Influence of stream macrophytes on slimy sculpin (Cottus cognatus) distribution and in-stream food webs

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Macrophytes & Stream Dynamics
- Aquatic vegetation is an important stream organism for its effects on stream processes and for its role as an energy source to stream food webs.
- Macrophyte effects on stream processes:
  - Influence channel shape by directing the main flow of water
  - Decrease water velocity
  - Retain fine sediments
  - Provide large surface area for the colonization of macroinvertebrates and epiphytic periphyton
- Retain organic matter, which supplements nutrient cycles
- Provide energy to the base of aquatic food webs
- Intercept light and shade stream benthos

Slimy Sculpin
- Small, benthic, invertevores
- Prefer riffle habitats with cobble substrate
- In cold-water streams, they dominate fish assemblage in terms of biomass and abundance
- Influence invertebrate assemblage through predation
- Compete with young brook and brown trout for invertebrate prey
- Food source for large brook and brown trout
- Previous research shows small-bodied sculpin (<4cm) comprise a majority of the sculpin population at open canopy sites in the Coon Creek Watershed during late summer (Laukkanen 2012).

Study Sites
- Three streams in the Coon Creek Watershed in Wisconsin served as independent replicates.
- Each contained a pair of riffle sites, both 20 meters in length; one had abundant macrophyte growth and the other contained little to no macrophyte growth.

Preliminary Results

Sculpin abundance
- Sculpin density (Fig. 2) did not differ significantly between sites with high and low macrophyte abundance

Sculin size distribution
- Size distribution (Fig. 3) was not congruent with the findings of previous research
- Average sculpin sizes were significantly different between sites with and sites without macrophytes
  (Stream x macrophyte interaction, ANOVA p = 0.0001)

Sculpin diet
- There were no consistent diet patterns observed between replicate streams. Sculpin gut contents suggest that sculpin diet is stream specific.
- The average mass of gut contents per mm of sculpin length (Fig. 4) was significantly different between sites with low and high macrophyte abundance (ANOVA p = 0.001)

Preliminary Outcomes
- The results indicate that sculpin that inhabit stream reaches with high macrophyte abundance experience higher food availability than sculpin in reaches that lack macrophytes.
- The lack of significant difference in sculpin density between sites with and without macrophytes was likely due to physical differences between Spring Coulee Creek and the other two streams.

Analytical Methods

Organism abundance
- Macrophytes: Percent cover as well as total and species specific biomass were determined using the quadrat method
- Periphyton: Fifteen samples collected per site from a known area of substrate using a tube sampler. Ash free dry mass and chlorophyll a analysis were performed.
- Macroinvertebrates: Five replicate samples collected using a Hess sampler. Organisms were sorted to family; total and taxon specific biomass were calculated.
- Slimy sculpin: Sculpin were collected using a kicknet. All sculpin measured for total length.

Sculpin diet
- Ten small (<5cm) and ten large (>6cm) sculpin were euthanized with MS-222. Gastric lavage was performed to extract gut contents. Whole and partial organsisms were identified and the dry mass of gut contents were calculated per mm of body length.

Periphyton abundance
- Biomass of periphyton was significantly different between sites with high and low macrophyte abundance (Stream x Macrophyte interaction; ANOVA p = 0.004) (Fig. 1), however chlorophyll a only differed significantly between streams (ANOVA p = 0.01)

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References: