Spring 2017

Wetland Connectivity and Macroinvertebrate Diversity

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Dragons & damsels in distress?:
The impact of wetland-river connectivity on dragonfly and damselfly food webs

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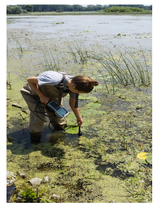
Introduction

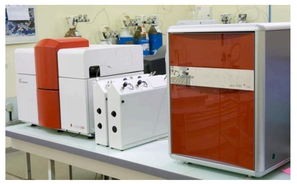
Wetlands are often subject to decreased hydrologic connectivity (e.g. dyke construction), resulting in alterations in food web structure. By impeding the movement of organic matter and organisms between habitats, we may expect to see reductions in trophic positions and diversity. Examining how the diet and diversity of wetland organisms are impacted in these restructured wetlands is one way of assessing the consequences of altering connectivity.

Fig 1. Two wetland sites surveyed. Central Pool (A) has been dyked, while Eaglemarsh (B) remains connected to the river. Photos by Jacob Pollock.

Methods



- We performed diversity and odonate surveys at the Shiawassee National Wildlife Refuge in Saginaw, Michigan from 15 wetlands either disconnected or connected to nearby rivers



- Homogenized macroinvertebrates were analyzed on an elemental analyzer (Vario PYRO Cube), interfaced to a stable isotope mass spectrometer

Research Predictions

1. Wetland-river connectivity will result in longer food chains.
2. Connected wetland sites will have greater species richness and diversity than disconnected sites.

Results

Dragonfly and Damselfly Food Webs

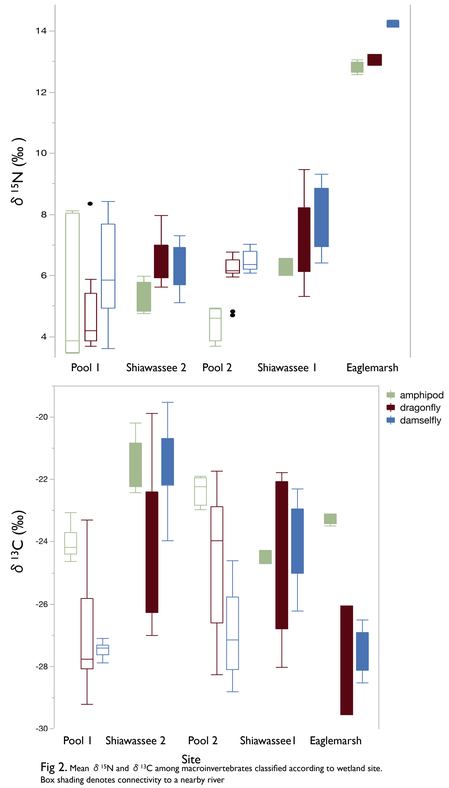


Fig 2. Mean $\delta^{15}N$ and $\delta^{13}C$ among macroinvertebrates classified according to wetland site. Box shading denotes connectivity to a nearby river

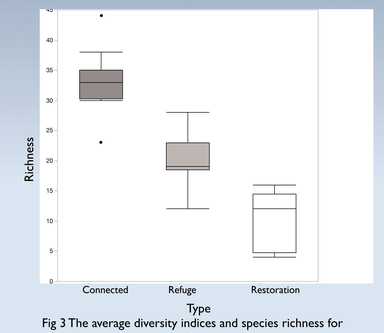
Connected sites had higher species richness than both disconnected site types (ANOVA, $p<0.0001$)

Average $\delta^{15}N$ values were higher in connected sites (t-test, $p < .0001$)

The average offset in $\delta^{15}N$ was different between Pool 1 and Pool 2 (ANOVA, $p<.0001$)

Amphipods had higher $\delta^{13}C$ values than dragonflies and damselflies respectively, (ANOVA, $p=.0012$ and $p=.0022$)

Diversity



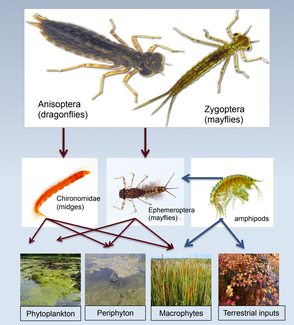


Fig 3 The average diversity indices and species richness for macroinvertebrates surveyed

Conclusions

Wetlands connected to a river had higher diversity and species richness than disconnected sites.

- This may be because wetland-river connections provide opportunities for species to enter adjacent ecosystems
- Some organisms may be limited by conditions provided by connectivity(e.g. higher oxygen levels)

Although $\delta^{15}N$ levels were significantly higher in connected wetlands, it is unlikely that this increase is due to longer food chains, suggesting alternative differences in nitrogen inputs to connected and disconnected wetlands

- Organic material, anoxic condition in wetland sediments, and a influx of nitrate from adjacent water bodies could favor denitrification

Future Directions

Further investigate sources of connectivity-driven sources of isotope variation (e.g. denitrification)

Amino-acid specific stable isotope analysis would provide data to discriminate the source of the observed shift in d15N between wetland types

Expanding the study by including more members of wetland food webs (e.g. primary producers and fish)

References

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