A survey of the acanthocephalan parasites of fish species
Otsego County, NY
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Abstract: The survey documents the diversity of the acanthocephalan parasites in the fish species of Otsego Lake, Cooperstown, New York, and of nearby water bodies of the Biological Field Station (SUNY Oneonta), as well as of Canadarago Lake, Richfield Springs, New York.

INTRODUCTION

Acanthocephala, or thorny-headed worms, are parasites of vertebrates, and are commonly found in species of birds, mammals and fishes (Schmidt and Roberts, 2005). The body of an acanthocephalan consists of a proboscis and a trunk (see Figure 1). The distinguishing feature of acanthocephalans is the proboscis, which is covered with hooks, and can be retracted. The hooked proboscis is used to anchor the worm to the intestinal wall of the vertebrate host. The hooks themselves can damage the host intestine, and can affect overall fish health (Schmidt and Roberts, 2005). In some cases, hooks can actually penetrate through the intestinal wall, leading to perforations, which can be fatal (Schmidt and Roberts, 2005). It is unclear how often this happens in nature.

Most of the acanthocephalan trunk consists of reproductive organs. The sexes are separate, and mating takes place in the vertebrate host intestine. Acanthocephalans are considered pseudocoelomates, i.e., their mesoderm does not line their entire body cavity. Acanthocephala lack a digestive tract. Instead, they absorb nutrients directly from the lumen of the host intestine (Schmidt and Roberts, 2005). Absorption occurs across the tegument of the parasite.

The life cycle of acanthocephalans typically consists of two hosts. The first host, or intermediate host is an arthropod. The life cycle begins when an arthropod intermediate host ingests acanthocephalan eggs from the external environment. Once inside the arthropod host, the acanthocephalan egg develops into a larval stage. The life cycle continues when the intermediate host and its acanthocephalan larvae are ingested by a vertebrate predator, such as a fish. Once ingested by the vertebrate predator, the acanthocephalan larva develops into a sexually mature adult worm. The vertebrate predator is considered a definite host; it is the host in which individual adult acanthocephalans mate and produce eggs. The life cycle is completed once eggs are passed into the outside environment in the feces of the vertebrate host, and are consumed by the intermediate host. Occasionally, additional hosts, known as paratenic hosts, are interjected into the life cycle. This occurs when the arthropod intermediate host is consumed by a vertebrate predator that cannot serve as a definitive host. In such cases the larval acanthocephalan does not

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undergo further development, and encysts within the body of the paratenic host until the appropriate vertebrate predator, or definitive host, consumes the paratenic host.

The goal of this survey was to collect as many species of acanthocephalan parasites as possible from the fishes of Otsego Lake, and the surrounding area, in Cooperstown, New York and Canadarago Lake, Richfield Springs, New York. Other water bodies include the Chain Ponds the Thayer Farm Big Pond, BFS, Springfield, NY, and Moe Pond, Cooperstown, NY. The identification of species of acanthocephalan parasites can provide insights into host specificity, i.e., the number of host species in which a parasite species is found. These data can contribute to our knowledge of the biological diversity of our region.

This fish parasite survey data can also provide information on the health of the ecosystem and its food web. Acanthocephalans, like many other kinds of parasites, move up the food chain during the course of their life cycles. Thus the presence of these worms in their fish definitive hosts indicates that multiple trophic levels are intact within the food web. Although it may seem counterintuitive, the presence of parasites, such as acanthocephalans, in an ecosystem, such as Otsego Lake, is a positive sign of the health of the lake.

METHODS

Fish were collected by hook and line, trap net, gill net, or with a seine in Otsego Lake, the Thayer Farm Big Pond, Moe Pond, Goodyear Lake, and Canadarago Lake. Fish were necropsied immediately after capture, or were kept alive in aquaria in the facilities of the Biological Field Station Upland Interpretive Center and Hop Shed at Springfield, NY until necropsy. Fish were either killed directly by double-pithing, or were anesthetized first by placement in FinQuil and subsequently dissected.

Fish were examined for parasites with the aid of a dissecting microscope. Each section of the digestive system was examined for Acanthocephala (as well as other parasites), as was the body cavity, liver, heart, gills, gonads, fins, eyes, and muscle layer.

Acanthocephalans encountered were either preserved in ethanol, or were fixed in 5% formalin after 24 hours of storage in tap water at 4° Celsius. Whole-mount microscope slides of parasites were prepared by staining worms in Semichon’s acetocarmine, dehydrating in a graded ethanol series, clearing in methyl salicylate, and mounting in Canada Balsam. Acanthocephalans were identified to genus using the taxonomic key by Hoffman (1999), and to species by the taxonomic key provided by Amin (1985).

RESULTS

Sunfishes, including Lepomis gibbosus (Pumpkinseed) and Lepomis macrochirus (Bluegill), and Micropterus salmoides (Largemouth bass) were the most commonly infected hosts. Acanthocephalans were not encountered in the fish examined from the Thayer Farm Big Pond. Acanthocephalan species encountered include Leptorhynchoides thecatus, Neoechinorhyncus rutili and N. cristatus.
Table I summarizes the results of the survey. Two hundred twenty-five individuals of 13 different fish species were examined for parasites (see Table I). Adult acanthocephalans were found in the intestines and/or pyloric cece of the fish, and larval acanthocephalans, or cystacanths, were encysted in the viscera of the body cavity of seven fish species. Of the seven species of fish that were found to host acanthocephalan species, there was a greater prevalence in white sucker, rock bass, and largemouth bass. Prevalence can be defined as the percentage of hosts infected with a parasite species. Three of four white suckers, or 75%, were infected with the acanthocephalan species *Neoechinorhyncus cristatus*. Five of eight rock bass, or 63%, were infected with the acanthocephalan species *Leptorhynchoides thecatus* and/or *Neoechinorhyncus rutili*. Sixteen of thirty-five largemouth bass, or 46%, were infected with the acanthocephalan species *Leptorhynchoides thecatus* and/or *Neoechinorhyncus rutili*.

Table 1. Fish species examined and their acanthocephalan species in water bodies.
DISCUSSION

Each of the species of acanthocephalan we encountered has a complex life cycle. As an example, the life cycle of *Leptorhynchoides thecatus* is as follows: 1. Sexual reproduction in the digestive tract of the definitive fish host, 2. Shedding of eggs through fish feces, 3. Entanglement of eggs in algae, via egg casing filaments, 4. Ingestion of eggs by the amphipod intermediate host, *Hyallela azteca*, 5. Ingestion of amphipods into either the paratenic or definitive host. If ingested by a paratenic host, acanthocephalans will encyst in organs until that host is preyed upon by the definitive host, where they will be freed from the cysts and attach to the digestive tract of the definitive host.

Based on the presence of *Leptorhynchoides thecatus* in Otsego and Canadarago Lakes, we know that each component of this life cycle occurs. Some component of this life cycle must be absent in the Thayer Farm Big Pond, where *L. thecatus* was not found.

Recently at the Thayer Farm Big Pond a search for amphipods, the intermediate host for *L. thecatus*, was conducted; none were collected. Absence of this host, or even low numbers, could account for the lack of *L. thecatus* in this water body.

Future research could include additional searches for the intermediate amphipod host, *H. azteca*, in the Thayer Farm Big Pond. Also, it is worth examining additional fish species for acanthocephalan parasite presence, as well as diversity. Having a greater spectrum of fish species in our study can aid in our knowledge of the different acanthocephalan parasites and the hosts they infect. This could also lead to another study looking at potential seasonality of parasite infections. This study is part of a broader scale, long-term effort, which will contribute to our understanding of the Otsego Lake and of water body ecosystems.

REFERENCES


