Deadly Dynamics: Studies of an Invasive Parasite of Waterfowl

Chiedu Okonmah
Rebecca Z. Bachtel
Jennifer A.H. Koop

Follow this and additional works at: https://huskiecommons.lib.niu.edu/studentengagement-honorscapstones

Recommended Citation
Okonmah, Chiedu; Bachtel, Rebecca Z.; and Koop, Jennifer A.H., "Deadly Dynamics: Studies of an Invasive Parasite of Waterfowl" (2021). Honors Capstones. 373.
https://huskiecommons.lib.niu.edu/studentengagement-honorscapstones/373

This Dissertation/Thesis is brought to you for free and open access by the Undergraduate Research & Artistry at Huskie Commons. It has been accepted for inclusion in Honors Capstones by an authorized administrator of Huskie Commons. For more information, please contact jschumacher@niu.edu.
Northern Illinois University

Deadly Dynamics: Studies of an Invasive Parasite of Waterfowl

A Capstone Submitted to the University Honors Program in Partial
Fulfillment of the Requirements of the Baccalaureate Degree With
Honors

Department of Biological Sciences

By: Chiedu Okonmah

DeKalb, Illinois

June 6, 2021
Capstone Title:
Deadly Dynamics: Studies of an Invasive Parasite of Waterfowl

Student Name:
Chiedu Okonmah

Faculty Supervisor:
Dr. Jennifer Koop

Faculty Approval Signature:

Department of:
Biology

Date of Approval:
September 6, 2020

Date and Venue of Presentation:
Recorded Video
Abstract

There are many knowns and unknowns about invasive species and their patterns. The purpose of this research is to investigate variation in invasion history between invasive trematodes, snails, and waterfowl. To do this, snails (*Bithynia tentaculata*) were crushed and analyzed under a microscope to find metacercariae (*Cyathocotyle bushiensis* and *Sphaeridiotrema* spp.), which are the parasites that infect the host. They were counted and added to data showing prevalence, abundance, and intensity. Data from 2018, 2019, and 2020 were compared to each other to check for annual variation in prevalence, abundance, and intensity between the years. Even though the data for 2020 needs to be completed, variation was seen in all factors over the three years. Future work can be done in order to make a connection between infection dynamics and waterfowl mortality rates.
Introduction

There are many systems of life on Earth. One of these systems are invasive species. To be an invasive species, an organism should be from a different ecosystem as well as cause harm to the new environment it has been introduced to. Invasive species can be any living organism such as: plants, fungus, fish, insects, etc. The issues that invasive species can bring can come in different forms. They can cause harm to local environments, the economy, and human health.

Mortality among waterfowl near the upper Mississippi River has increased in part, due to invasive parasitic trematodes (Sandland, 2014). The trematodes Cyathocotyle bushiensis, Sphaeridiotrema globulus, and Sphaeridiotrema pseudoglobulus are the species of parasites that invade the waterfowl and are thought to have been introduced along with their faucet snail hosts (Bithynia tentaculata). Faucet snails are aquatic snails native to European freshwater (Sandland, 2014). They were introduced to the Great Lakes in the late 1800s, and have since moved east to west and into the Upper Mississippi River (Sauer, 2007).

The trematodes spend half their life cycle in waterfowl and the other half in snails. The trematodes start as free-swimming miracidia that infect a snail host by embedding in its body tissues (Bachtel, 2018). Then, miracidia mature into rediae within the snail, which leads to cercariae being released from the rediae and the snail host back into the water. These cercariae swim and infect a second snail host where they mature into metacercariae (Bachtel, 2018). Finally, when infected snail hosts are consumed by waterfowl the metacercariae develop into adult flukes within the intestines of the waterfowl, often resulting in hemorrhaging and death (Bachtel, 2018).

Previous studies have noted annual and seasonal variation in trematode infections that could explain variation in waterfowl mortality (Sauer, 2007). We hypothesize that in Pool 7 of
the Mississippi River, an area of high recent waterfowl mortality, we will see similar variation in annual and seasonal trematode infections. My study will build on an existing dataset of trematode infection dynamics in several pools of the upper Mississippi River and Lake Oneida, in New York. Lake Oneida populations represent a more well-established population of faucet snails and trematodes as compared to the Mississippi River populations. I collected snails from Pool 7 of the Mississippi River and brought them to the laboratory to analyze for parasites. I quantified the number of metacercaria in each snail and combined this data with historical data collected from the same site during different years and seasons.

**Methods**

First, 150 adult snails were collected from Pool 7 of the Mississippi River (GPS point) in June 2020. They were collected from shallow riprap near the shoreline by hand by Dr. Jennifer Koop. The live snails were brought back to the lab within 48 hours of collection. Once in the lab, they were placed in falcon tubes and euthanized by freezing at -20C. Snails were individually taken out of the tube, measured in duplicate from the top of the spire to the operculum using a digital calipers (0.01mm accuracy). After measuring a snail, it was placed into a 10 cm plastic petri dish and crushed using a smaller glass petri dish. Treated water was added to the petri dish, as well. The snail was then examined under a dissecting microscope. While under the microscope, the number of metacercariae were counted and recorded, as well as the species of the parasite, and prevalence. This procedure was repeated for the rest of the snails that were collected from Pool 7 and frozen. This data was added to an existing database created using the same protocols. The database included metacercariae counts from snails collected in Pool 7 in September of 2017-2019.
Results

To start, the data we collected in 2020 was from a small, incomplete sample size. With the data that we did have from 2017-2020, we saw variation in specific areas. First, there was annual variation in prevalence (number of infected snails) for *C. bushiensis*, but when it comes to most of the snails, they were infected by *Sphaeridiotrema* spp. Compared to prevalence, abundance (mean number of metacercaria per snail) also showed annual variation, but it showed in opposite directions based on the species of trematode. Lastly, intensity (mean number of metacercaria per infected snail) showed annual variation as well as being similar to abundance due to high prevalence in both 2018 and 2019.

Discussion and Future Work

From the results shown, annual variation is present in prevalence, abundance, and intensity between 2018 and 2019. Again, there is a sample size for 2020, but it is incomplete. Conclusive results depend on the completion of the sample size from 2020. From completed sample sizes in 2018 and 2019, because variation is seen, there is worth in future investigation for a connection between infection dynamics and waterfowl mortality rates (Sauer, 2007). With future work, there can be more research on variation in infection across greater invasion pathway.
References

