Fishy fears: the development of a novel predator avoidance assay for fathead minnows (*Pimephales promelas*) across multiple life stages

Background

- There is a growing recognition of the importance of assessing ecologically-relevant behavioral endpoints within ecotoxicology, aquaculture, and environmental monitoring.
- One class of ecologically-relevant behaviors is predator avoidance behaviors, which hold importance for the survival and propagation of fish populations.
- The predator avoidance behaviors of adult fathead minnows (FHMs) have been well-characterized, but larval behaviors remain poorly understood.



Goal: To develop a behavioral assay that assesses predator avoidance behaviors of FHMs across multiple life stages.



Objective 1: Verify that alarm cue (AC) collected from pond-reared donors induces predator avoidance behaviors, as measured via Toxtrac, in adult FHMs.



Objective 2: Develop a predator avoidance assay, using the pond-reared AC verified in objective 1, for use in 13-15 days post hatch (dph) FHMs.



Figure 2. Change in time under shelter and time spent frozen by adult FHMs in the control, sham-exposed, and alarm-cue exposed groups (n =15/group). Letters above bars represents significant differences. Error bars represent standard error.



Figure 3. Change in time spent under shelter, speed, distance travelled, and acceleration by 13-15 dph FHMs in the control, sham-exposed, and alarm cue-exposed groups (n = 32/group). Letters above bars represents significant differences between groups. Error bars represent standard error.

Experimental Approach

Adult FHMs (n = 15/group) and 13-15 dph larval FHMs (n = 32/group) were randomly divided into control, shamexposed, or alarm cue-exposed groups and subjected to a predator avoidance assay as shown in Figure 1.



Figure 1. Conceptual schematic of the experimental design of the predator avoidance assay. The specific objective addressed is indicated by the icon. For fish in the sham- and AC-exposed groups, distilled water or alarm-cue served as the stimulus, respectively.

Conclusions & Future Directions

- FHMs.

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These findings validate the use of alarm cue collected from pondreared FHM donors as predator stimulus for lab-reared FHMs across multiple life stages and represent the first comprehensive study of the behavioral response of larval FHMs to alarm cue.

Alarm cue collected from pond-reared donors elicited significant changes in the time spent under shelter in both larval and adult

However, the magnitude and significance of the change in behavioral responses to stimuli differed across life stages.

The differing responses of larvae and adult FHMs to alarm cue highlights the importance of taking life stage into account when incorporating behavioral endpoints.

Future studies will investigate the sensitivity of this assay to neurotoxic and/or psychoactive compounds.



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