

Crawling through the Seasons: Seasonal Community Shifts in Freshwater Macroinvertebrates

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Introduction

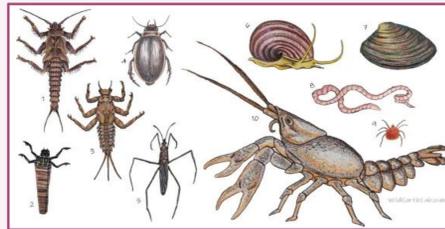
Aquatic macroinvertebrates are a major part of many aquatic animal cycles, as they are the source of food for many organisms such as the American eel (*Anguilla rostrata*).¹ Macroinvertebrates are commonly used as bioindicators to further understand many freshwater ecosystems, as they house a diverse array of invertebrates such as scuds (*Amphipoda*), aquatic worms (*Oligochaeta*), net spinning caddisflies (*Hydropsychidae*) and many more.²

Macroinvertebrates vary in their sensitivity to pollutants in aquatic habitats and have high levels of bioaccumulation, which is the buildup of toxic chemicals in living organisms.³ Many are considered sensitive as they cannot live in heavily polluted waters, such as caddisflies and stoneflies, while some are considered somewhat tolerant, like scuds.⁴

This project is building off of our summer research⁵ which focused on the diversity and abundance of the macroinvertebrate community of the Bronx River in the summer. While there are many studies that focused on the relationship between stream health and macroinvertebrate diversity and richness, not much is known about how other factors, such as seasonality, can affect macroinvertebrate richness. Focusing on seasonal patterns can better indicate exactly how we can use macroinvertebrates to better protect many other endangered aquatic fauna that feed off of macroinvertebrates.

Throughout the United States, macroinvertebrates in freshwater ecology are often seen as a community of different species, rather than assessed as one species population and tend to change during various moments throughout the year. This study examines the seasonal patterns of macroinvertebrate communities within the northeastern United States.

Fig. 1. Picture of different macroinvertebrates (Photo credit: Wild Earth Lab, "What are aquatic macroinvertebrates? Their role in food webs and use as bioindicators!" by Valerie)



Macroinvertebrate identifications:
1. stonefly, 2. caddisfly, 3. mayfly, 4. aquatic beetle, 5. water strider, 6. freshwater snail, 7. freshwater mussel, 8. aquatic worm, 9. water mite, 10. crayfish.

Methodology

The Leaf Pack Network (LPN) is a community science initiative led by the Stroud Water Center that uses leaf packs to snapshot macroinvertebrate diversity as indicators of stream health. Data from the LPN is stored at MonitorMyWatershed,⁶ an open-source database from Stroud Water Center that contains data from their nationwide monitoring activities on macroinvertebrate communities and water quality.

We chose to focus our study sites on the east coast of the U.S. to control for location. The majority of our sites were found in states such as New York, Pennsylvania, Massachusetts, and Washington DC. A total of fourteen sites were included in this study, between three and four sites for each season. For each of the four seasons, three months were categorized into each season: Fall (September - November), Winter (December - February), Spring (March - May), and Summer (June - August).

For each month, we collected data on the taxon abundance and richness from the macroinvertebrate count data of the leaf pack at each specific site. However, throughout the search, we could not find leaf pack data on the months of February and September. To reduce temporal variability, we focused our time frame on more recent years, specifically between 2022 and 2025.

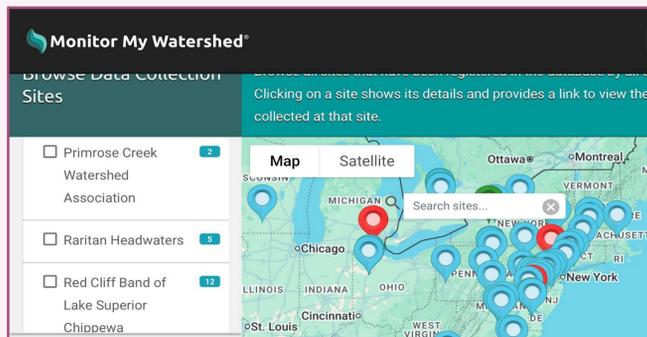


Fig 2. Monitor My Watershed⁶ database website

Abstract

Macroinvertebrates are used as bioindicators for water quality, because they vary in sensitivity to pollutants. Not much is known about how seasonality affects macroinvertebrate community composition. This study focused on seasonal patterns within macroinvertebrate communities of the eastern coast of the United States. We hypothesized that based on seasonality there would be a lower abundance and richness of macroinvertebrates in the colder seasons compared to the warmer seasons. To conduct this study, data was gathered from the Leaf Pack Network initiative via the open-source MonitorMyWatershed database. Fourteen sites were selected from the open-source database and used for analysis of macroinvertebrate richness and abundance variability across seasons. The results showed that richness in the Fall months was greater than in all other seasons. The results of this study underline the need for more research focused on seasonal patterns with macroinvertebrate abundance.

Research Question & Hypothesis

Research Question: How does macroinvertebrate species richness vary throughout the seasons within the East Coast of the United States?

Hypothesis: The abundance and richness of macroinvertebrates will be greater in the warmer seasons (summer and spring) than the colder seasons (fall and winter) due to the fast reproduction of algae, which is a main food source for macroinvertebrates, in the warmer seasons.

Data & Figures

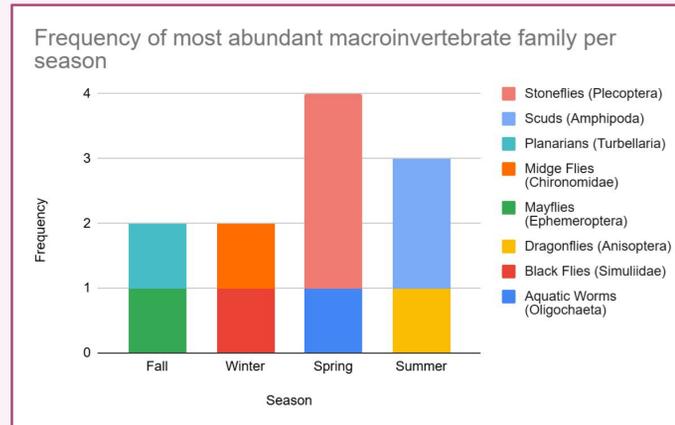


Fig 4. Frequency of most abundant macroinvertebrate families per seasons.

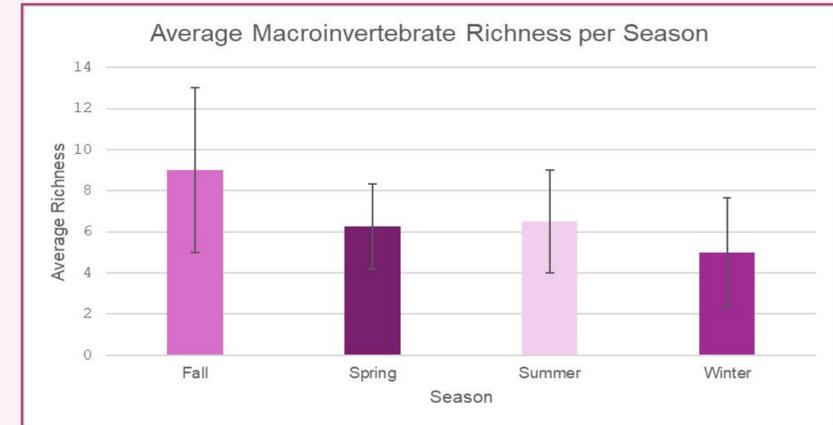


Fig 6. Average macroinvertebrate richness per season.

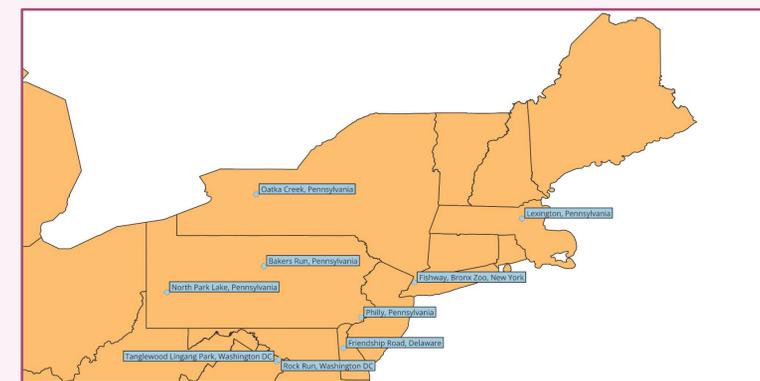


Fig 3. Map of our sites on the east coast.

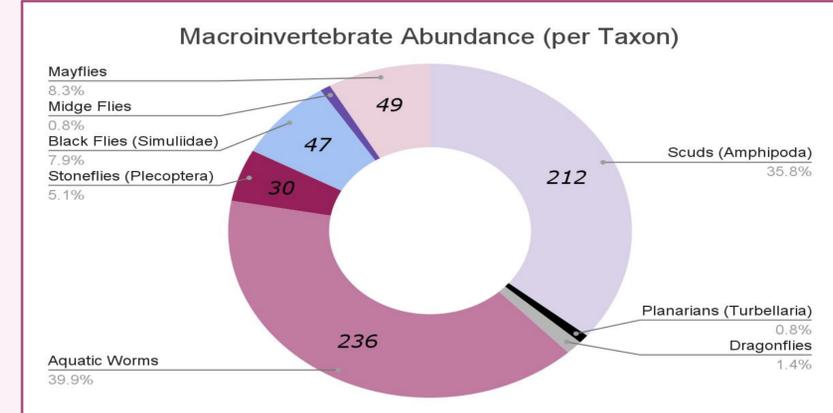


Fig 5. Macroinvertebrate abundance across all leaf packs (per TAXON).

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