



A Swimmer's Itch “Bridge” Program for the Crystal Lake Watershed Association

Final Report*
September, 2016

*This report was written for the Crystal Lake Watershed Association (CLWA), a non-profit 501 (c) group tasked with protecting and promoting the natural qualities of Crystal Lake and its surrounding watershed.

I. Avian Schistosome Species Assessment

Crystal Lake will be surveyed to determine the presence and relative abundance of all snail species. A subset of those species with a large enough population size to contribute to significant swimmer's itch will be assayed. All cercariae types released from the snails, both schistosome and non-schistosome, will be preserved and sent away for species identification via DNA analysis.

A complete, whole-lake snail survey was conducted on 7 July 2016. The only snail species known to harbor itch-causing parasites that we found in large enough numbers to assay was *Stagnicola emarginata*. All cercarial types observed (6) upon examination of 10,212 *S. emarginata* snails were preserved in 100% ethanol and shipped to the University of Alberta (Dr. Patrick Hanington) for DNA analysis and species identification. Additionally, tissue samples from all snail species (5) were preserved and shipped for analysis and species identification.

Additionally, at least two complete bird surveys will be conducted along the entire shoreline to assess waterfowl population size and diversity. Fecal samples from hatch-year birds (assuredly born and raised on the lake) will be collected later in the summer when parasite eggs may be present. Eggs will be filtered from the fecal matter and identified to species, if possible. Both eggs and hatched miracidia will be preserved and sent away for identification via DNA analysis.

Two (2) complete waterfowl surveys were conducted, 17 June and 10 August. Variations between surveys can exist for several reasons: (a) crèche formation, (b) natural and/or human-induced mortality, (c) immigration/emigration, and (d) survey error (birds were not easily observable). Crystal Lake has noticeably lower numbers of summer resident waterfowl than other Michigan Swimmer's Itch Partnership (MSIP) lakes of comparable size we surveyed in 2016. We found only 2 mallard broods, 4-5 Canada geese broods, and 5 common merganser broods.

Eighteen (18) fecal samples from hatch-year birds of all three waterfowl species were collected on 10 August and analyzed for miracidia (larvae) of avian schistosomes. Both mallard broods were sampled. Two (2) of the 5 samples were positive. It should be noted, however, both infections were very light (1 miracidium found in each sample after extensive searching). Given the paucity of mallards on Crystal Lake and the very low level of infection, we don't consider this observation to be alarming or cause for further action.

Seven (7) hatch-year common mergansers were sampled and all but one harbored schistosome parasites. Several of the infections were alarmingly heavy, so it is quite easy to imagine how just a few common merganser ducklings can seed thousands of snails over miles of shoreline in a given summer. We are confident the common merganser is the primary carrier for the parasites causing swimmer's itch on Crystal Lake.

Hatched miracidia from the common merganser samples were preserved and shipped to Dr. Hanington's lab for DNA analysis and species identification. Unfortunately, there were not enough miracidia from the positive mallard samples for DNA analysis.

Results from both cercariae (from snails) and egg/miracidia (from waterfowl) species analysis should provide an accurate assessment of the schistosome species causing swimmer's itch on Crystal Lake.

We expect results from both cercariae and miracidia DNA analyses used for schistosome species identification to be completed by October/November. Those data, once received and reviewed, will be sent as an addendum to this report.

II. Initial Education and Outreach Activities

SICON scientists will provide the following components of riparian education in 2016:

- 1. Formal presentation at the CLWA annual meeting (date pending)*
- 2. Presentations at key fundraising events identified by the CLWA board (pending SICON availability)*
- 3. Personalized answers to riparian questions via the contact link on SICON's website (swimmersitchcontrol.com)*
- 4. Periodic social media updates via SICON's website*
- 5. Dedicated page for CLWA on SICON's website*
- 6. Written, end-of-season report to CLWA*

We attended the CLWA Annual Meeting held on Saturday, July 23 2016 and gave a 30-minute presentation followed by a short question and answer session. A mini-display was set up prior to the meeting to generate riparian interest and included live representative snails from Crystal Lake, live schistosome cercariae viewed under a microscope, and two poster displays highlighting our current research, education, and control efforts in Michigan.

We have been working closely with the Michigan Swimmer's Itch Partnership (MSIP) to encourage state legislators to allocate public funds to battle swimmer's itch. Governor Snyder recently signed Michigan's new state budget that includes \$250,000 earmarked for swimmer's itch control in 2017. Funds will be distributed to the Leelanau Institute for Applied Science (LIAS) in October. The MSIP will work closely with the LIAS to distribute those state funds to MSIP member lakes for their swimmer's itch control efforts. We also gave an educational presentation and answered questions at the 24 August MSIP meeting held at the Leelanau Center for Education.

Our new website at www.swimmersitchcontrol.com has provided another avenue for riparians to learn more about swimmer's itch, get answers to their personal questions, and report swimmer's itch cases on Crystal Lake and other MSIP member lakes. We now have a presence on Facebook, LinkedIn and Twitter to broaden our outreach. There is a page dedicated to the CLWA. We have received and answered queries from Crystal Lake riparians regarding our current work for the CLWA.

III. Whole-Lake Snail Infection Rate Assessment

Approximately 200 host snails from each of 10 sites will be collected between mid-June and mid-August a minimum of 5 times. Sites will be selected with help from CLWA representatives. Collected snails will be isolated and checked for patent schistosome infections via microscopy. All parasite infections, including non-schistosomes, will be documented and identified to species (where possible) in order to provide a complete suite of biological diagnostics for the CLWA.

We worked with CLWA representatives to identify 10 key sites for snail collections. Five (5) whole lake collections occurred on 29 June, 8 July, 20 July, 2 August, and 5 August. A total of 10,212 *Stagnicola emarginata* snails were collected and individually analyzed over the study period.

A total of 6 different cercariae types were observed. Representatives of each type were preserved in ethanol and sent to the University of Alberta for DNA analysis and species identification. We expect results by October/November. Those data, once received and reviewed, will be sent as an addendum to this report.

The overall, lake-wide snail infection rate for itch-causing schistosomes was 0.79%, with a range of 0.10% (Orchard Hill-R9) to 1.67% (7 Pines Resort-A5). Although snail infection rate may be used as a viable metric for parasite load *at the same site* from week to week or year to year, snail densities must also be considered for accurate comparison *between sites* or for *comparing to sites on other lakes*. For that reason we measured snail densities at all 10 collection sites on 7 July. We found *S. emarginata* densities (snails/m²) ranging from 0.2 (Yacht Club-A3) to 26.9 (M6 Hotspot-M6). We multiplied the infection rate by the density at each site to determine what we call the swimmer's itch Severity Index (SI). That resulted in a range of 0.08 (Yacht Club-A3) to 19.99 (Onkeonwe Rd-J11). The Severity Index is a more accurate metric for comparison between all 10 sites on a Crystal Lake and for comparison with similar sites on other MSIP member lakes.

SI Severity Index (% Infected x Density)			
Site:	Schisto Infection %	Stag density (per square meter)	SI Severity Index
Beulah Beach (Q13)	0.65	7.6	4.93
Orchard Hill (R9)	0.10	4.5	0.43
Nichols Rd (O7)	0.27	11.9	3.27
M6 Hotspot (M6)	0.72	26.9	19.48
Yacht Club (A3)	0.38	0.2	0.08
7 Pines Resort (A5)	1.67	8.8	14.72
CBCA (G7)	0.56	2.9	1.62
Onkeonwe Rd (J11)	1.53	13.1	19.99
CSA (A6)	1.00	3.2	3.20
River Point (L11)	0.92	2.4	2.22

Snail infection rate is currently the best diagnostic metric for assessing various swimmer's itch control measures. SICON continues to collaborate with other scientists from the U.S. and Canada attempting to find alternative, less costly methods. Sampling the water to quantify cercariae via qPCR holds promise and will be actively studied by SICON scientists in 2016.

Each snail collection we made at each site was accompanied by water sampling. Twenty-five (25) 1L water samples were passed through a 20µm mesh plankton tow and the resultant 50ml sample preserved in 100% ethanol. All 182 samples from 5 different MSIP member lakes have been sent to the University of Alberta (Dr. Patrick Hanington) for qPCR analysis and cercarial count determination. In collaboration with Dr. Hanington's lab, we hope to correlate our snail infection rates (whole-lake and site-specific) with the cercarial counts to determine if less expensive water sampling can replace the more costly snail infection rate analysis as a quantitative metric of parasite load.

IV. Research Coordination

During the bridge program of 2016, SICON will provide consultation and coordination for any on-going research on Crystal Lake. The bridge program provides a valuable opportunity to collect baseline data without instituting any type of control measure. SICON's preference would be that no merganser control measures be used in 2016, including spring/fall harassment, manipulation of merganser nest trees, and targeted fall hunting. It would be appreciated if the CLWA would begin to encourage member riparians to not shoot at, chase, or harass mergansers, which will make them easier to catch and relocate in 2017.

We began planning to scientifically assess snail raking by the CLWA. However, we didn't realize that Dr. Thomas Raffel (Oakland University) was coordinating and conducting a similar study on Crystal Lake in 2016. Out of professional courtesy, we terminated those plans for the 2016 season.

We have some interesting data from our work on Higgins Lake regarding the value of a spring harassment program and encourage the CLWA to evaluate our study on Higgins Lake before continuing with merganser harassment. On Higgins Lake, Lyon Township (approximately 1/3 of the lake perimeter) did not allow spring harassment in 2015 or 2016 while Gerrish Township (approximately 2/3 of the lake perimeter) conducted robust harassment and depredation activities during both years. The spring activities in Gerrish Township did not reduce the snail infection rates in 2016 nor did they reduce the number of merganser broods in 2016.

It would also be important to notify SICON should any shoreline group apply copper sulfate in an attempt to kill snails. We assume regular communication between SICON and CLWA representatives will occur throughout the summer season so that all activities relating to swimmer's itch will be coordinated.

We had regular contact with Ted Fisher (Crystal Lake Swimmer's Itch Partnership Chair) and Joel Buzzell (CLWA President) as well as others throughout the summer and enjoyed open and frequent communications.