A preliminary study examining the relationship between water quality and the presence of freshwater sponges in the White River Watershed

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Background

Sponges (Phylum: Porifera) date back more than 500 million years. They lack true tissues and organs. As filter feeders, nutrients, algae, and bacteria are removed by choanocytes (flagellated cells) lining the many canals and chambers in the sponge body. Sponges are often found on rocks where flow rates are stable enough for colonization. They serve as food for ducks, crayfish, and aquatic invertebrates such as caddis flies, mayflies, and midges.

Little research exists explaining why sponges are found in certain places: is location tied to water quality, nutrient availability, and/or flow rates? Additionally, as a macroinvertebrate, it is not used as an indicator species in macroinvertebrate studies of water quality.

The focus of this project was to catalog sponge locations in streams within the White River and Muskegon River watersheds, and determine if a relationship exists between the water quality and the locations where sponges were found. If significant relationships are found between water quality and the presence of sponges, the statistical model could be used to predict the likelihood of sponges being found in a certain location through water quality data alone.

Methods

Site Selection
- WRWP macroinvertebrate survey sites
- Road-stream crossings with rocky substrates
- Downstream from dams and pond/lake outlets

Data Collected
- Water quality parameters were measured using an *In-Situ Aqua TROLL* multi-parameter probe
- Measurements: Temperature, dissolved oxygen, pH, conductivity, oxidation/reduction potential
- Stream characteristics: depth, width, flow rate

Finding Sponges
- Visual inspection of submerged rocks and logs
- Deeper rocks and those not directly in the current were examined
- Sponges tissue and gemmules were collected for DNA barcoding and species identification in the lab.

Results

Location of Sponges:
Two new sponge sites identified:
- Minnie Pond Spillway (Brohman, MI)
- Robinson Lake Outflow/Robinson Creek (White Cloud, MI)
- Sponges had been found previously in Grant, Wheeler Drain, and the Muskegon Community College campus

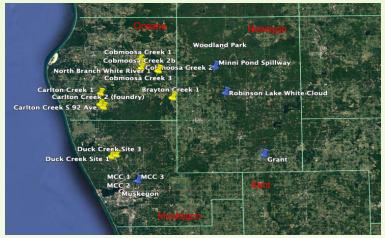

Figure 1: Sampling sites in West Michigan, County names in red.

Sponge Species:
DNA barcoding was unable to conclusively distinguish between sponges found at Minnie Pond and Robinson Lake
Sponges were likely:
- *Ephydatia fluviatilis*
- *Ephydatia meulleri*
- *Spongilla lacustris*

Figure 2: Sponges samples.A) Robinson Lake outflow; B) Minni Pond Spillway

Statistical Analysis:
- Stepwise forward regression was used to analyze the relationship between water quality parameters and the presence of sponges
- Water temperature, RDO, and Actual Conductivity all showed a significant relationship with the presence of sponges
- Sites used in statistical analysis: n=17
- Sites with sponges: n=4

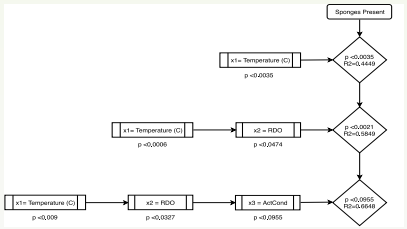

Figure 3: Stepwise forward regression results and p values for the significant water quality parameters.

- When the water quality variables are applied to the equation, y values close to 1 indicate a greater probability sponges will be present. Values close to zero indicate a decreased probability sponges will be present.

$$y = -3.45750 + 0.12141(x1) + 0.17925(x2) + 0.00166(x3)$$

Conclusion

Current Study
- Locations without rocky substrates had no sponges
- Not all locations with rocky substrates had sponges
- Locations downstream of water control dams or pond outflows all had sponges
- Preliminary results indicate a statistical relationship between temperature, dissolved oxygen, and actual conductivity (CI=90%) and the presence of sponges.

Future Studies
- Find more sites with sponges to the model: focus on water control dams and pond outflows
- Expand beyond the White river watershed
- Compare sponge species with water quality: is there a relationship?
- Use eDNA analysis to confirm presence of sponges
- Incorporate GIS data as additional parameters in the statistical model
- Return to sites in winter to collect gemmules for gemmosclere analysis to confirm species
- Collect accurate data on flow rates and incorporate them into the model

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