

Anthropogenic Litter Abundance and Composition in Urban Streams: Influence of Site and Habitat

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Introduction

- Anthropogenic litter (AL) refers to trash, such as plastic, glass, and other materials that find their way into the environment.
- Accumulation of AL is a growing concern at a global scale.
- Rivers are a key site of AL disposal and transport to global oceans.
- Yet, research on AL assemblage, density, and movement within rivers is relatively uncommon
- Understanding the abundance and distribution of AL is needed to inform efficient clean-up and prevention strategies.
- Our objective was to quantify the abundance and composition of AL in different habitats at multiple sites in an urban watershed

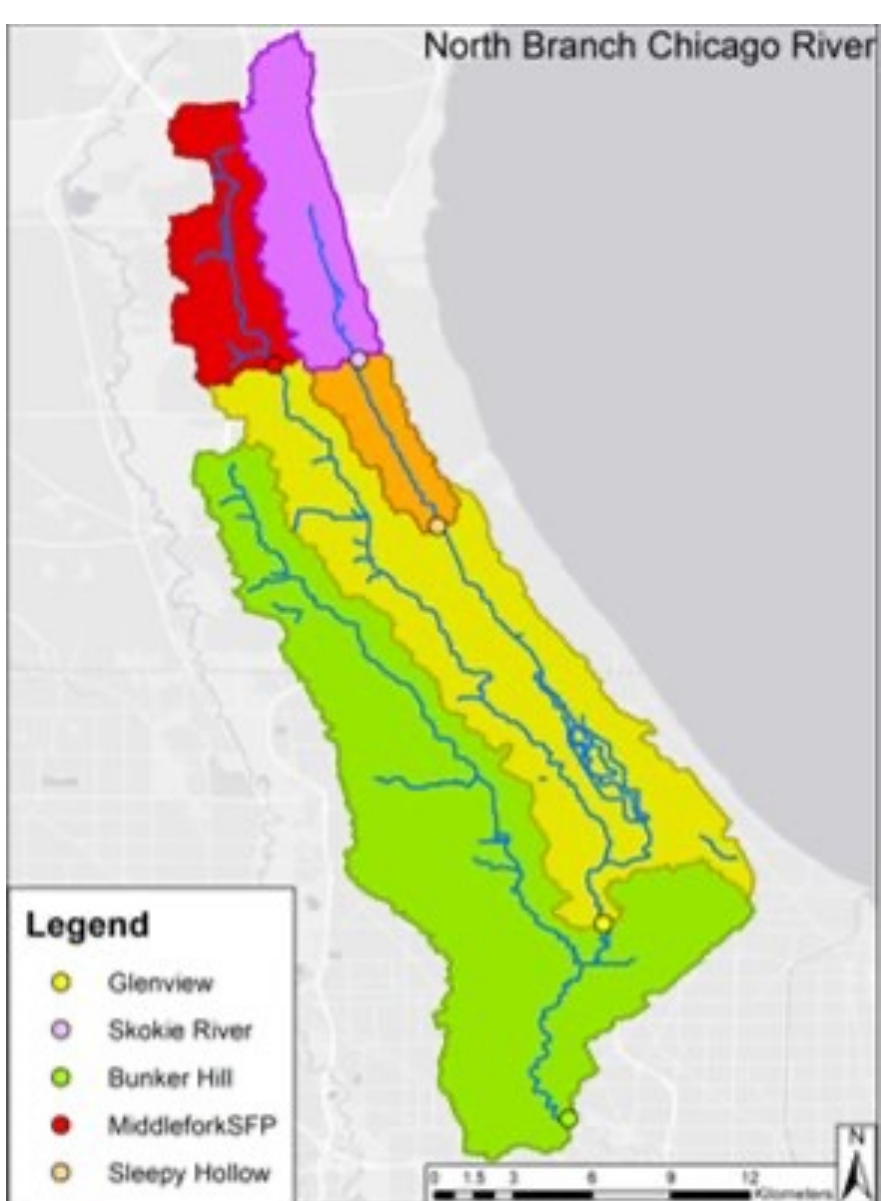


Fig. 1: AL Collected in the Field

Hypothesis

We Predict:

1. Greater AL at the downstream sites relative to upstream.
2. AL assemblage will be different among habitats within the streams
 - Overhanging vegetation, riparian zone, and floating habitats will be dominated by lightweight items (e.g., plastics, styrofoam)
 - Benthic habitats will consist of more heavy material (e.g., glass, rubber)



Study Sites

Tributaries:

- Skokie River
- Middle Fork Savannah

Mid-watershed:

- Glenview Woods

Downstream

- Bunker Hill

Fig. 2: Study Sites in the North Branch of the Chicago River

Methods

Field Work

- a. We marked 3, 100 m reaches at each of the study sites
- b. All AL was collected from the reaches
- c. We separated material according to habitat found
 - Overhanging vegetation
 - Riparian zone
 - Floating
 - Benthic (submerged)

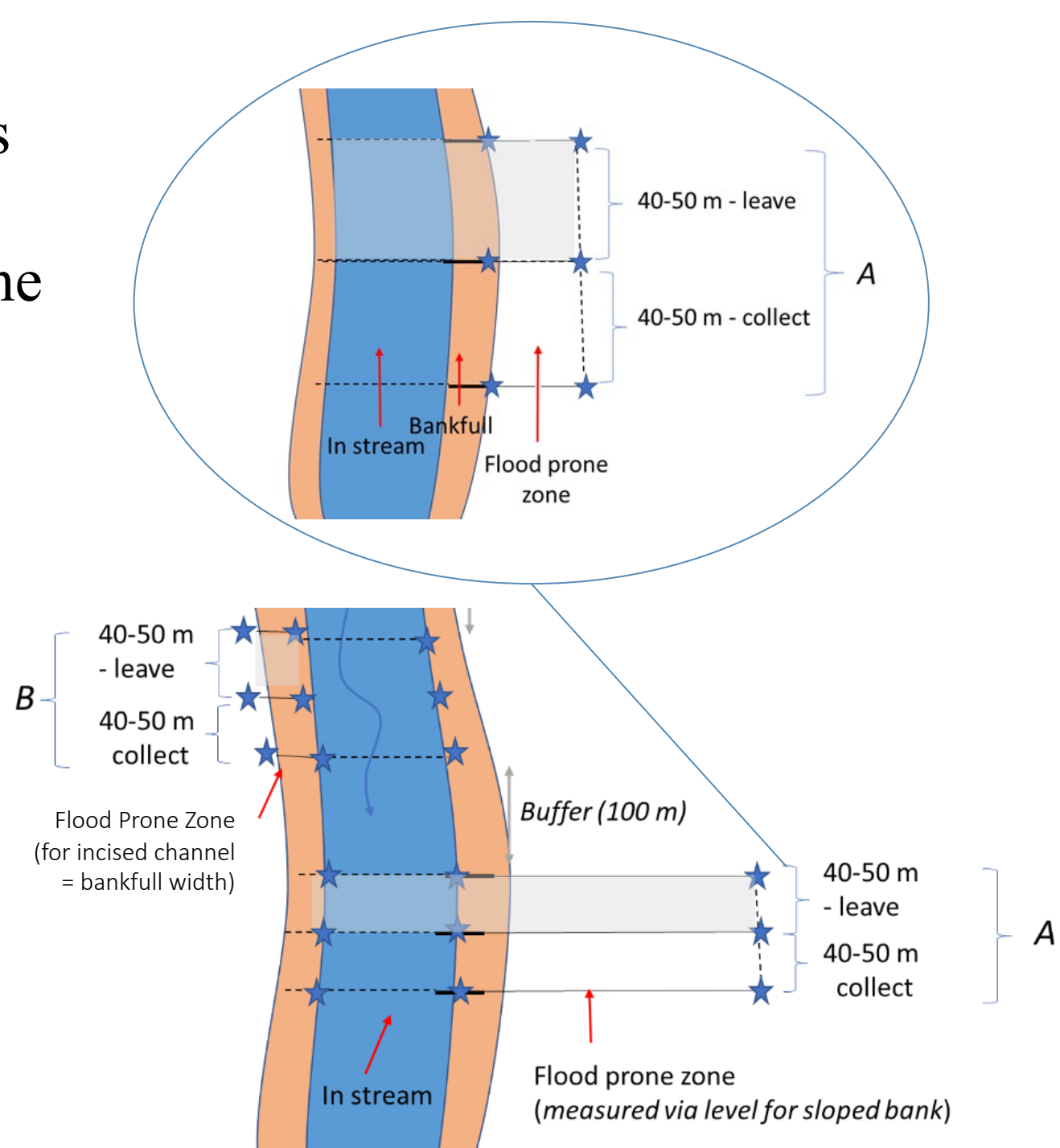


Fig. 3: Experimental setup of stream reaches

Laboratory Processing

- a. Categorized, weighed AL
- b. Mass, dimension, and shape were measured for macroplastic
- c. Used ATR to determine the plastic polymer type.

Data Analysis (done in R)

- a. Worked on code to create stacked bar graphs (*ggplot2*)
- b. Worked on code to analyze community of AL by non-metric multidimensional scaling (NMDS) (*vegan*)

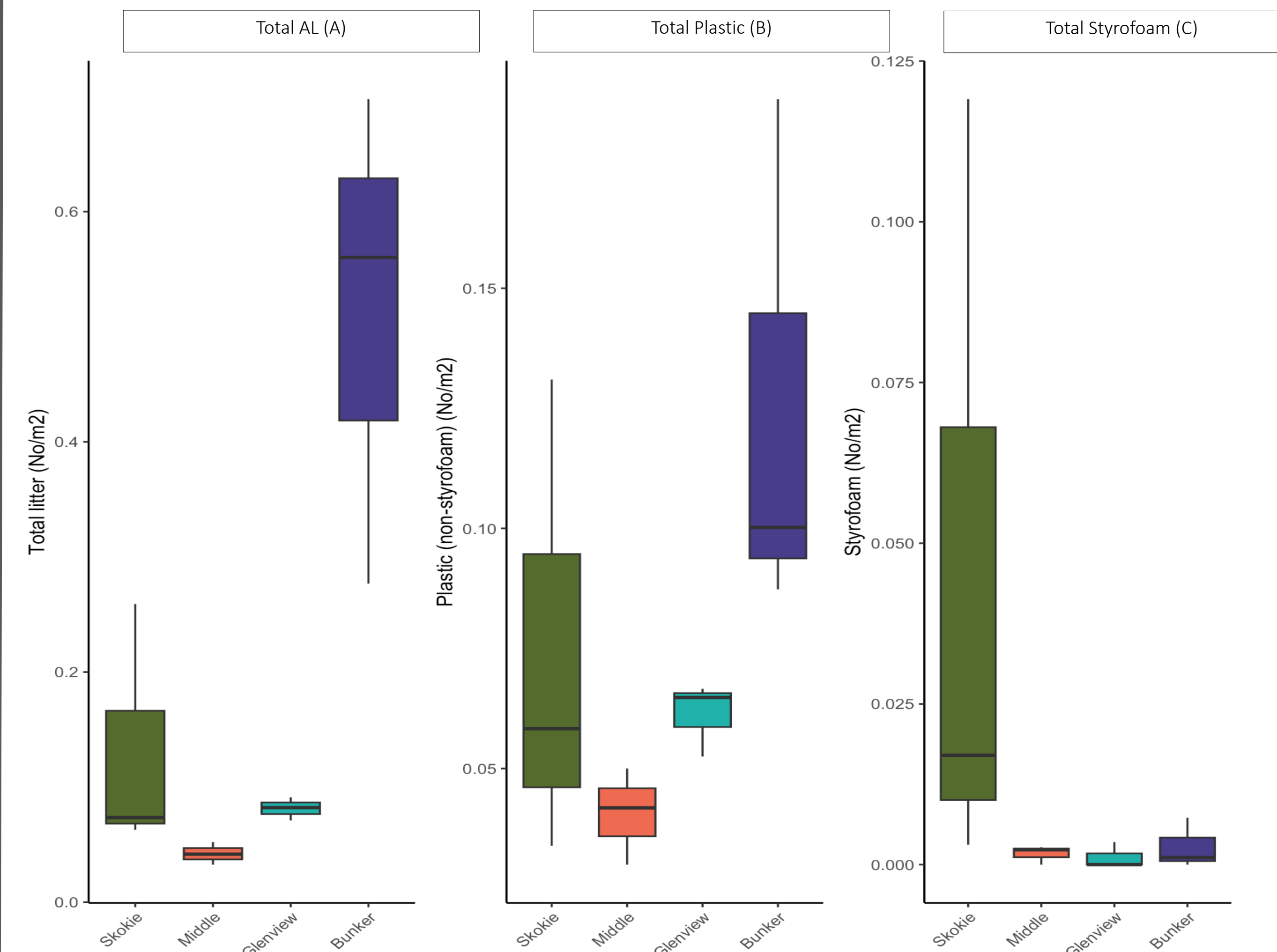


Fig. 4: Total litter, total plastic (non-Styrofoam), and total Styrofoam in each of the streams.

- Total litter and plastic were highest downstream – consistent with our predictions
- However, one of the upstream sites (Skokie River) had higher than expected values for all AL.

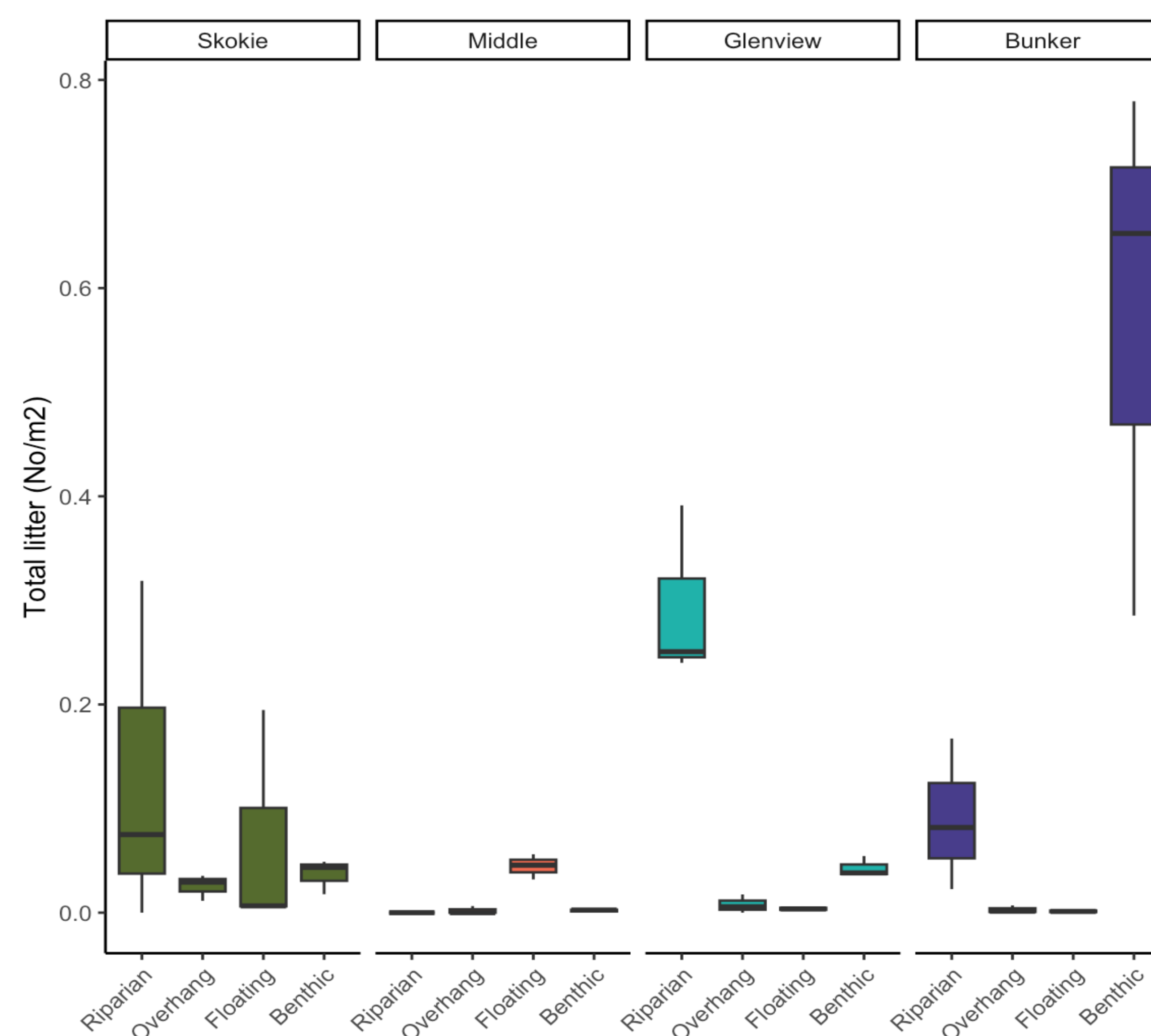


Fig. 5: Total litter in each of the streams, separated by the four habitats analyzed.

- We expected benthic habitats to show the greatest litter density, but this was only true for the most downstream sites.
- At Skokie River and Glenview Woods, the greatest amount of AL was found in the riparian zone (streamside vegetation)

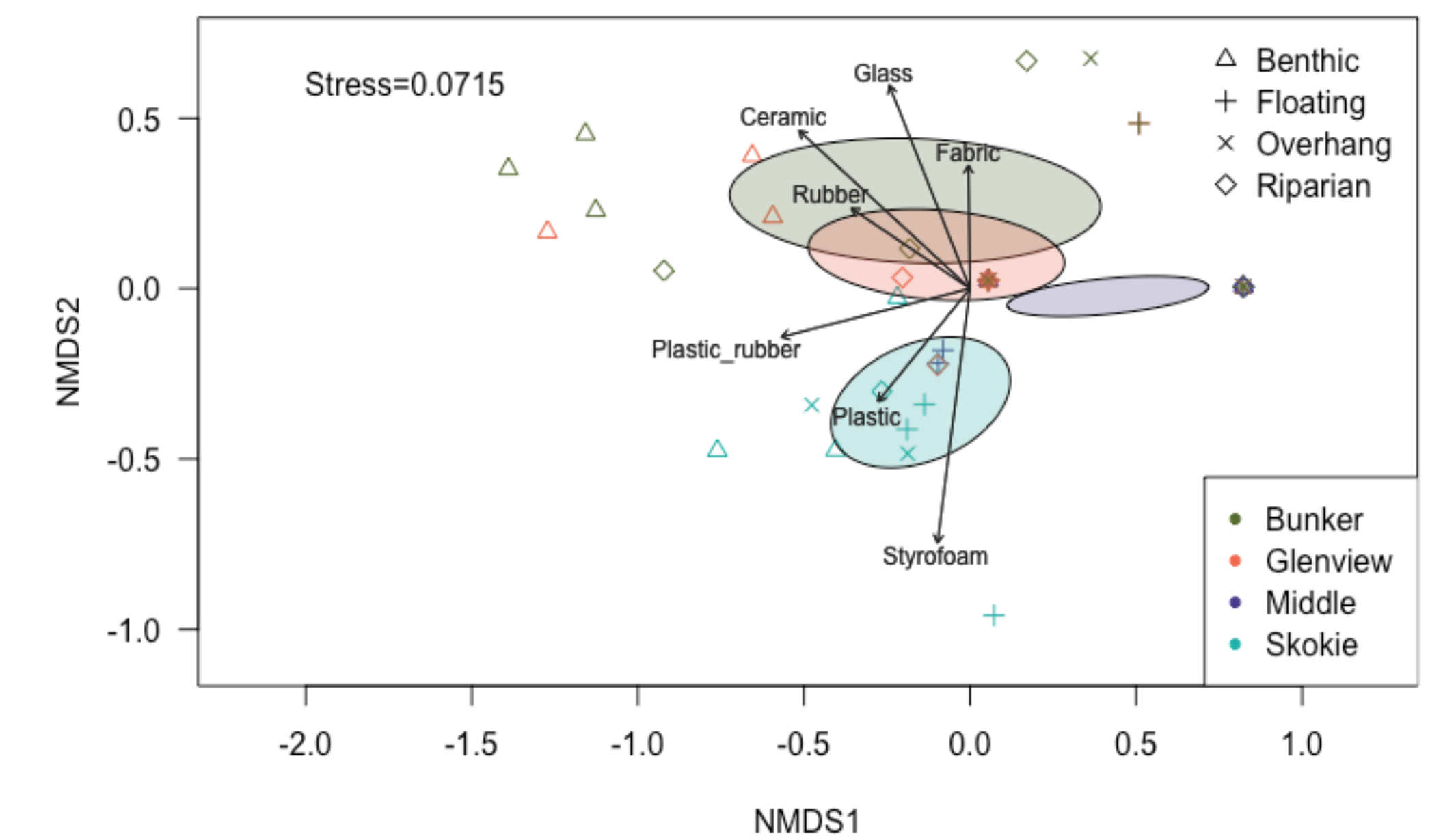


Fig. 6: NMDS analysis of AL "community" composition among sites and habitats grouped by site

- The two upstream sites (Skokie – Blue) and Middlefork (Purple) had distinct communities of AL relative to the two downstream sites, which were not different from one another

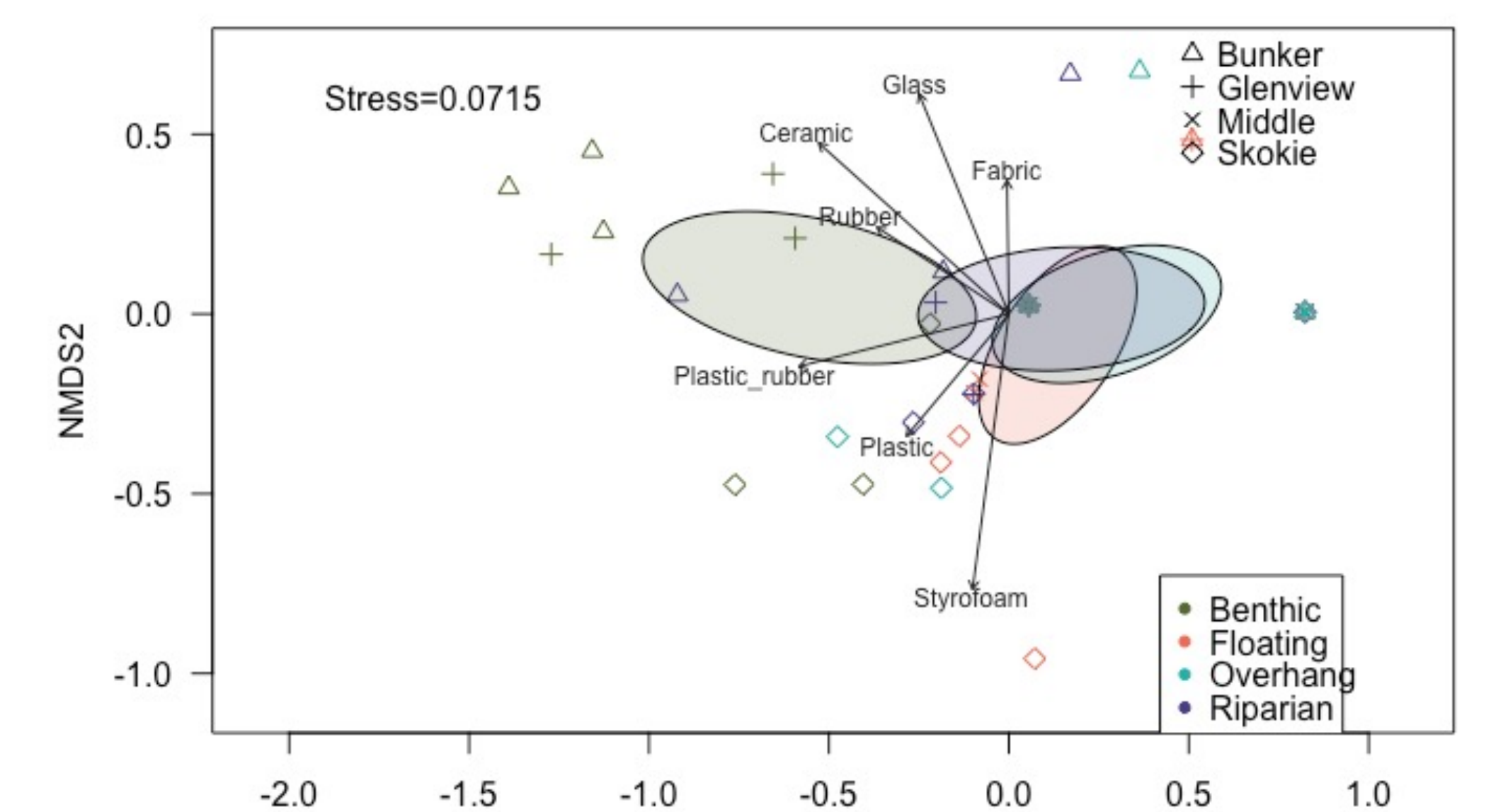


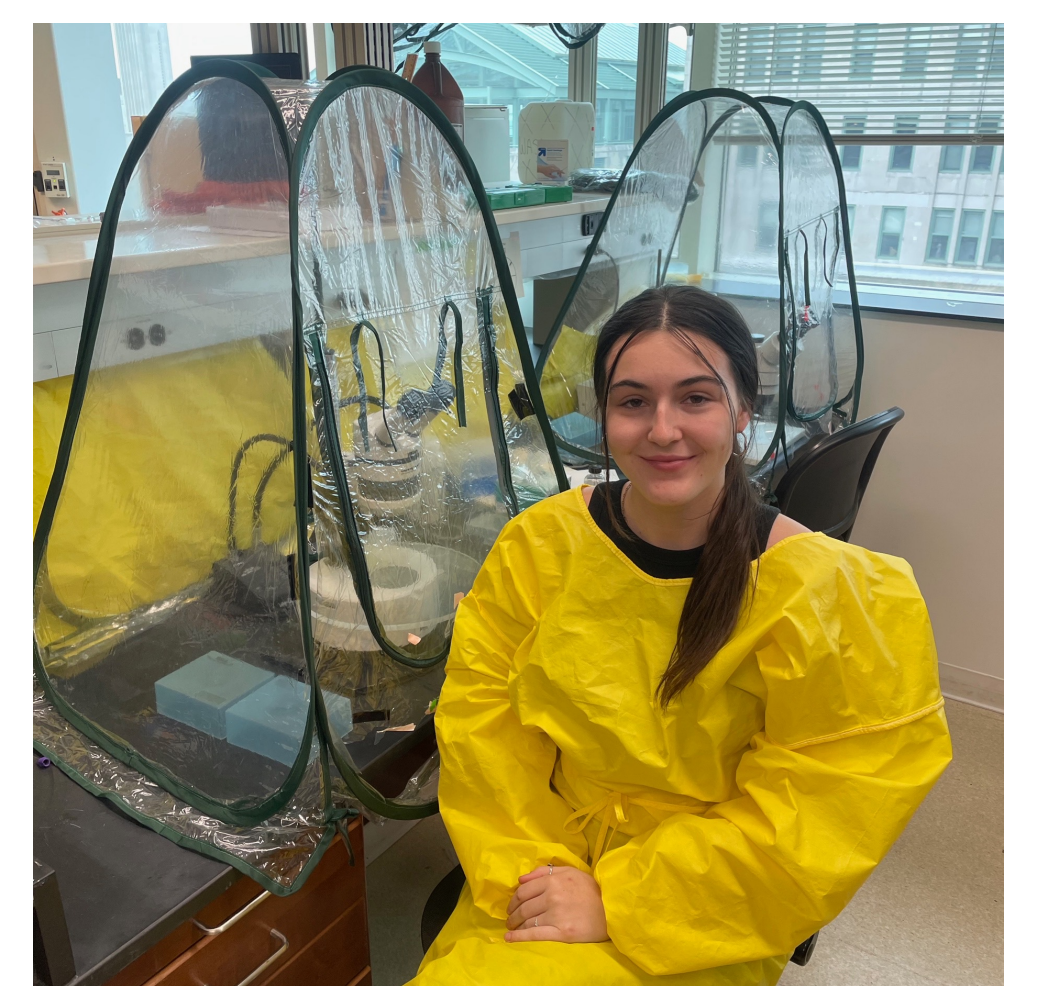
Fig. 7: NMDS analysis of AL "community" composition among sites and habitats grouped by habitat type

- The Benthic community had distinct communities of AL relative to the other habitat types (Floating, Overhang, Riparian), which were not different from one another

Discussion

Conclusions:

1. There was ultimately more AL downstream than upstream
 - a. AL primarily accumulates at downstream locations, likely due to movement of wind and current.
 - b. Seen in figures 4 and 5
2. The composition of AL differed by site
 - a. Each site differs both in composition of AL and of human activities at each site.
 - b. Seen in Figure 6
 - c. As composition of AL differs at each site, clean-up procedures could be adapted to the specific needs of each site.



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