

Epidemiological Factors Contributing to the Infection of Parasitic Jellyfish in Oklahoma Paddlefish

Katie L. Easter, Beth Okamura, Ashlie Hartigan, Dr. Mark Paulissen

Department of Natural Sciences, Northeastern State University, Tahlequah, OK 74464



Introduction

- The eggs of Oklahoma's largest game fish (*Polyodon spathula*), called roe, are used as popular substitute for caviar since Oklahoma supports a stable population of Paddlefish.
- Polypodium hydriforme* is a parasitic freshwater jellyfish that infects the oocytes of acipenseriform fishes, like sturgeon and paddlefish, that inhabit the Midwestern river systems of the United States. In the past, Sturgeon have been the prime supplier of commercially sold caviar but overfishing by humans has caused a fast decline in these populations (Boreman, 1977).
- Assessments were used to examine possible connections between parasite and host by comparing characteristics of females whose roe was infected with *P. hydriforme* to characteristics of the uninfected females.
- Data collected on each female included quality of roe, catch location, total roe weight, roe screened weight, roe fat weight, fish weight and length.
- Findings suggest that there were no differences in fish length, fish weight, total roe weight and quality of roe between females with infected and uninfected roe. However, it was determined that roe screened weight was higher in infected individuals and roe fat weight was significantly lower in infected individuals.
- The purpose of this study was to determine, if any, the correlation between characteristics of individuals infected with *P. hydriforme* in Oklahoma paddlefish when compared to non-infected individuals by examining variables such as length (measured eye to fork of tail), weight, roe features, quality of caviar and location the paddlefish were caught.
- This study demonstrates that differences that do occur between infected and uninfected female paddlefish center around roe data. Our results show that roe fat weight is lower in infected females and higher in uninfected females (Figure 2). Further study is needed to determine if parasites in the infected eggs could potentially affect the amount of roe fat produced by the host

- Infected eggs are larger and greyer in color and easily distinguished from non-infected roe. The processing team collected data such as fish length, fish weight, location of catch, quality of roe, roe fat, roe with fat and total weight of roe that would be sold from each female that is processed.
- By analyzing these data, conclusions may be drawn about epidemiological infection factors in Oklahoma paddlefish



Figure 1: *P. hydriforme* emerging from a Paddlefish egg into its free-living medusa form.

- Data Analysis: Welch's T-tests were categorized into fish length (eye to fork of tail in mm), total weight of fish, roe total weight (eggs with membrane and fat), roe fat weight (membrane and fat, no eggs) and screened roe weight (eggs with no membrane or fat) with length recorded in mm and roe fat elements recorded in kg. Each t-test compared data from uninfected individuals to data of 6 infected individuals using these seven variables. Results were conveyed using box and whisker plots with the mean of each data set shown in red. Chi squared tests were used to analyze catch location and quality of roe data, results were reported in tables. Results were considered significant using an alpha of .05.

Results

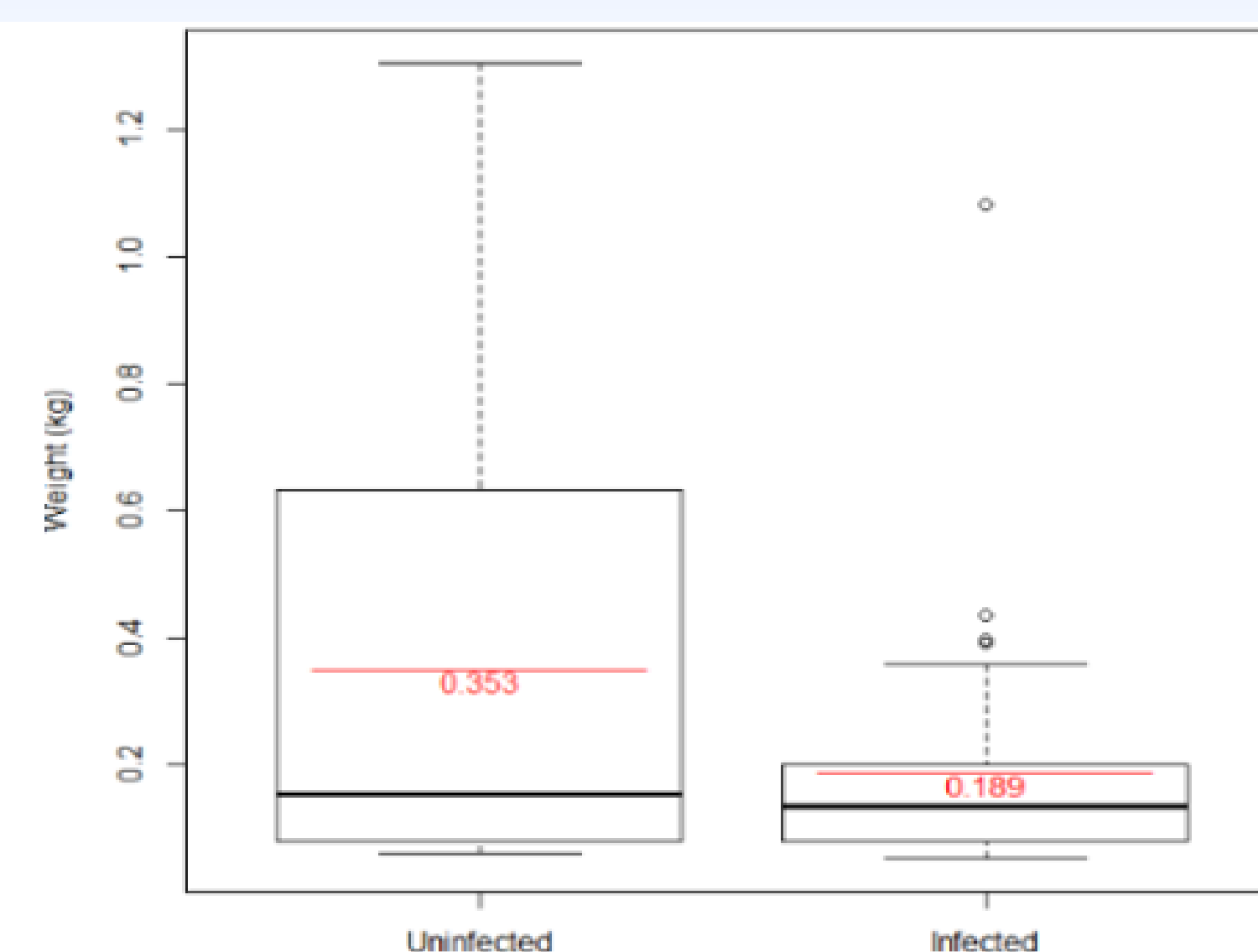


Figure 2: Box and Whisker plot of roe fat weight with red line representing the mean. Roe data showed differences in roe fat weight ($t=2.245$, $df=51.42$, $p=0.029$, Figure 1) where the average of infected individuals was 0.19 kg and 0.36 kg in uninfected individuals.

Results cont'd

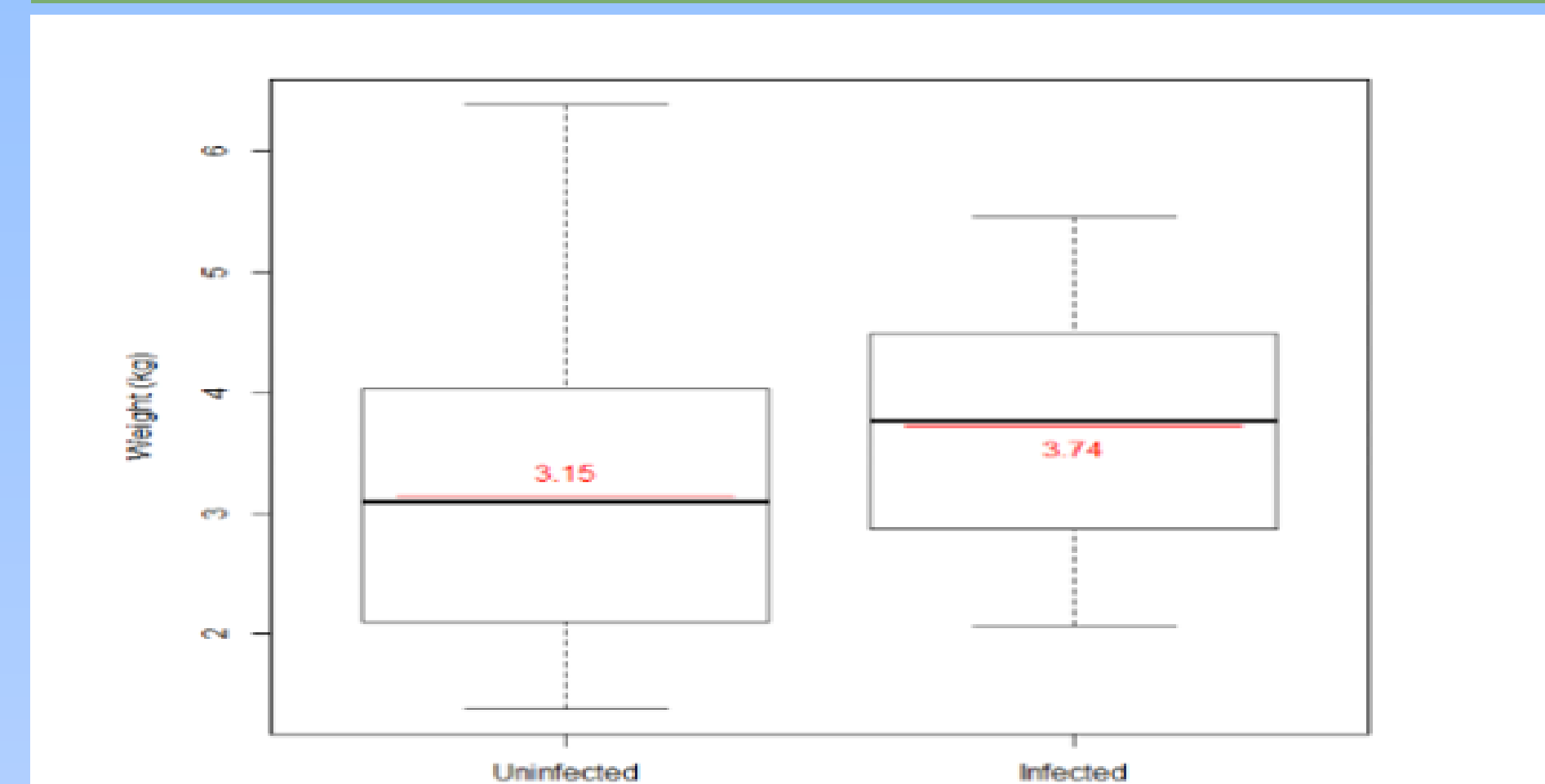


Figure 3: Roe screen weight ($t=2.041$, $df=57.81$, $p=0.0458$, where the average of infected females was 3.73 kg and 3.15 kg in uninfected females

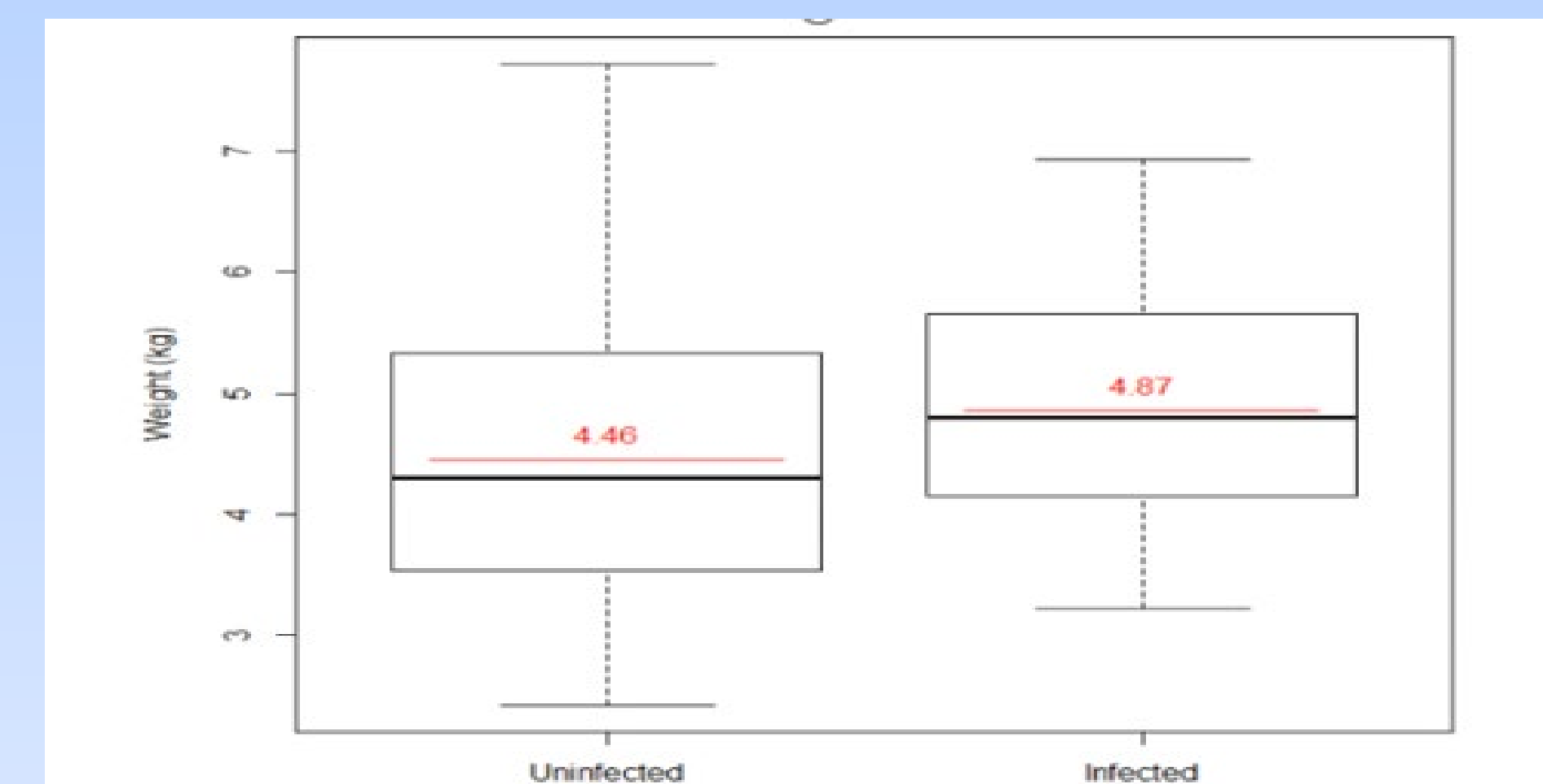


Figure 4: Roe total weight ($t=1.418$, $df=58.29$, $p=0.162$, where the average of infected females was 4.87 kg and 4.46 kg in uninfected females.

Quality and Location Data

Table 1: Chi squared analysis table showing quality of row categorized on a caviar gradient where 4= top shelf quality, 2= light or off color and P= pressed/broken/pate-like, $\chi^2=0.96$, $df=2$ and $p=0.61$.

Caviar Grade:	Light or off color (2)	Top shelf, dark gray (4)	Pressed, Broken, Pate-like eggs (P)	Total
Infected	7	20	1	28
Uninfected	11	19	2	32
Total	18	39	3	60

Table 2: Chi squared analysis table showing catch location of infected and uninfected *Polyodon spathula* females, $\chi^2=10.86$, $df=4$ and $p=0.03$.

Location:	Oologah Lake	Lake Above Gray's	Lake Below Gray's	Neosho River	Miami Park	Total
Infected	5	10	5	8	0	28
Uninfected	5	22	0	5	1	33
Total	10	32	5	13	1	61

Discussion

- Our results show that roe fat weight is lower in infected females and higher in uninfected females (Figure 2). Further study is needed to determine if parasites in the infected eggs could potentially affect the amount of roe fat produced by the host. Differences in roe screened weight were also observed in this study (Figure 3). The roe screened weight in infected individuals was higher than that of uninfected individuals. Further study is needed to determine whether there is a difference in the weight of parasite present eggs and the weight of the parasite absent eggs.
- Total roe weight data suggest that there were no differences between infected and uninfected females (Figure 4). It's possible that since less than 1% of the eggs in each batch are infected, it wouldn't change the total roe weight enough to see a difference (Holloway et al., 2011).
- Results suggest that parasite positive roe does not affect the quality of roe produced and further study is needed to determine the cause perhaps due to the structure of the egg after fertilization (Table 1) (Linhart, 1997). There were no differences between infected and uninfected individuals in fish length and fish weight. This may suggest that the parasite does not affect growth processes of infected females.

Conclusion and Future Work

The Paddlefish Research Center experienced the lowest number of fish processed at the facility in recorded history where there were 1,686 females processed from March to April in 2017 and 539 in 2018. These low numbers are most likely due to abiotic factors that influence spawning activity which may have resulted in sample sizes for this project being much lower than expected (Long et al., 2017). The exact spawning event of Paddlefish is difficult to determine and is heavily reliant on precipitation (O'Keefe et al., 2007). If rain does not occur Paddlefish will spawn in other locations with suboptimal conditions (Miller and Scarnecchia, 2011), perhaps making them less available to anglers.

Acknowledgments

I would like to thank Dr. Mark Paulissen who served as an advisor and mentor on this project. I would like to thank biologists, Jason Schooley of the Paddlefish Research Center for allowing me to use data collected on each fish and Brandon Brown for approving the project to take place at this facility. I would like to thank Wishard Caviar Company for accommodating and assisting me in the caviar room to collect infected eggs.

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Contact

Katie Easter smitheas@nsuok.edu

Methods

- Infection was assessed and eggs were collected from 61 female paddlefish in the caviar room at the Paddlefish Research Center in Miami, Oklahoma from April 7th to April 22, 2018. Out of 61 females, 28 batches of eggs were positive for infection and 33 batches were uninfected.
- Batches of eggs collected from one female at a time were brought into the caviar room and an initial screening would take place using a spatula to carefully examine infection before the eggs were separated from the fat