

Aquatic macroinvertebrates affect Lake Sturgeon eggs and free embryos.

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Introduction

- Overlap in Lake Sturgeon (*Acipenser fulvescens*) spawning habitats and the distribution of many benthic macroinvertebrates suggests that species interactions across trophic levels may be common.
- Little is known about how various macroinvertebrate **functional feeding guilds (FFGs)** may be interacting with lake sturgeon eggs and free embryos.
- Prey from non-fish taxa have shown plastic responses in hatch time when exposed to predatory cues (Wojdek et al., 2014).
- Predaceous** stoneflies can aid broadcast spawning fish by scavenging dead eggs which prevents the spread of fungus and decreases oxygen consumption (Nicola, 1968) and negatively affect fish through direct consumption of live eggs and fish larvae (Errol and Phillips, 1968).
- Scrapers** and **filterers** may decrease the abundance of and alter the successional microbial community composition documented on the surfaces of sturgeon eggs which may affect development (Fujimoto et al., 2013).

Objective and Hypotheses

Objective

- Determine if and by what means macroinvertebrate FFGs affect the egg size, hatch success, hatch time, and the body size of larval sturgeon.

Hypotheses

- Predator stoneflies will cause higher rates of mortality and induce early hatching, thus affecting the body size of larval sturgeon.
- Species from the scraper and filterer FFGs will increase egg survival and the body size of larval sturgeon.

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Methods

- Gametes were collected from one male and one female in the Upper Black River and fertilized at the Black River Sturgeon Research Facility on June 4, 2015.
- ~30-35 fertilized eggs were placed in 3" PVC couplings with each FFG collected from spawning sites (Fig. 1) and arranged in Heath trays (Fig. 2) for incubation.
- Egg samples were collected 3 days after exposure to macroinvertebrates.
- Hatch success was monitored daily and larval sturgeon were digitally photographed (Fig. 3) and measured for total length and yolk-sac area using ImageJ software.
- Results were considered significant if $\alpha < 0.05$.

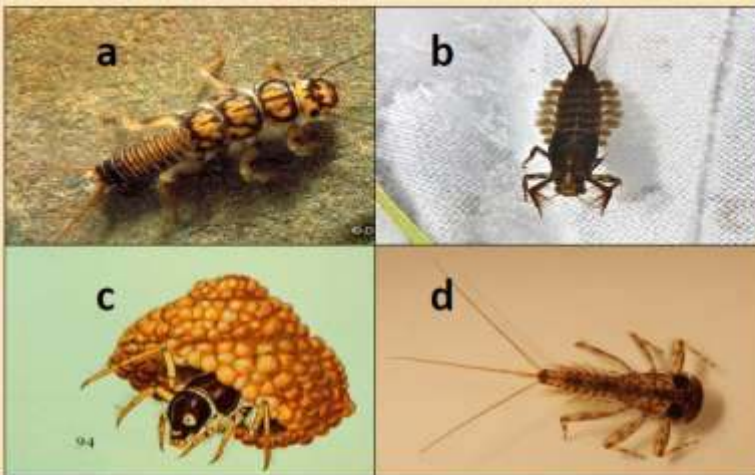


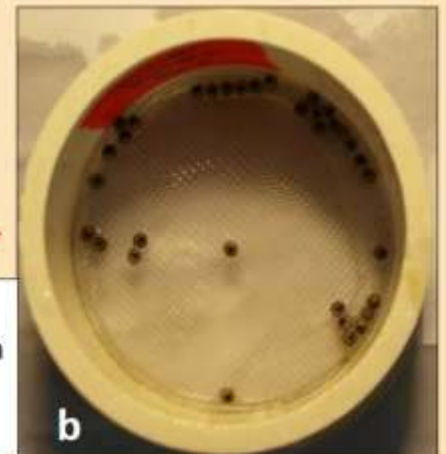
Fig 1. Functional feeding guilds used for experiments. (a) Perlidae (predator); (b) Isonychiidae (collector-filterer/facultative predator); (c) Helicopsychidae (obligate scraper); (d) Heptageniidae (facultative scraper)



Fig 3. Hatched lake sturgeon free embryos were anesthetized to measure total length (mm) and yolk sac area (mm²) of individuals.



Fig 2. (a) Heath trays used to incubate (b) PVC couplings which contained lake sturgeon eggs and macroinvertebrates.



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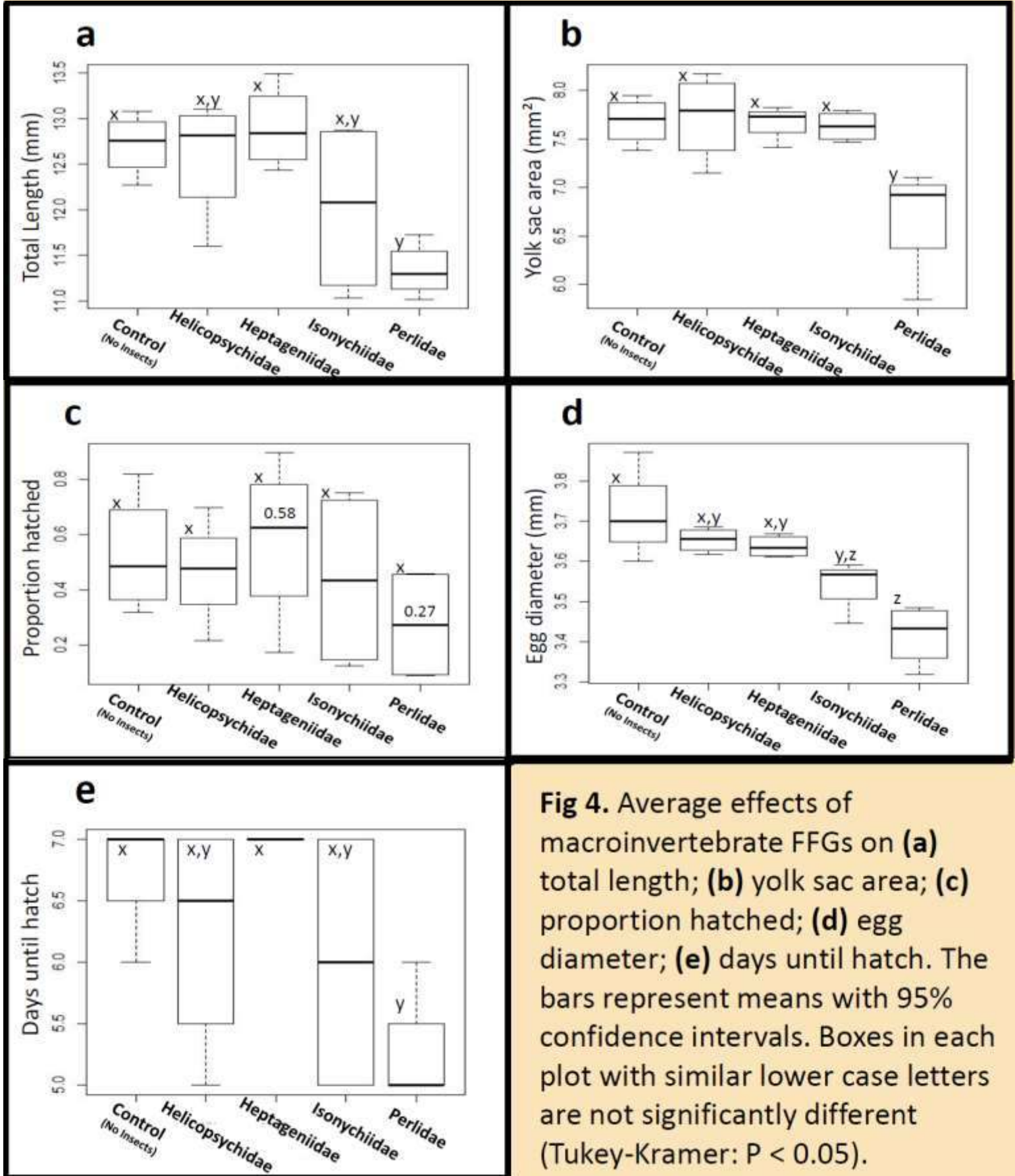


Fig 4. Average effects of macroinvertebrate FFGs on (a) total length; (b) yolk sac area; (c) proportion hatched; (d) egg diameter; (e) days until hatch. The bars represent means with 95% confidence intervals. Boxes in each plot with similar lower case letters are not significantly different (Tukey-Kramer: $P < 0.05$).

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Results

Predator (Perlidae)

- Predator stonefly treatments revealed significant effects on total length (Fig. 4a), yolk sac area (Fig. 4b), egg diameter (Fig. 4d), and days to hatch (Fig. 4e).
- Mean proportion hatched in the predator treatment was considerably less than the facultative scraper treatment ($\Delta = 0.31$) but differences were not significant (Fig. 4c).

Collector-Filterer/ Facultative Predator (Isonychiidae)

- These collector-filterer/facultative predators consistently showed intermediate although insignificant effects on total length (Fig. 4a), egg size (Fig. 4d), and days until hatch (Fig. 4e).
- ### **Obligate/ Facultative Scrapers (Helicopsychidae and Heptageniidae)**
- Data means for all response variables were statistically similar to the control means (Fig. 4a-e).

Discussion

- Results reveal that obligate predatory insects such as the stonefly family Perlidae could exhibit coupled direct effects on recruitment by inducing early hatching which results in smaller larval body size.
 - Collector-filterer/facultative predators such as Isonychiidae show intermediate effects on the hatch time, total length of larvae, and egg size.
 - There is no interaction between the two scraper treatments and the variables measured in this study. However, slight differences in total length and proportion hatched could be explained by scrapers changing the egg surface's microbial communities which may affect development. Microbial communities are currently being investigated.
- Conclusion – Benthic macroinvertebrates should be considered significant biotic factors influencing development and recruitment of Lake Sturgeon.**

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Acknowledgments

Successful egg fertilization was possible with the help of Jenna Ruzich, Shaley Valentine, Dillon Ross, Garrett Johnson, Adam Chastan, and Justin Waraniak. Funding provided by Michigan State University Department of Fisheries and Wildlife and the Michigan Department of Natural Resources.