Substrate preference of stream macroinvertebrates in Rice Creek Field Station, Oswego NY

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ABSTRACT

Stream ecosystems have transitions between diverse habitats and in addition, streams travel through changing terrestrial communities. Macroinvertebrates are crucial for nutrient cycling in stream ecosystems. Different trees surrounding streams have different nutritional value. We predicted that leaves with higher nitrogen content would attract more invertebrates using a litter bag experimental design. The macroinvertebrates in this experiment did not show a preference between oak leaves, ash leaves, and plastic. Amphipods were more abundant on oak leaves, which are rich in nitrogen. Plastic a close second but could have attracted amphipods as shelter. There is evidence to support that oak would have the most abundance of macroinvertebrates although there is no evidence of a pattern to prove that.

INTRODUCTION

•Macroinvertebrates are important for cycling nutrients in streams (Hussain & Pandit 2021)
•Location in the streams may also play a role in the diversity and abundance of organisms found in the litter bags (Lassonen et al. 1998)
•Where vegetation is abundant, macroinvertebrates are abundant (Heino et al. 2004)
•Macroinvertebrates cycle nutrients in different feeding strategies, which will affect how those nutrients are distributed (Wallace & Webster 1996) and how food webs are sustained (Santoja et al. 2020).
•the stream can attract more macroinvertebrates (Laasonen et al. 1998)
•Nutrient rich leaves would decompose the fastest due to the increased number of macroinvertebrates that prefer them due to easier digestion (McCabe & Gotelli 2000)
•The relative amount of C and N influence macroinvertebrate substrate use (Motomori et al. 2001)
•C and N are nutrients for invertebrate feeding. Carbon however is more difficult to digest compared to nitrogen (Delgado-Daquerizo et al. 2015)
•To determine which litter type is preferred, the type of nutrient will play a crucial role in attracting macroinvertebrates for food and shelter (Petit et al. 2012)
•Plastic is also a large factor for habitat for the macroinvertebrates (Pinochet et al., 2020)

OBJECTIVES AND HYPOTHESES

•I predicted that macroinvertebrates are more abundant in descending order from, oak, ash, and plastic.
•Scientific goals are to calculate difference in each of the three litter bags and decide on if macroinvertebrates have a preference on nutrients which benefit their ecosystem
• The abundance of each bag of litter can be beneficial to learning how to help with the environment and nutrient cycling so ecosystems can live in better environments. If nutrients are offered, the abundance will be affected due to what that ecosystem requires

METHODS

•35 g of fallen *Quercus, Fraxinus americana,* and plastic litter from Rice Creek Field Station in Oswego NY, into separate mesh bags
•Oak was chosen knowing that nitrogen is an abundant nutrient source (Hu et al. 2013)
•Ash was chosen knowing that carbon is an abundant nutrient source, which has a similar carbon ratio to the topics used in Hofer & Richardson 2007
•Plastic was chosen knowing that macroinvertebrates commonly use as a shelter source (Pinochet et al. 2020)
•Bring bags to the stream at Rice Creek, Oswego NY and place the litter bags in the water
•Bags were placed in vegetation in a deeper part of the stream and cobble in a shallow part of the creek in September 2024
•Three weeks later, the bags were collected from both parts of the stream
•Macroinvertebrates counted according to taxonomic groups and tally which species that they belong to for each litter bag, in the lab
•Data standardized for sampling time and analyzed with GraphPad prism (V. 10), La Jolla CA

RESULTS and DISCUSSION

Macroinvertebrates and leaf substrate

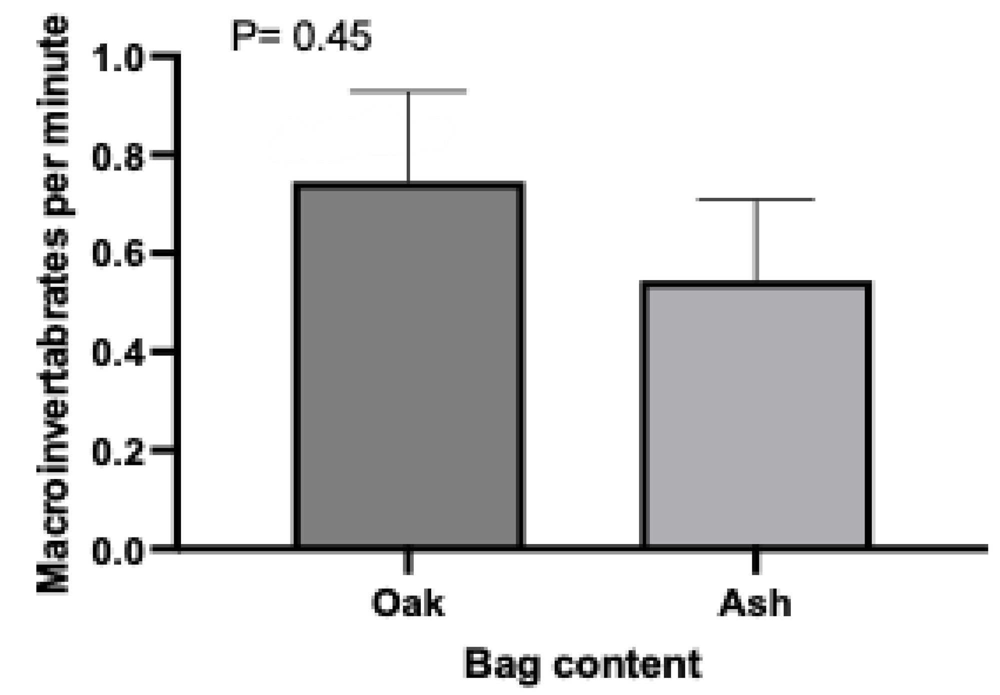

Figure 1- Macroinvertebrates sampled on ash and oak leaves in Rice Creek, Oswego NY. P=0.45 for t-test. Error bars are SEM

•There was no significant difference between oak and ash in abundance of macroinvertebrates, error bars are SEM and P=0.46
•Both leaves provide nutrients to macroinvertebrates and those macroinvertebrates do not always prefer one over the other (Hofer & Richardson 2007)
•The reasoning behind oak being slightly higher can be due to higher nitrogen in carbon to nitrogen ratios being preferred (Motomori et al. 2001)
•The lack of pattern may be due to the data collected is on both running water and still water. Therefore, there is a chance that there may be a pattern in one location rather than the other location. (Heino et al. 2004)

Total macroinvertebrates: Natural and artificial substrates

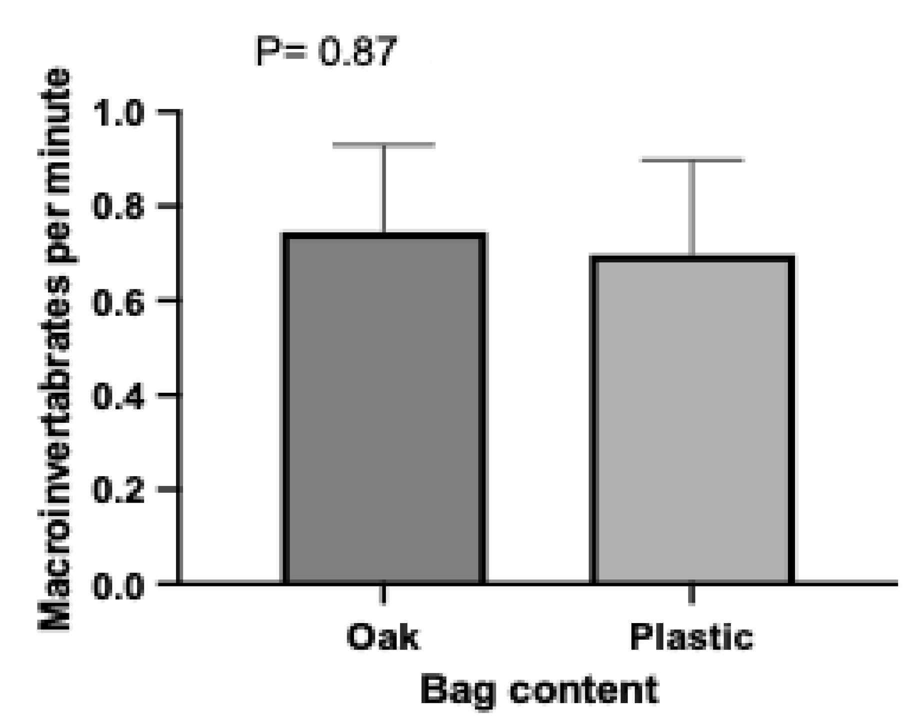

Figure 2- Macroinvertebrates sampled on ash and oak leaves in Rice Creek, Oswego NY. P=0.87 for t-test. Error bars are SEM

•There was no significant difference between oak and plastic in the range of density across the abundance of macroinvertebrates, error bars are SEM and p= 0.87
•Macroinvertebrates may be using the plastic as shelter and the leaves as food simultaneously (Pinochet et al. 2020)
•There is a possible connection between the species that use the plastic for shelter to protect them in high nitrogen ratio locations (Hu et al. 2013)
•The location of the bags may have a high number of nitrogen to carbon ratios; therefore, the plastic can be in a position near the leaves (Santoja et al. 2020)

Total amphipods and substrate

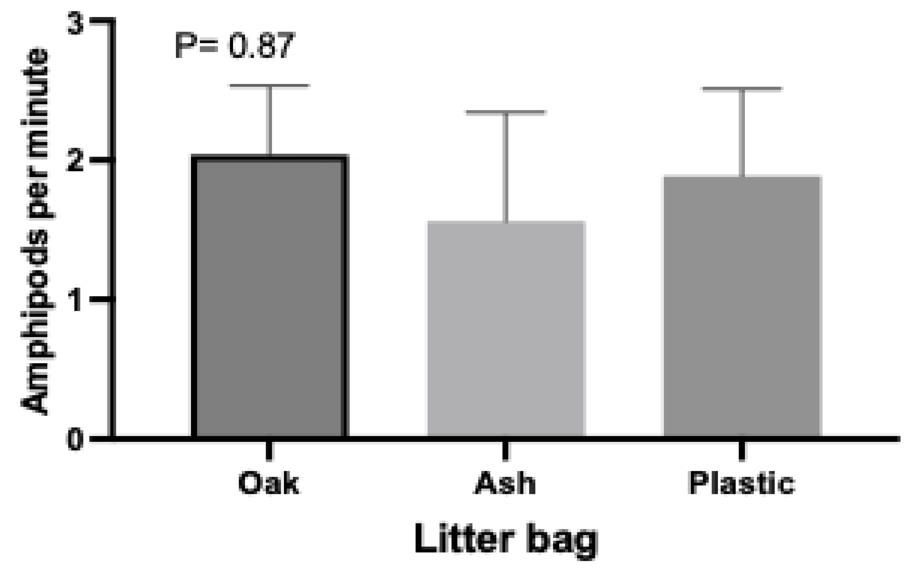

Figure 2- Macroinvertebrates sampled on ash and oak leaves in Rice Creek, Oswego NY. P=0.87 for ANOVA test. Error bars are SEM

•There was no significant difference between oak, ash, and plastic in abundance of amphipods, error bars are SEM and p= 0.87
•The different locations where the litter bags were placed may have been put in disturbed spots where less amphipods can be found (McCabe & Gotelli 2000)
•The lack of difference in the leaves can correlate with the amphipods not having a preference on nutrition (Petit et al. 2012)
•Amphipods are more abundant in clean streams and the plastic may diminish that, altering the expected result (Lassonen et al. 1998)
•The cleanliness of the streams are a direct connection to the health of the contents within, the addition of more nutrient availability could have attracted invertebrates (Hussain & Pandit 2021)

CONCLUSIONS

•There is no significant pattern between macroinvertebrate abundance related to substrate
•For the next experiment, all the bags will be in the same section and in the same type of stream, flowing, static, etc.
•The nutrient difference between each litter bag does not support that the macroinvertebrates prefer one over the other nor affect the abundance
•Although the data looks to be different. The results show that there are no differences between each litter bag and the number of macroinvertebrates
•Depending on the food available in a location, we can find an abundance of macroinvertebrates

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