Does *Helobdella stagnalis* cross foster?

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Abstract

Does *Helobdella stagnalis*, a leech species that provides parental care, take care of progeny that are not their own? It has been shown that *H. stagnalis* parents and offspring do not recognize each other when separated in the lab. We then wanted to investigate whether these leeches cross-foster adopted offspring. We hypothesize that without recognition adults will provide parental care to any offspring. We collected 35 leeches with and without broods from Montezuma Well, AZ, and set up groups with four different treatments to test the hypothesis. The treatments were (Treatment 1) a control of just a parent and its own offspring; (Treatment 2) an adult that had half its offspring replaced with half of another's; (Treatment 3) an adult with its entire brood removed and replaced by another; (Treatment 4) an adult that had no offspring of its own, but was placed with another's offspring. The results showed that this species does cross-foster.

Introduction

Parental care in leeches is a behavior shown in many species in leeches. We investigated mechanisms of parental care in one species of leech found in Montezuma Well in Rim Rock, Arizona. Montezuma Well is a large natural well that discharges about 1,100 gallons of water per minute into the Beaver Creek. The water stays between 19-24 degrees Celsius with high levels of arsenic (Blinn 2008). Our study species *Helobdella stagnalis* performs parental care by laying eggs in cocoons on their ventral side. When the eggs hatch, the offspring attach to the parent which provides for the growing offspring (Kutschera & Wirtz 2001). Once matured, the offspring detach from their parent. Beresic-Perrins (2010) showed that when the offspring were detached prematurely from their parent, the offspring and parent do not recognize each other, however the offspring will seek out and try to reattach to their parent or any near-by adult. With these results, the next step in investigating the parental behaviors was to determine whether these leeches are able to cross-foster. We hypothesize that these leeches are able to cross-foster. To test this hypothesis, we devised 4 treatments to apply to each family group (see fig. 1) Treatment 1 is a control group consisting of a parent and its own offspring. Treatment 2 is a parent with half its own offspring and half the offspring of another leech. Treatment 3 is a parent with all unrelated offspring. Treatment 4 is a non-brooding adult with all unrelated offspring.

Basic Research

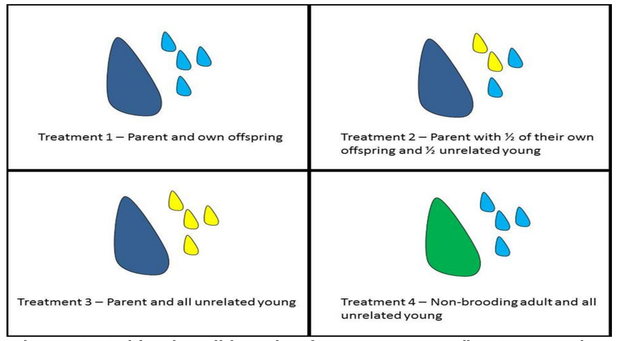

Figure 1: Table describing the four treatments (by R. Beresic-Perrins).

Methods

We collected 30 *Helobdella stagnalis* leeches from Montezuma Well in January and February 2012. We collected 20 non-brooding adults and 10 brood carrying adults that had at least two offspring attached. We kept the leeches in laboratory conditions, where we kept each family and adult individually in specimen cups using source water. We kept them in conditions mimicking Montezuma Well, 12:12 light cycle and 21 degrees Celsius temperature. After resting the leeches for 24 hours after collection, we assigned the families randomly to one of the four treatments. For Treatment 2, we dyed half the progeny blue using a 0.1% solution of Methylene Blue to minimize mixing up of the adopted and their own progeny. Once the leeches were set up into their treatments, they were observed daily for 20 days. We recorded the number of their own progeny attached and detached, number of not own progeny attached and detached, and number of own and not own progeny dead. They were watered and fed every other day as well. We then compared the results of the four treatments using an Kruskal-Wallis . We then compared the survival of young for Treatment 2 using a t-test. Then we ran a MANOVA to see if there was a difference in offspring survival among the 4 treatments across the 20 days.

Figure 2: A picture showing an overview of Montezuma Well, and the area collected our specimens.

Results

The average proportion of young surviving at 20 days for each treatment was T1: mean+SE = 0.44+0.0.39, N=8; T2: mean+SE = 0.66+0.37, N=14; T3: mean+SE = 0.78+0.33, N=10; and T4: mean+SE = 0.49+0.41, N=7 (Fig. 3). There was no significant difference in offspring survival across all 4 treatments (KW[3, 0.05] = 4.25, p > 0.05). There was no difference in survivorship between the parent and foster broods for T2 (W[1, 0.05] = 0.36, p > 0.05) (Fig. 4) There were no multivariate differences between all four treatments over time (F[3, 0.05] = 0..56, p=0.64. (Fig.5).

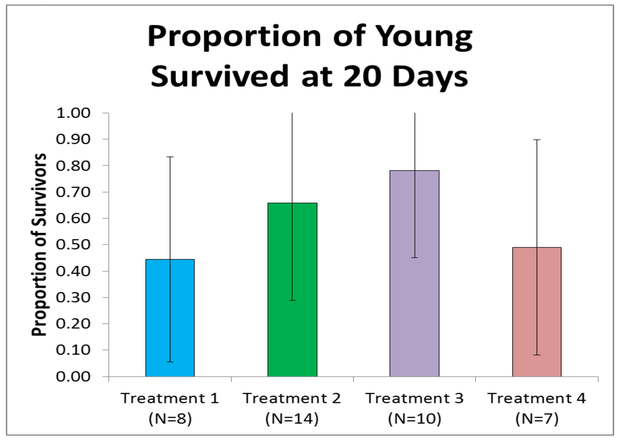

Figure 3: Graph of survival of young amongst treatments

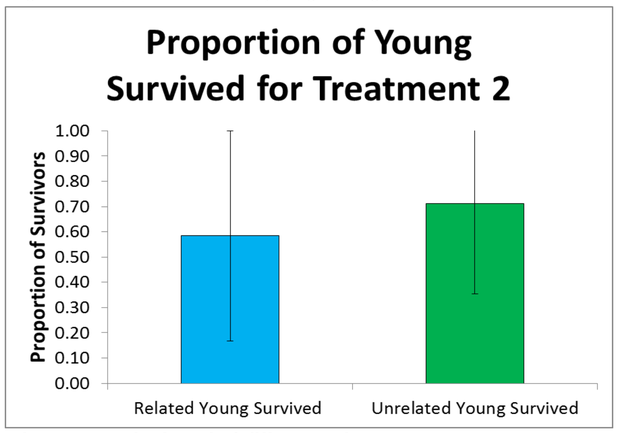

Figure 4: Graph of survival differences in Treatment 2.

References

Beresic-Perrins, R.K., 2010. NAU Thesis, submitted

Blinn, D.W. 2008. The extreme environment, trophic structure, and ecosystem dynamics of a large, fishless desert spring: Montezuma Well, Arizona. In Stevens, L.E. and V.J. Meretsky, editors. Every last drop: ecology and conservation of aridlands springs in North America. University of Arizona Press, Tucson, in press.

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Discussion

Our results were all not significant, there was no difference in the number of young surviving between the four treatments and no difference in the care of their own and adopted young in Treatment 2. We did notice that there was a slightly higher survival in offspring in Treatment 3, but we are not sure of the reason this occurred. It may be due to low sample size or there is something occurring that we have not measured. So, without significant differences in data, it is clear that this species does actively cross-foster their progeny. We can now use this information to further investigate the mechanisms and evolution of parental care in this species. Understanding the mechanisms of parental care in invertebrate species allows us to make more informed inferences when describing parental care in humans.

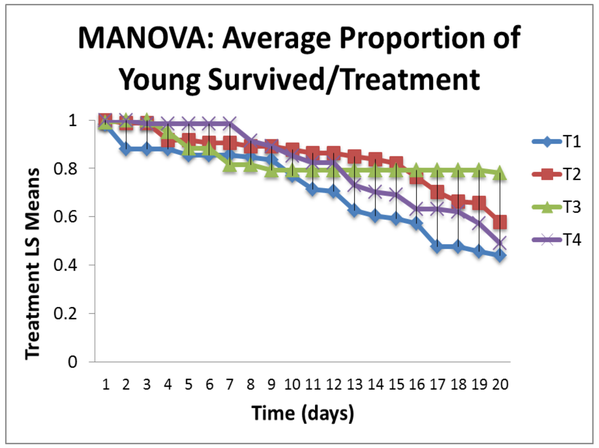

Figure 5: Graph of MANOVA test.

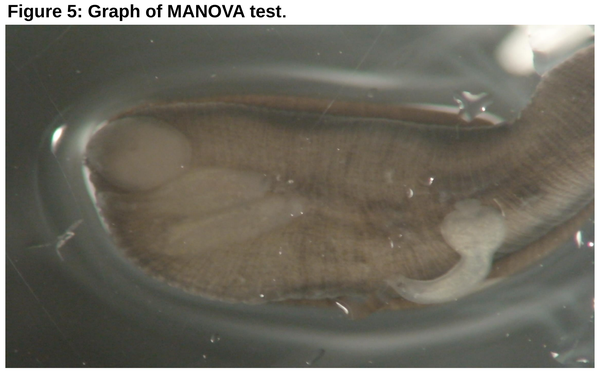

Figure 6: Picture of progeny attached to adults underside.

Acknowledgments

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