What you net depends on if you grab:
Sampling method affects measured microplastic concentration

WORK IN PROGRESS

Lisa Watkins*, Patrick J. Sullivan & M. Todd Walter; *Cornell University, New York, USA*

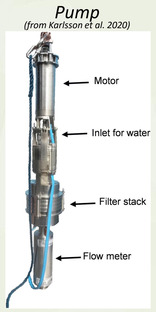
Motivation

Aquatic microplastic sampling methods differ in their strengths and ideal applications (e.g. by sampling volume, skill, mobility).

Occasionally the results of studies that used different methods are combined to gain a regional or global picture of how microplastic pollution is distributed. But is this appropriate?

Previous studies have indicated that methods do matter[a,b,c]. This work aims to build off those efforts and identify the causes and extent of how methods affect measured concentration

Grab



Neuston net

Methods

Literature Review: 116 studies included based on 3 criteria
1. appeared in Google Scholar search of select keywords
2. sampled surface of waterbody down to 1m depth or less
3. reported volume sampled or the means to calculate it

Field Samples: Paired Grab (1-4L) and neuston net samples (10 minute, 21,000±9,000L) collected in several neighboring streams. Grab sample then filtered through net mesh size (0.335mm). Processed via wet peroxide oxidation & density separation. All particles categorized visually with dissecting microscope before subsample confirmed with Raman spectroscopy.

Determining why difference exists: We compiled potential explanations from discussion sections and conversations with researchers. We then calculated or collected reasonable upper-bounds for each proposed explanation. Those values were then compared against the magnitude that would be needed to explain the concentration differences observed in paired studies (including our own field samples).

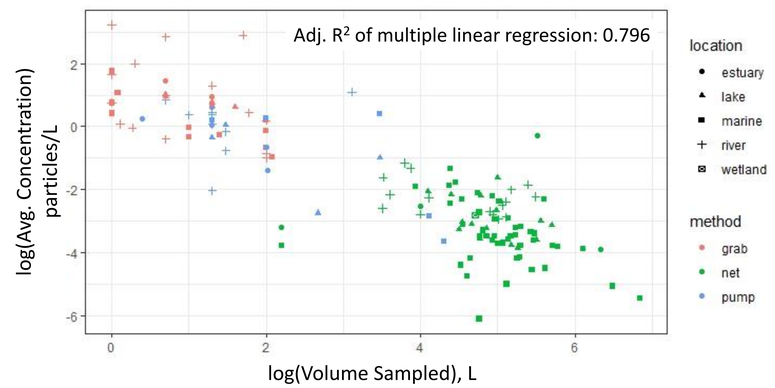
Research Question

Across 116 papers measuring microplastics in surface water, do we observe systematic differences in measured concentration due to sampling method as indicated in previous works?

By looking closer at paired-method sampling efforts, can we indicate what causes measured concentration to differ (and what does not)?

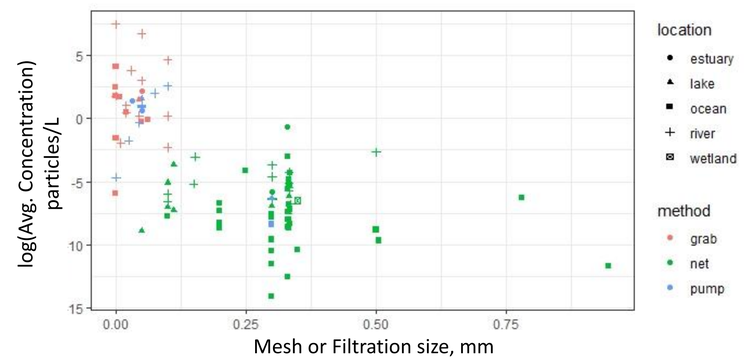
Literature-wide: Method Matters

to a greater extent even than the category of waterbody sampled



Paired studies consistently result in higher grab concentrations

Mesh size explains some, but not all of it



This preliminary work confirms previous findings[b], now expanded across a wider swath of literature.

What causes this systematic difference in concentration?

Here are the possibilities we are investigating one-by-one.

1. **Contamination**
   Even if consistent, would affect smaller volumes more
2. **Fibrous particles escape**
   Do more escape during sampling than when sieving after?
3. **Net volume overestimation**
   Due to inconsistent measurement or net drag
4. **Heterogeneity of sampled water**
   Larger sample volumes smooth out local inconsistencies

(If upper-limit < magnitude needed, new explanation needed)

We welcome your feedback & ideas!

(This work is ongoing)

What other potential explanations should we explore?

What caveats/biases in the compiled literature may be affecting the systematic differences observed?

*CONTACT: LTW35@cornell.edu

References

We've relied heavily on the work of others to make this analysis possible and have cited only a select few below. Additional works included in our literature review and other foundational, motivating works are tabulated and will be made available when we have finished this analysis. Contact us if you have a question or concern!

a) Barrows A, Neumann C, Berger M, Shaw S. (2017). Grab vs. neuston tow net: a microplastic sampling performance comparison and possible advances in the field. *Analytical Methods*, 9. DOI: 10.1039/c6ay02387h.
b) Covernton G, Pearce C, Gurney-Smith H, Chastain S, Ross P, Dower J, Dudas S. (2019). Size and shape matter: a preliminary analysis of microplastic sampling technique in seawater studies with implications for ecological risk assessment. *Science of the Total Environment*, 667. DOI: 10.1016/j.scitotenv.2019.02.346
c) Hung C, Klasios N, Zhu X, Sedlak M, Sutton R, Rochman C. (2020). Methods Matter: Methods for sampling microplastic and other anthropogenic particles and their implications for monitoring and ecological risk assessment. *Integrated Environmental Assessment and Management*, 00. DOI: 10.1002/ieam.4325
d) Karlsson T, Kärrman A, Rotander A, Hassellöv M. (2020). Comparison between manta trawl and in situ pump filtration methods, and guidance for visual identification of microplastics in surface waters. *Environmental Science and Pollution Research*, 27. DOI: 10.1007/s11356-019-07274-5

Acknowledgements

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