Observations on the reproductive biology of the darter fish *Etheostoma kennicotti* in response to gill parasite infections

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Introduction

The Fecundity Compensation hypothesis holds that nutrient theft due to parasitism can significantly affect ovum mass, clutch size, or both [1]. Heins suggests this compensation may have evolved as a non-immunological defense mechanism allowing the host organism to shift vital nutrients away from potentially costly immune defense toward reproduction. The effects of the *Aethycteron* sp. gill parasites on the reproduction of *Etheostoma kennicotti* was examined over the course of a year; however, for the purpose of this poster months of February through June will be the primary focus which includes peak reproductive months. Determining the impact of parasitism on *Etheostoma kennicotti's* reproductive capabilities can offer a glimpse into the life history and the ecological challenges facing this otherwise poorly studied species.

Figure 1 Etheostoma kennicotti Image provided by North American Native Fishes Association

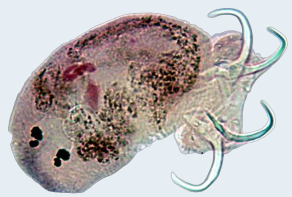

Figure 2 Undescribed Aethycteron sp.

Methods

Monthly collections for *Etheostoma kennicotti* were done from February to June 2017 at Estill Fork in Jackson County, Alabama. Each fish was euthanized and stored separately in 10% phosphate-buffered formalin. Specimens of 25 mm length or greater were weighed prior to extraction of their gonads. The gonadosomatic index (GSI) was found by dividing the gonadal weight of each fish by their somatic weight and used to identify peak reproductive periods (**Figure 5**). Extracted gonads were cleaned of connective tissue and photographed. The oocytes were counted, sized, and typed based on their maturity level: latent, maturing, and mature ripening. From here, clutch count was determined by the number of maturing and mature ripening oocytes (**Figure 7**). To determine parasitic activity, the gills were first extracted from the sexually mature specimens and were counted through the usage of an Olympus SZX7 stereo microscope. The prevalence of parasitic infection was calculated by finding the total number of specimens that carried at least one parasite and then dividing that value by the total number of sexually mature fish (**Figure 8**). Mean intensity of parasitic infection was found by averaging the parasite load of each monthly host population (**Figure 6**).

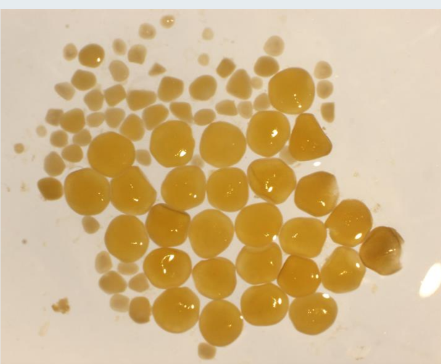

Figure 3 Latent, maturing, and mature oocytes collected in March Image provided by Corinne Peacher

Figure 4 Mature ripening oocytes collected in April Image provided by Corinne Peacher

Results

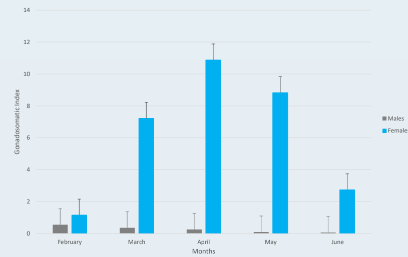

Figure 5: Gonadosomatic Index

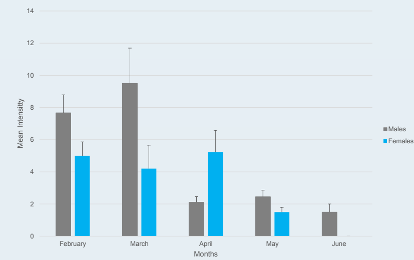

Figure 6: Mean Intensity of Infection

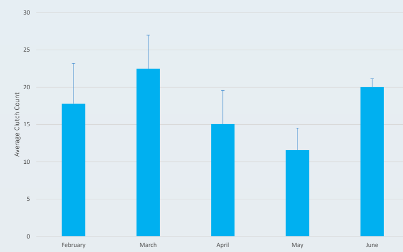

Figure 7: Average Clutch Count

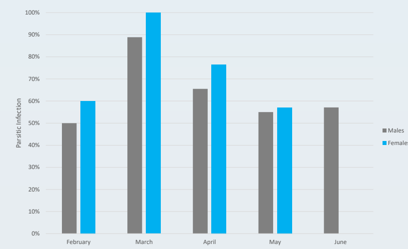

Figure 8: Prevalence of Parasitic Infection

Discussion

The relationship between Etheostoma kennicotti and Aethycteron sp. creates a line of research that can provide evidence supporting the Fecundity Compensation hypothesis. Aethycteron sp. have been shown to be temperature dependent, with parasite populations peaking in March when water temperatures ranged from 14°C to 20°C [3]. This dependence is reflected in Figures 6, 7, and 8. Parasitic intensity and clutch count both increase during the months of March and April, the peak reproductive months of E. kennicotti (Figure 5). This observation is consistent with the Fecundity Compensation hypothesis in that the greater the number of parasites a fish hosts the greater number of smaller oocytes they produce in response to the infection. Though prevalence of infection peaks in March, the intensity of the infection is highest in April when the oocytes are nearing full maturation and are at their largest size. This would seem at odds with the hypothesis, but this remains an ongoing experiment as data is still being collected and interpreted.

References

[1] Heins, David C. (2012) "Fecundity Compensation in the Three-Spined Stickleback Gasterosteus Aculeatus Infected by the Diphyllobothriidean Cestode Schistocephalus Solidus," Biological Journal of the Linnean Society 106, no. 4: 807–19.
[2] Million, Kara M., Crissy L. Tarver, Sean Hipe, and Bruce W. Stallsmith.
(2017). "Does Infection by the Monogenean Gill Parasite Aethycteron Moorei Affect Reproductive Ecology of the Darter Etheostoma Flabellare in Mill Creek, Tennessee?" Copeia
105 (1): 75–81. doi:10.1643/CE-16-403.
[3] Olsen OW. (1968). "Types of monogenic Trematodes," in Animal Parasites: Their Life Cycles and Ecology. 199. Mineola (NY): Courier Dover Publications.

Acknowledgements

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