Effect of Food Fluctuation on the Relationship Between Dry Body Weight and Length for *Heterandria formosa*

Ashley Derival and Matthew Schumm

ABSTRACT

BACKGROUND: Food fluctuation is a condition where the availability of food is irregular through time. For animals, including fish, fluctuating food levels can alter the mechanisms at which they choose to survive and perform. Variable food can lead to a negative Jensen's effect where low rates of food can affect the species negatively, but high rates of food have no significant positive effect.

PURPOSE: This experiment aims to analyze the effect of food fluctuation on the relationship between dry body weight and length for *Heterandria formosa*, a species of live-bearing fish.

METHODS: To observe the effects, we gathered fish from variable-fed tanks (fluctuating system) and constant-fed tanks and measured each fish's individual length with PictureMeasure. We then lyophilized the fish after freezing to collect the dry body weight.

RESULTS AND CONCLUSION: Findings shown that energy reserves within the body weight do not deplete when these fish experience fluctuations in food. However, negative effects of food fluctuation may be seen elsewhere in variables not directly measured, such as reproduction. The experiment is still ongoing as more data is still being collected throughout the seasons. Among these data are those that have not been analyzed yet, such as metabolic rates, behavior, and body width. Future research should aim to continue collecting data to get a better understanding of the variables not directly measured.

INTRODUCTION

- Food is an essential component to growth and maintenance. When one's food supply or the means to get their food is negatively affected, the results may be seen in their body, physiology, reproduction, etc.
- Low food periods can decrease an organism's performance and high food periods can improve performance, but a negative Jensen's effect occurs when low food periods have a stronger energetic impact than high food periods.
- Low food can reduce reserve body mass and thus reduce weight relative to length, but different organisms have strategies to reduce or tolerate this mass loss.

Figure 1: Trout Pond

Figure 2: Wacissa River

Heterandria formosa are model organisms to examine this relationship to examine the effects of food fluctuation. In Tallahassee, they have been extensively studied at two populations: Wacissa River and Trout Pond. At Wacissa River, the population density is higher with low predation. At Trout Pond, the population density is much lower with higher predation. The fish from these populations were cross-bred and used for this experiment.

METHODS

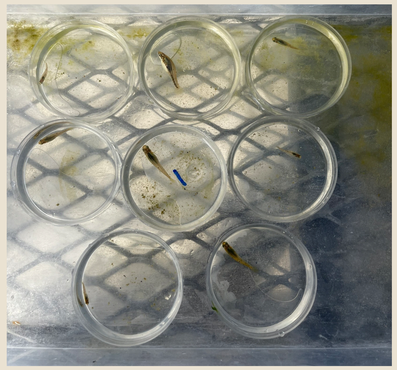
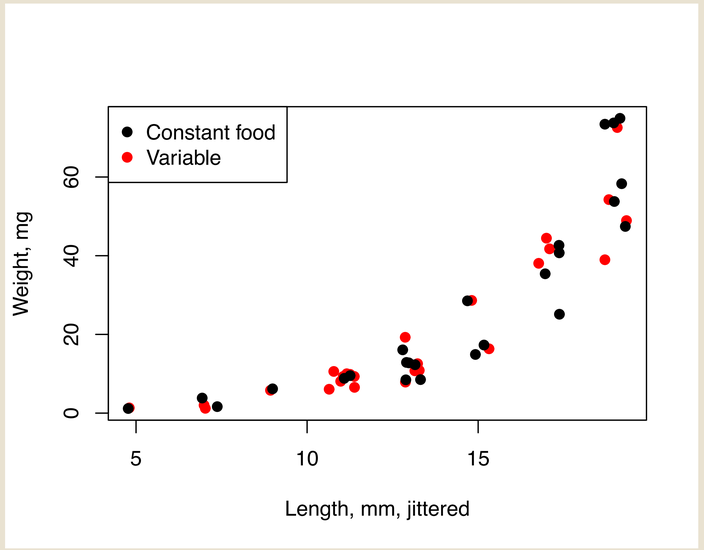


Figure 3: Fish from variable-fed and constant-fed tanks were each put in a petri dish to measure their length using the "PictureMeasure" app

Figure 4: Fish were then frozen, placed in tubes based on their length range and tank, and placed in the lyophilizer to obtain their dry weight

RESULTS



Graph: Heterandria formosa relationship between weight and length when put under fluctuating and consistent food conditions. A Chi-square test of deviance on a log-link Gamma-likelihood model with weight ~ log(length) and food showed a p-value for effect of the Variable food factor of 0.49 (not a significant negative effect)

CONCLUSION

These findings suggest that *Heterandria formosa* do not deplete energy reserves when they experience fluctuations of food. However, the effects of it may be seen elsewhere, such as reproduction and physiology.

Figure 5: Male (top) and female (bottom) Heterandria fish. Photo from Florida Museum by Zachary Randall

- The fish may reduce the rate at which they use up energy, and instead choose not to reproduce to continue to perform and survive.
- A previous study (Felmy et al., 2021) have shown that fish from the high population density site, Wacissa River (WR), survive significantly better under fluctuating or low food conditions than the population with low density fish (Trout Pond).
- Food levels are low from competition at WR, so they have evolutionarily adapted to survive. Such effects may be seen from these results, as these fish have WR ancestry and may carry these adaptations.

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