

Plastic Party Crashers:
Interactions of Macroplastics
and Macroinvertebrates in
Freshwater Ecosystems

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Mentors: Dr. Jon Sweetman, Dr. Daniel Allen, Mason Ward





About Me!

Washington College (Chestertown, MD)

Class of 2025

Environmental Science and Anthropology
Majors & Chesapeake Regional Studies Minor

C-StREAM Fellowship

Penn State University (State College, PA)

Research Assistant: Aquatic Ecology &
Environmental Change

- Experience with graduate level research
- Field work in freshwater systems
- Working with macroinvertebrates

Projects!

Allen Lab: Assessing the feasibility of assisted macroinvertebrate establishment in achieving ecological uplift in restored streams in the Chesapeake Bay Region, StreamCLIMES project¹

Sweetman Lab: Examining factors influencing the diversity of macroinvertebrate communities in vernal pond ecosystems, including chemical contaminants and microplastics²

Location: Western Maryland, Central PA -> Shaver's Creek (Penn State), Rothrock State Forest (PA), Tuscarora State Forest (PA)

Partners: University of Maryland Center for Environmental Science, Chesapeake Bay Trust, Maryland DNR, Anne Arundel County, and PA DCNR



Independent Research Project: Interactions of Macroplastics and Macroinvertebrates in Freshwater Ecosystems

What are aquatic macroinvertebrates?

aquatic insects, worms, snails, crayfish, and other crustaceans that have no internal backbone and live part (or all) their lives in water³

How are they impacted by plastics?

1. Feed: macros are divided into four functional feeding groups: shredders (CPOM), collectors (FPOM), grazers, and predators⁴
2. Habitat: benthic living macroinvertebrates

We predict that plastic litter type in streams will affect macroinvertebrate richness and diversity.



Methods:

5 treatments x 3 reps

Plastic was cut into 15 cm x 6 cm strips

30 g of each type of plastic were put into a traditional mesh leaf-pack bag

Site location: Shaver's Creek, Central PA

A plastic "leaf pack" was put every 10-15 m and attached to rebar with nylon thread

"Leaf-packs" were left in the stream for 4-weeks following Stroud Water Research Center: Leaf Pack Network[®] protocol⁵

Macros were sorted and identified to the family level and abundances recorded

Diversity and richness were calculated using R statistical software



1



Ziploc Bags (LDPE)



2



Black Trash Bags (LDPE)



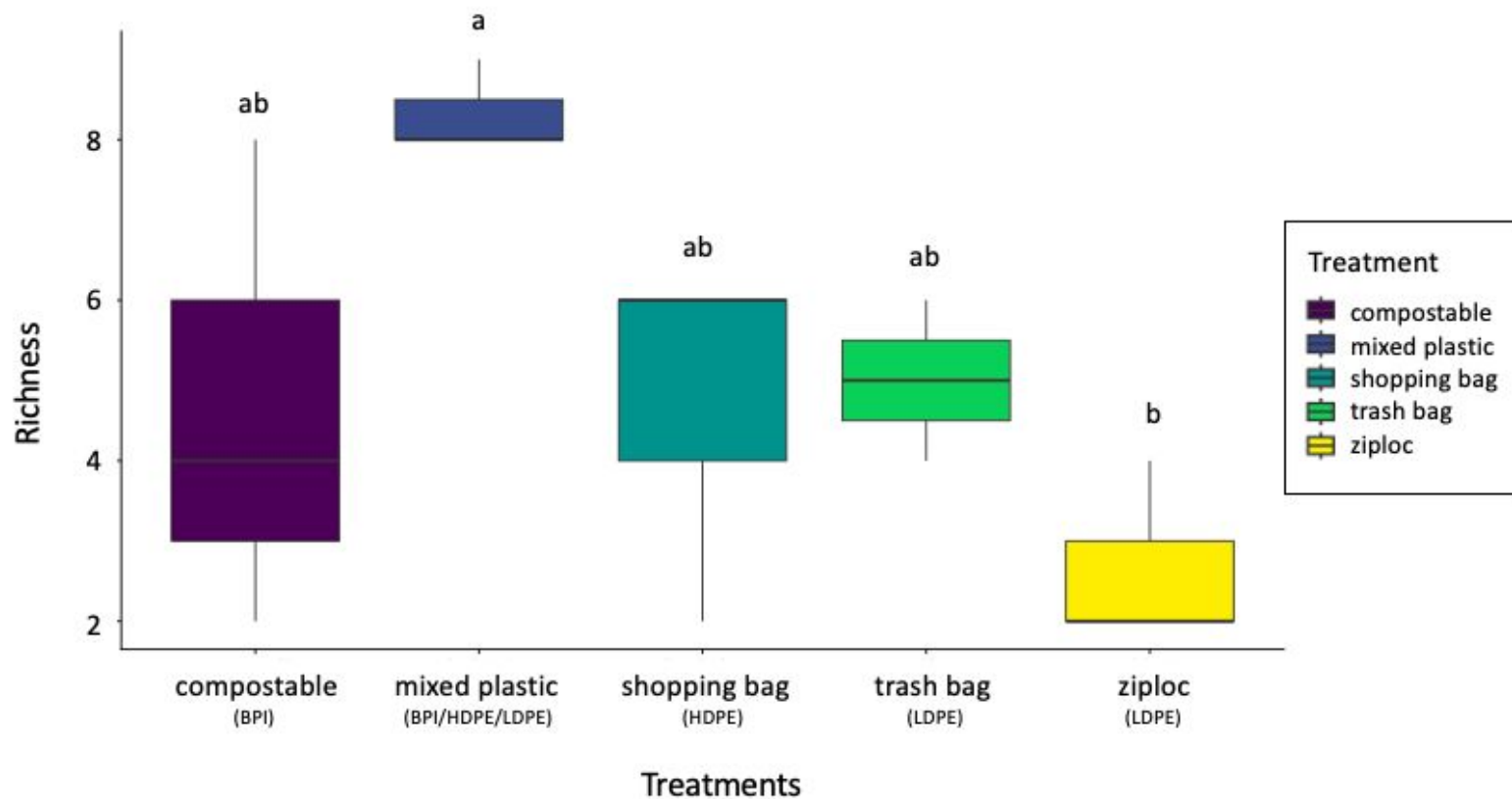
Compostable Bags (BPI)

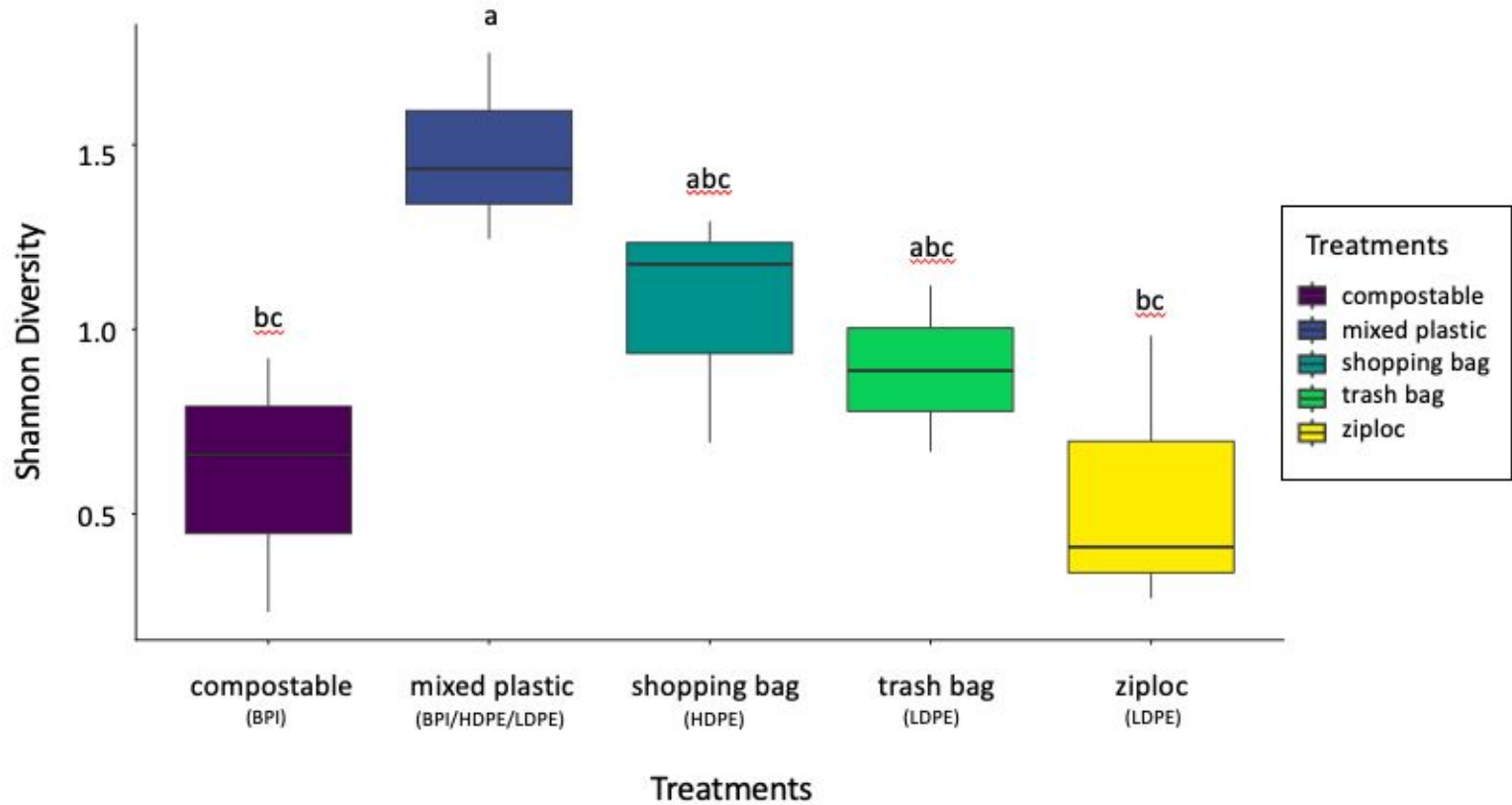


Shopping Bags (HDPE)

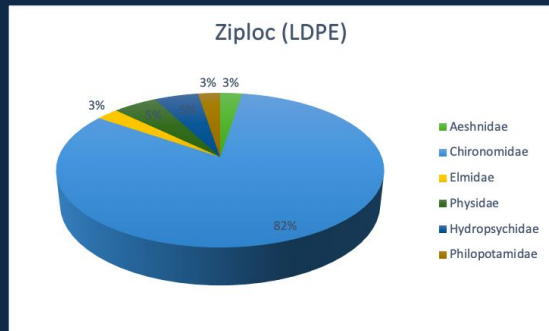
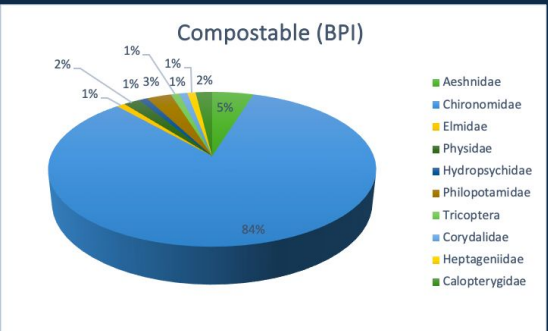
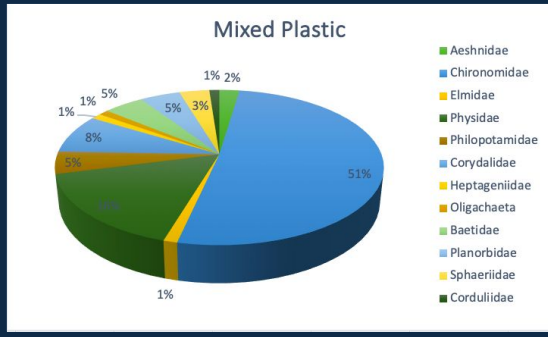
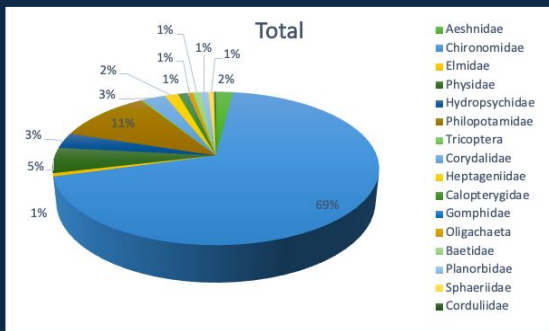


Mixed Plastic (BPI/LDPE/HDPE)





- 1- Non-Biting Midge (larval stage), Chironomidae, Jose Ortega
- 2- Dieter Tracey, Marine Botany UQ (ian.umces.edu/media-library)
- 3- Tracey Saxby, Integration and Application Network (ian.umces.edu/media-library)
- 4- Kim Kraeer, Lucy Van Essen-Fishman, Integration and Application Network (ian.umces.edu/media-library)





Diptera: Chironomidae



Megaloptera: Corydalidae



Odonata: Aeshnidae



Odonata: Calopterygidae



Ephemeroptera: Heptageniidae



Trichoptera: Hydropsychidae



Trichoptera: Philopotamidae



Coleoptera: Elmidae

Discussion

Original thoughts about darker vs lighter plastics impacting macroinvertebrate diversity was not supported by our data

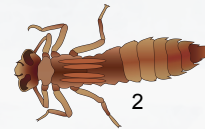
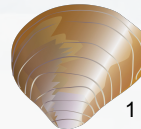
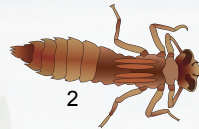
Potential reasoning for statistical differences:

(mixed plastic ~ ziploc and mixed plastic ~ compostable)

- a. mixed plastic means variation of habitat types in the same area
- b. there could be larger spaces in between the mixed plastic pieces
 - c. ziploc LDPE was the only transparent material

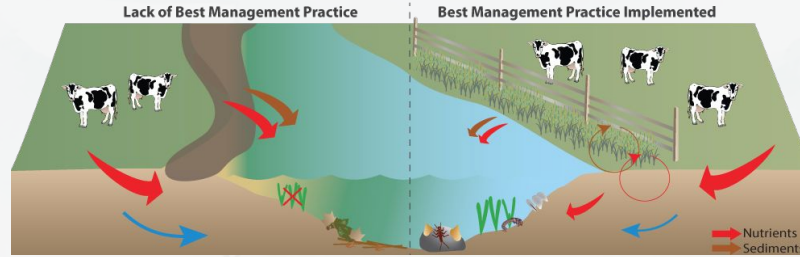
Future studies may include:

- a. longer study period with multiple collection points
- b. measurement of chlorophyll accumulation on plastic surface
- c. including a traditional leaf pack to compare with the plastic “leaf packs”
 - d. more reps!

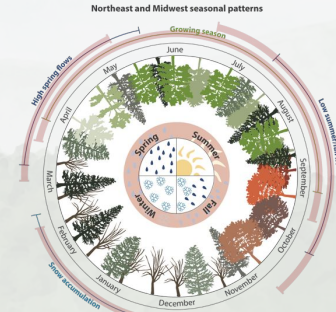




Kim Kraeer, Lucy Van Essen-Fishman, Integration and Application Network (ian.umces.edu/media-library)



Brianne Walsh, Integration and Application Network (ian.umces.edu/media-library)



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Competency: Systems Thinking!



Jane Thomas, Integration and Application Network (ian.umces.edu/media-library)

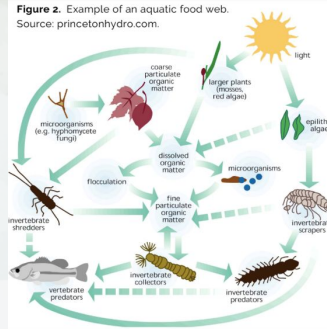
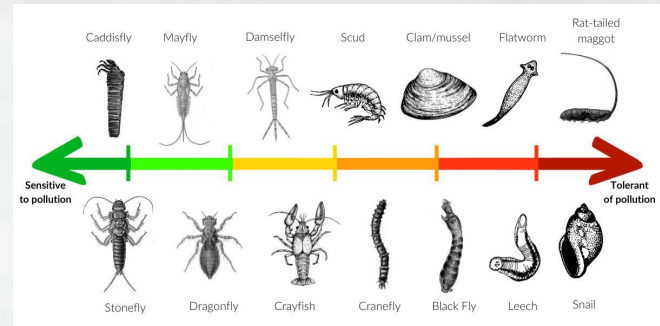
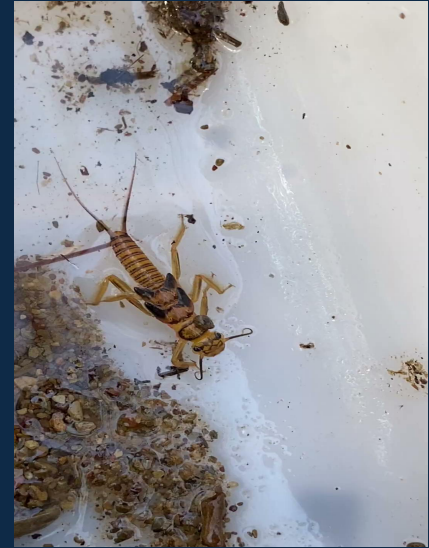


Figure 2. Example of an aquatic food web. Source: princetonhydro.com.



Utah State University Extension <https://extension.usu.edu/waterquality/research/wq-aquatic-macroinvertebrates>

Thank You!



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References:

- 1- THE ALLEN LAB at The Pennsylvania State University. <https://www.allenlab.org/>
- 2- Sweetman Lab. <https://jonsweetman.com/index.html/>
- 3- U.S. Department of the Interior. (2015). *Aquatic macroinvertebrates*. National Parks Service.
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<https://www.nps.gov/articles/aquatic-macroinvertebrates-ecological-role.htm>
- 5- *Leaf Pack Network Manual*. Leaf Pack Network. (2023).
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