Behavioral Response of Small Everglades Fish to Hydrological Variation, Predator Cues and Parasites

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Introduction:

Depths in the Everglades fluctuate seasonally. During the dry season, many of the Everglades' dry commu-nity subhabitats are noticeably altered by the seasonal rise and fall of water levels. The seasonal rise and fall of water levels results in a fluctuating hydroperiod that has a marked influence on the behavior of the fish. There are many factors that influence the movement of small Everglades fish (e.g., food). This study aimed to understand if there were seasonal changes in the movement behavior of small Everglades fish (e.g., foraging behavior, exploration behavior) in response to environmental changes such as hydroperiod and predator cues.

Hypotheses and goals:

Our goals are to understand factors that affect fish movement across the landscape. In particular, we hypothesized that water levels, the seasonality of the hydroperiod, and predator cues would influence the movement behavior of fish. Our hypotheses were as follows:

1. Mosquitofish (Gambusia holbrooki) move more when the water level rises and falls. During the seasonality of the hydroperiod, the fish are exposed to a changing hydroperiod environment. We expected that the water level would affect the movement behavior of the fish.

2. Personal factors such as hunger, aggression, and fear would influence the movement behavior of the fish. We predicted that the fish would move more when they are hungry, aggressive, or fearful.

3. The presence of predators would influence the movement behavior of the fish. We predicted that the fish would move more when they are exposed to predator cues.

4. The presence of parasites would influence the movement behavior of the fish. We predicted that the fish would move more when they are exposed to parasite cues.

Methods:

For the first experiment, we sampled small Everglades fish from five sites between October 2014 and March 2016. Two sites, Kathleen Tiger and Dessau Panther, were located in WCA 3A, a long hydroperiod region that has not dry period. During the experiment, 32 fish from three sites were housed in the tank of each site. The fish were exposed to different hydroperiod environments, from August to November 2014, and collected daily at the Krone Alien and the Mark III Fish Camp Sites.

Materials and Methods:

For the second experiment, fish were housed in water collected at their site, allowed to acclimate to lab conditions, then housed individually in tanks with the same water. Observers prevented the fish from seeing across the tanks. Each fish was placed in the “water basin” after a calibration period. 80 fish were examined for the water basin effect. The first variable measured was the latency time: the time the fish took to react to the water basin. Eventually, the fish emerged and began to explore. 215 fish were photographed once a second for 20 minutes every 100 s.

For the first experiment, we used conditioned fish to ensure that there were no bias food in the water. Fish were allowed to adapt to each hydroperiod condition for a week, before any food was added. In the first experiment, the process was similar to the second experiment for all the hydroperiod treatments. For the current experiment, the fish were exposed to all the hydroperiod treatments, then filmed swimming and used the computer to analyze the movements of the fish. During the run, the fish were exposed to combinations of visual predator cues (30 different combinations). The fish were photographed once a second for 20 minutes every 100 s. During the run, the fish were exposed to combinations of visual predator cues (30 different combinations). During the run, the fish were exposed to combinations of visual predator cues (30 different combinations).

Results:

The fish spent the most time in the open when they only carried food. This suggests that the presence of food may make the fish more likely to escape from predators. However, the fish also had the lowest variation in speed with the presence of food, indicating that they were either uniformly stationary or constantly changing their behavior. The most important contributors to the movement behavior of the fish were the presence of food, the presence of predators, and the presence of parasites.

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References:

1. After the first experiment, there were clear effects of seasonality on the water environment. For example, some of the fish were observed to be more active during the wet season, while others were more active during the dry season. This suggests that the fish may have different movement behaviors depending on the season.

2. In the second experiment, latency times were shorter for all the cues, which may be related to the presence of the predator cues. The predator cues might have made the fish more likely to engage in escape behavior. Another possibility is that the predator cues may have made the fish more fearful, leading to a decrease in movement times.

3. For videos of our work and process, see J. Matt Hoch’s YouTube channel or Fish 59 (see below) https://www.youtube.com/watch?v=OSmJwA4d.

4. Fish are often associated with disease and parasites, and may be affected by the presence of predators. Some studies have shown that fish are more likely to engage in escape behavior when they are exposed to predator cues.