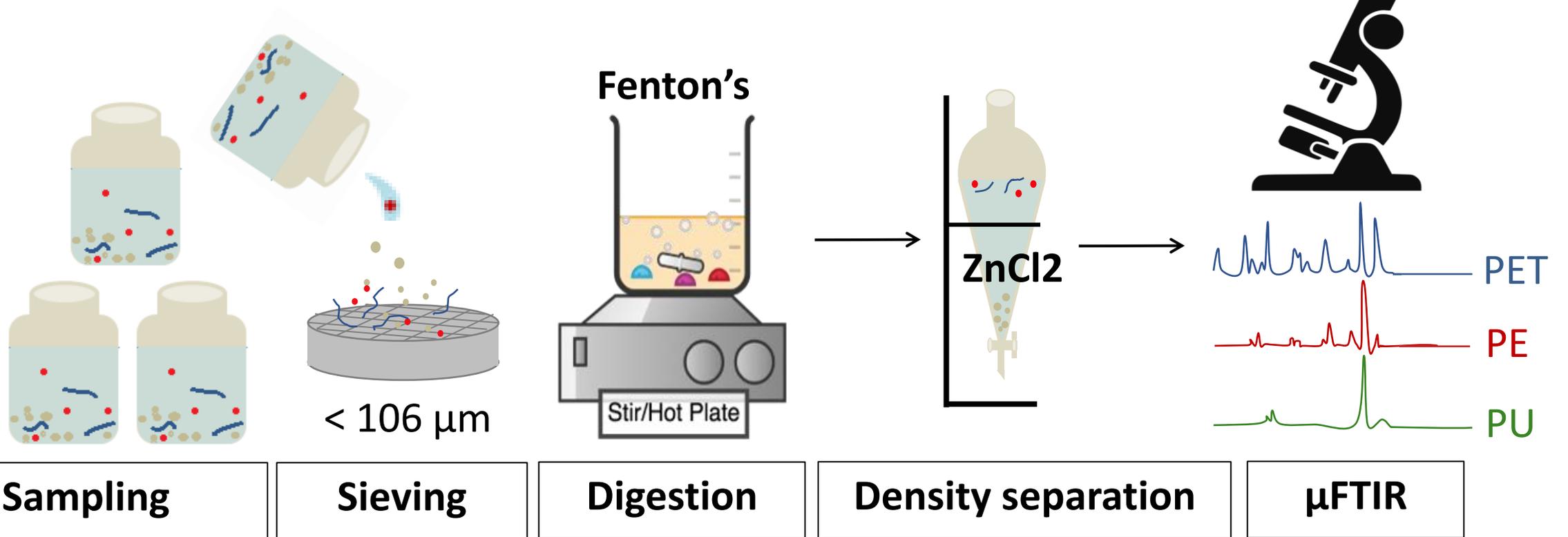
Picture: Spraakman et al. 2020, Ecol. Eng. 158, 106036



Rubber pavers

Methods

+ isopropyl alcohol



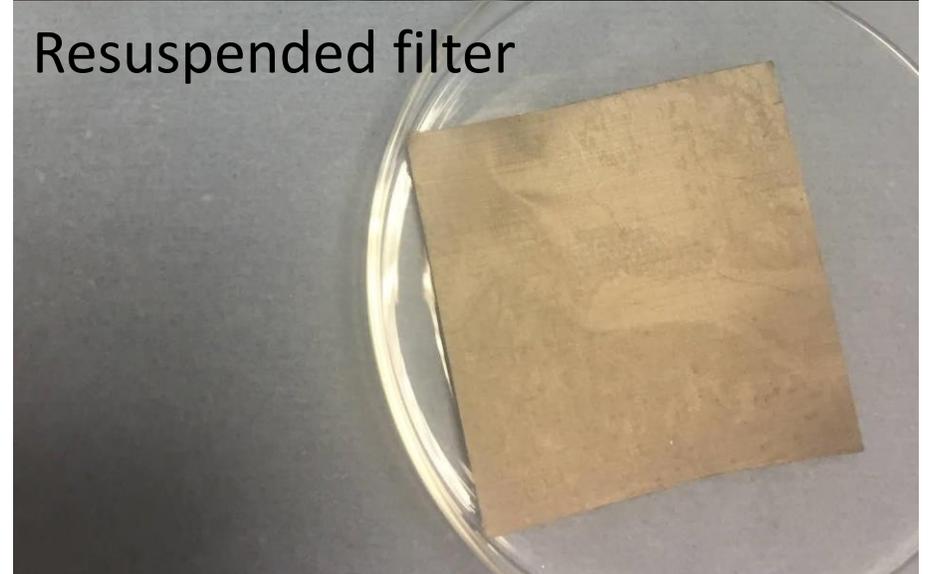
QA/QC

- Field blanks
- Lab blanks
- Resuspended “empty” filter
- 100% cotton lab coats
- No plastic sponges, bristles, etc.
- Soap & water, Elix triple rinse

Autosampler inside view

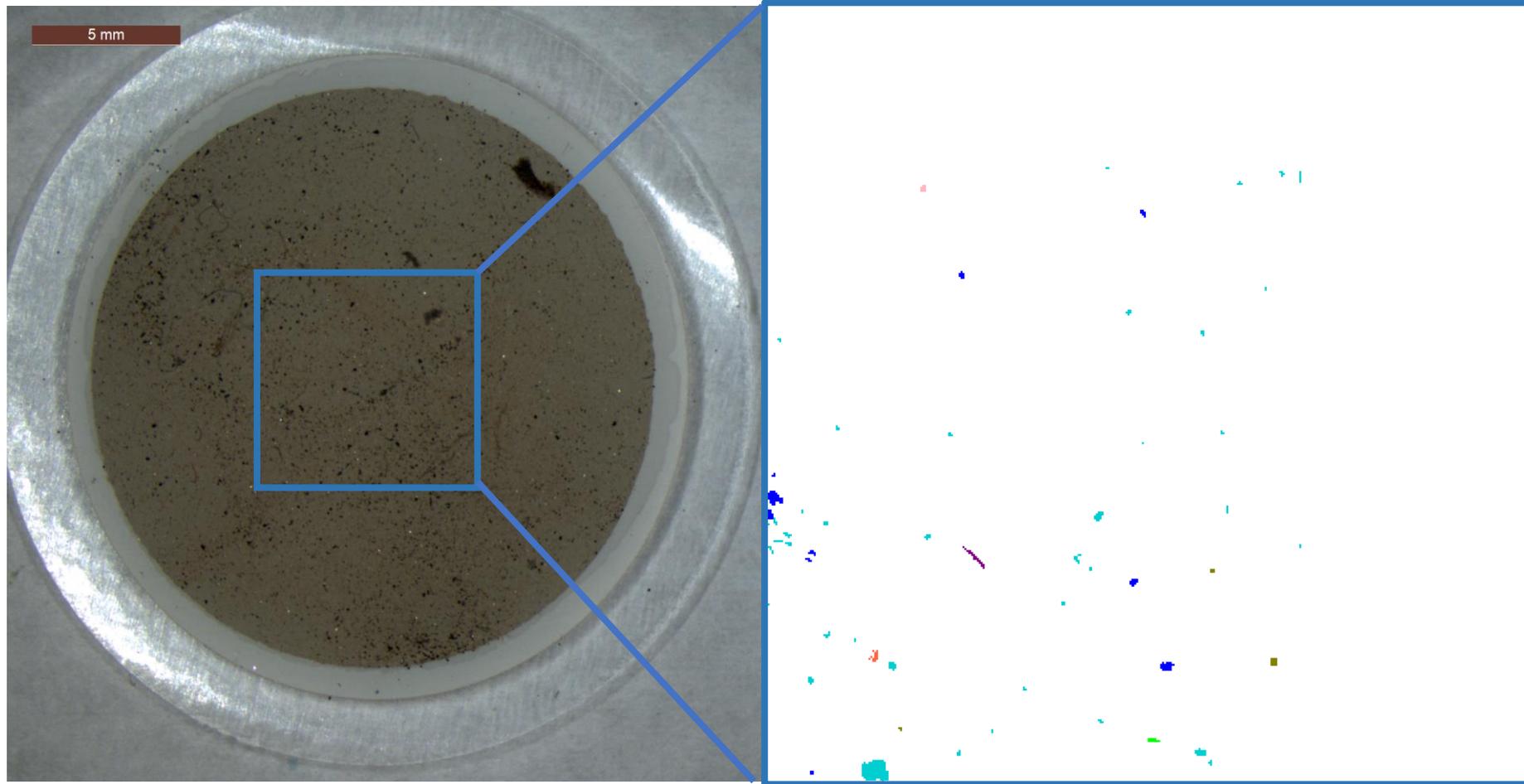


Resuspended filter



Preliminary Results

Example sample



Filtered stormwater
sample

Identified microplastics

Paired Samples

Inlet vs Outlet Microplastic Counts

Inlet (n = 11)

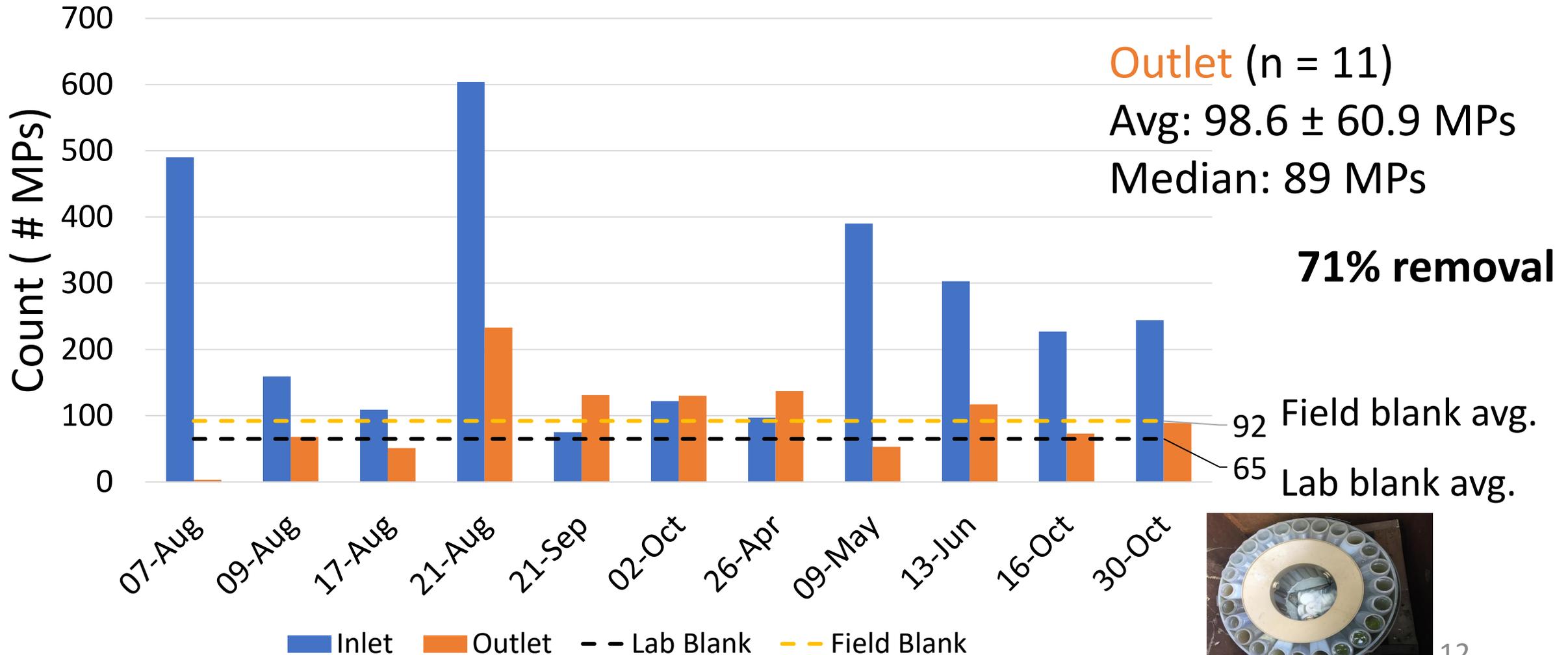
Avg: 256 ± 174 MPs

Median: 227 MPs

Outlet (n = 11)

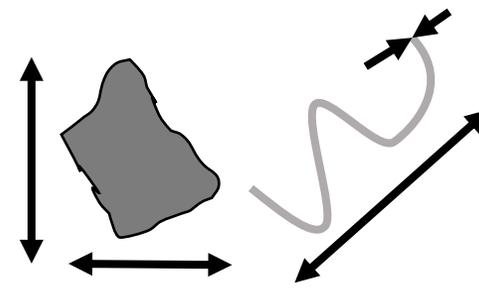
Avg: 98.6 ± 60.9 MPs

Median: 89 MPs

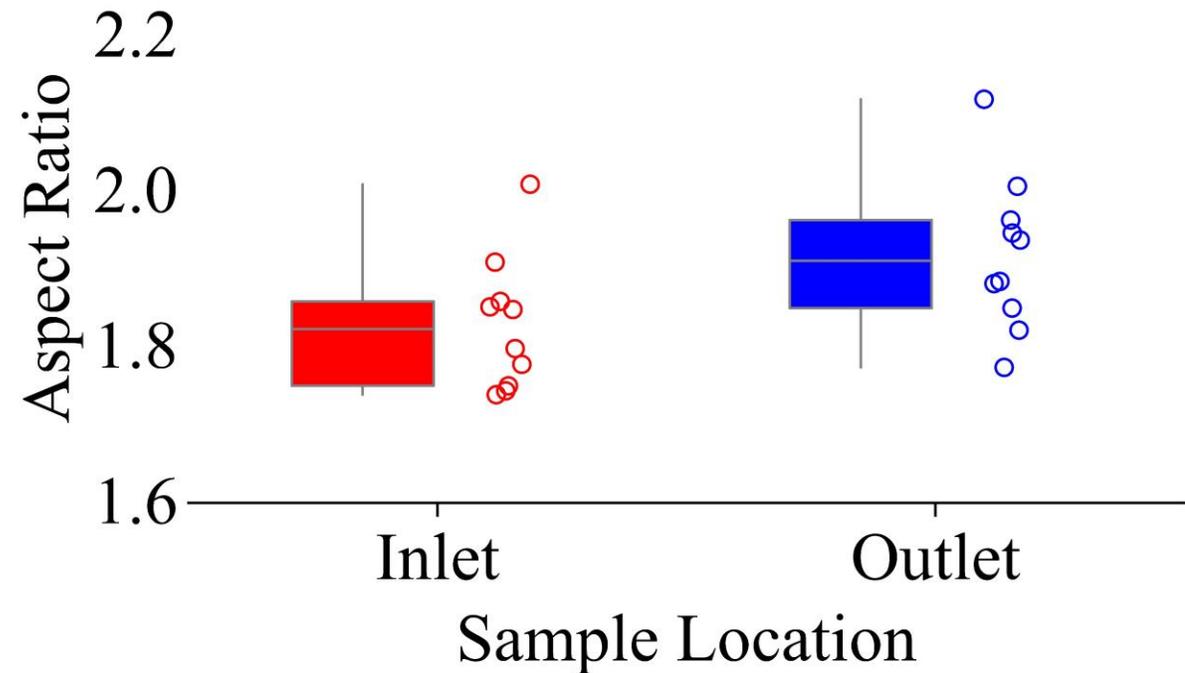


Morphologies?

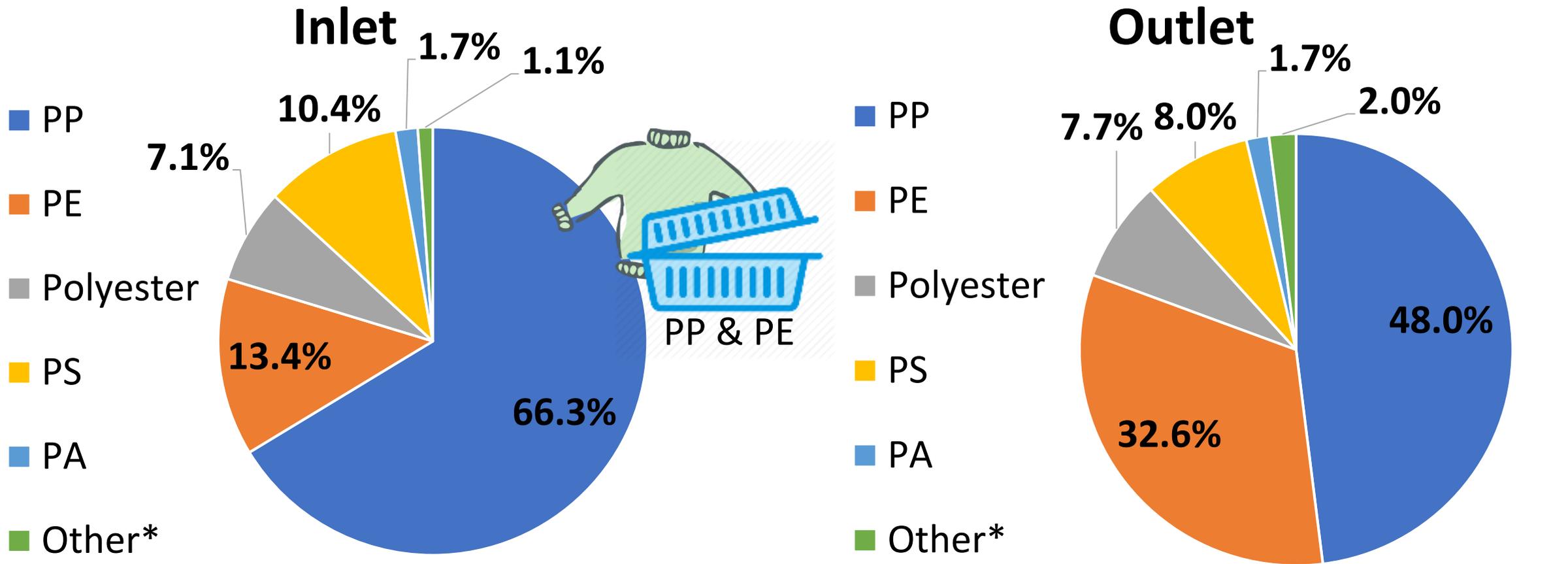
- No morphologies measured
 - Particle lengths & surface areas known
 - Difference in aspect ratio
 - Thinner microplastics at outlet
- (↑ aspect ratio)



Average Aspect Ratio



Polymer Identification



n = 18 samples
N = 4593 MPs

No rubber analyzed

n = 15 samples
N = 2062 MPs

*PVC, PU, ABS, pan-acrylic, acrylic, alkyd (+ phenoxy resin for inlet only)

Suspected plastic sources

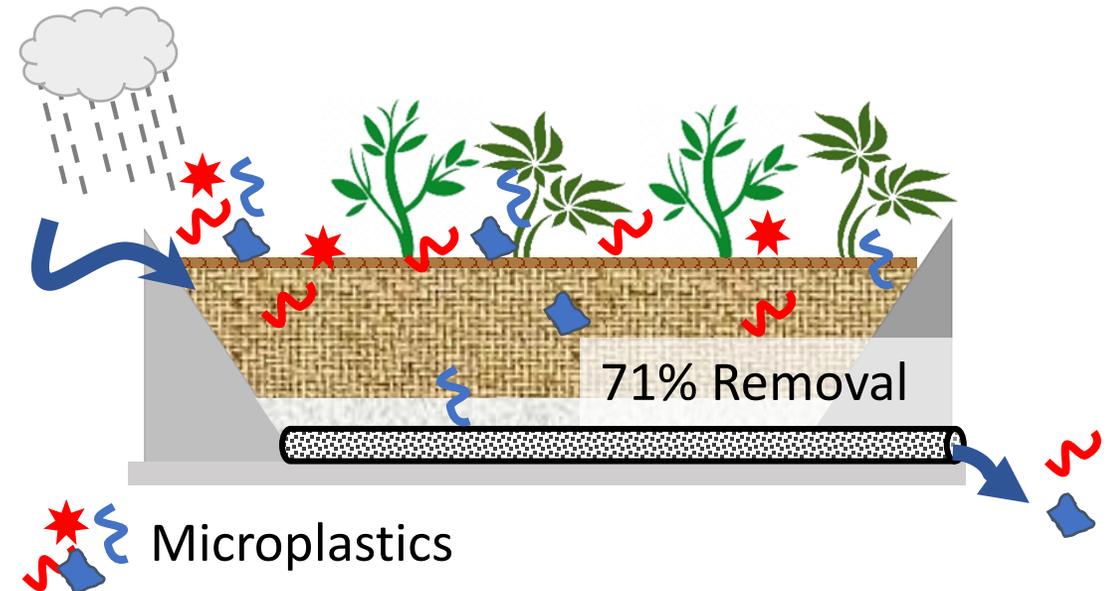
- Atmospheric deposition
 - Clothing - field
 - Litter
 - Tire and road wear
 - Rubber pavers
-
- Contamination
 - Field (Samplers, bottles, etc)
 - Lab (Air, wash bottle paint, etc.)



Macroplastics in & around
bioretention cell

Conclusions

- ↑ microplastic quantities in stormwater
- Likely underestimated due to method limits for rubber
- Bioretention cell efficiently removes
 - > 106 μm : microparticles ✓
 - 25 - 106 μm : microplastics ✓



Thank you! Questions?

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