

2019 Comprehensive Lake Assessment Contract

Intermediate Lake

Introduction

Freshwater Solutions (FWS) scientists, in collaboration with Dr. Patrick Hanington and his lab at the University of Alberta, just completed a year of great discovery and advancement towards better understanding how to control swimmer's itch. We conducted comprehensive assessment research on many of Michigan's premiere recreational lakes, including Walloon, Charlevoix, Elk/Skegemog, Long, Glen, Leelanau, Lime, and Little Traverse Lake. Additionally, we assessed beautiful White Sand Lake in northern Wisconsin. Those efforts lead to discovery of several additional species of schistosomes that cause swimmer's itch, as well as a new species that has yet to be described. We plan to use this large dataset from 2018 to apply for state and federal money to battle swimmer's itch in Michigan in the coming years.

The 2018 comprehensive assessment data we collected also allowed us to develop an exciting new species-differentiating qPCR assay for doing lake assessments. Not only can we assess how many cercariae are in the water, but now we can also determine what species are involved. That is important to lake associations for deciding how to best distribute funds for control. We are the first in the world to have created this valuable tool and will be using it extensively in 2019.

As you know, quality science gets published in peer-reviewed journals, and publishing is the best indicator for success of a scientist. We strive to publish our work in peer-reviewed journals in a timely fashion. Our most recent publication was "Use of qPCR-Based Cercariometry to Assess Swimmer's Itch in Recreational Lakes" published in *EcoHealth* in August 2018 in an open source format to ensure universal access to all. You can read it here: <https://link.springer.com/article/10.1007%2Fs10393-018-1362-1>

In October 2018, we submitted "Evaluation of targeted copper sulfate (CuSO₄) application for controlling swimmer's itch at a freshwater recreation site in Michigan" to *Parasitology Research*. The paper went out for review, came back with suggestions for minor improvements, and was just accepted for publication. We hope to have citation details by early March.

Our work on developing a schistosome species-specific assay will be reported in yet another paper titled “Species-specific qPCR assays allow for high-resolution population assessment of four species avian schistosome that cause swimmer’s itch in recreational lakes”. This manuscript was submitted to the *International Journal for Parasitology: Parasites and Wildlife* in February 2019. A fourth manuscript describing our discovery of a new schistosome species being shed from *Helisoma* snails in NW Michigan lakes is currently in progress.

Understanding the complete schistosome parasite profile for a lake is an essential first step towards controlling swimmer’s itch. Although one species (*Trichobilharzia stagnicola*) dominates the flatworm community, our recent research documented at least 7 different species of itch-causing parasites cycling in NW Michigan lakes, along with the new species being shed from *Helisoma* snails. More needs to be learned about the spatio-temporal distribution of these parasites and a comprehensive assessment of Intermediate Lake will substantially add to this endeavor.

Conducting a basic assessment under the premise that only *Trichobilharzia stagnicola* cycling through only common mergansers (*Mergus merganser*) and *Stagnicola emarginata* snails may not provide the level of certainty necessary for making responsible control decisions and may actually prove costlier in the long run. Platte Lake (Benzie County) is a prime example. They conducted a basic assessment in 2018, which did not result in definitive answers about the drivers of swimmer’s itch. They are considering spending additional money in 2019 to do a more comprehensive assessment.

A comprehensive assessment will document the diversity (species richness and relative abundance) of both the snail and waterfowl fauna. Fecal samples from dominant waterfowl hosts will be analyzed for schistosome miracidia. All snail species collected will be shed for trematode cercariae. DNA from both schistosome cercariae and miracidia will be barcoded for species identification. Water samples will be analyzed via qPCR using both the general assay (total cercariae) and the newly developed species-specific assay (relative abundance of different species).

Assessment Objectives

Objective 1: Determine the natural history of the parasite(s) causing swimmer's itch on Intermediate Lake.

Strategies and Tactics

- A. Determine the schistosome intermediate host(s).
 - Survey locations where swimmer's itch is a perennial problem to identify the presence of *Stagnicola* sp., *Physa* sp., *Gyraulus* sp. or *Helisoma* snails.
 - Collect hundreds of host snails (if present) and shed them for patent infections.
- B. Determine what parasite species are present and their relative abundance.
 - Preserve pure samples of all schistosome cercariae shed from host snails present, extract their DNA, and sequence the DNA to compare against species housed in GenBank for species identification.
- C. Assess population dynamics (size, age structure, etc.) of all summer resident anatids (ducks, geese, swans).
 - Conduct a boat survey of the entire lake shoreline to record summer resident anatid species, number of birds, and age categories.
- D. Assess relative infection levels and species identification in definitive hosts.
 - Collect avian fecal samples, where possible, and examine for avian schistosomes.
 - Preserve pure samples of all miracidia obtained from examined waterfowl, extract their DNA, and sequence the DNA to compare against species housed in GenBank for species identification.

Objective 2: Determine the level of parasite infestation on Intermediate Lake in order to establish a baseline for future comparison and to obtain a MDNR merganser trap & relocate permit in 2020 if mergansers are implicated and a permit is desired.

Strategies and Tactics

- A. Use qPCR analysis to accurately gauge schistosome cercariae levels in the water.
 - Collect water samples using the FWS established collection protocol at strategic locations (~10-12) around the lake perimeter, extract the DNA, and run qPCR to determine the level of cercariae.
- B. Use snail infection rates to assess schistosome parasite load.
 - See 1A.

Objective 3: Prepare a Letter of Authority documenting all assessment data for submission to the MDNR to obtain a common merganser trap and relocation permit for 2020-22.

Strategies and Tactics

- A. FWS will prepare and supply the ILA with an official Letter of Authority, a document required by the MDNR to apply for a common merganser control permit.
- B. FWS will assist the ILA in preparation of a MDNR application, if desired.

2019 Pricing

Total: \$5,000 (ILA only pays \$2,500 with a \$2,500 MISIP/TOM approved allocation)

The cost is less than similar work completed by FWS in 2018 on other NW Michigan lakes due to fewer sampling sites, fewer sampling dates, preservation and barcoding of only schistosome cercariae, fewer shoreline miles, no inclusion in future NSF funding, no water collection training, and no water collection kit. These additional components could be added at lake association discretion and for additional cost if desired.

It is important to note there is no research involved in this comprehensive assessment. Some have been confusing what FWS did in 2018 (“Comprehensive Assessment *Research* Initiative”) with what is proposed here as a comprehensive assessment (without research). FWS will prepare a Final Report for the ILA in the fall of 2019 documenting all of this work.

Payment Agreement

We will send out invoices with suggested payment in May (20%), July 60%), and in the fall after submission of the final report (20%). The undersigned agree to honor the labor and fiduciary responsibilities as described in this document to the best of their ability. Due to the uncertainties of both biological field research and fundraising, all parties agree to remain flexible and open to modifications with either component as we work together in 2019.

FWS Ron Reimink _____
Date

ILA Steve Young (President) _____
Date