



A Swimmer's Itch Control Program for Crystal Lake

Annual Report

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by

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*This report was written for the Crystal Lake & Watershed Association (CLWA), a non-profit 501 (c) (3) group of concerned citizens committed to protecting the beauty and water quality of Crystal Lake and its surrounding environment. The CLWA engages in monitoring, education, and advocacy on behalf of the broad community for whom Crystal Lake is a vital economic, recreational, and aesthetic resource.

----- *SPECIALIZING IN EDUCATION AND CONTROL* -----

Executive Summary

Two summers ago, SICON, LLC conducted a complete avian schistosome species assessment on Crystal Lake that included collecting over 10,000 snails from 10 different locations and 2 complete lake-wide bird surveys. In 2016, the overall lake-wide schistosome infection level in *Stagnicola emarginata* snails was 0.79% (for comparison purposes, values < 0.25% are ideal and values > 2.0% are considered epidemic on other lakes). Five common merganser broods (61 ducklings total) were observed on Crystal Lake in 2016.

In February of 2017, Swimmer's Itch Solutions, LLC reached an agreement with the Crystal Lake & Watershed Association (CLWA) to begin a science-based program to help control swimmer's itch on Crystal Lake. Using methods that have worked successfully in the past (on Glen Lake, MI and on Great Pond Lake, ME), we developed a program for the CLWA with the following components: 1) the removal of common merganser broods, 2) an assessment of parasitic loads in breeding common merganser hens, 3) a presentation at the CLWA annual meeting, and 4) a comprehensive final written report. Two noteworthy items regarding our 2017 swimmer's itch control program for Crystal Lake are:

1. At our request, the common merganser spring harassment program using pyrotechnics was suspended for 2017 so that we could trap common merganser broods more efficiently,
2. Scientific assessment of our program (e.g., snail infection levels or qPCR studies) was postponed until the summer of 2018 at the earliest. Given the biology of avian schistosome's lifecycles, the control benefits of trapping and relocating common mergansers don't become apparent until the second year of the program.

In early spring, Swimmer's Itch Solutions, LLC secured all necessary federal and state permits to conduct this program.

With the help of a Crystal Lake riparian, we found and confirmed 1 active common merganser nesting site.

During June and July, we trapped and removed all 14 common merganser broods (126 birds in total) that appeared on Crystal Lake. Another 12 common merganser adults (including 4 actively breeding hens) were lethally taken under our scientific collecting permit. Collectively, we removed a total of 138 common mergansers from Crystal Lake in 2017.

We share 3 key observations from 2017 and make 3 specific recommendations for 2018.

Key observations

1. Using trapping/relocation and lethal take, we removed 138 common mergansers from Crystal Lake in 2017.
2. Swimmer's itch was a prevalent and persistent problem on Crystal Lake in 2017.
3. Many riparians don't have accurate information about swimmer's itch. Educational and outreach activities must be an essential part of any effective swimmer's itch control program.

Specific recommendations

1. Consider reinstating a modified spring common merganser pyrotechnics harassment/control program.
2. Strongly consider funding some form of scientific assessment of swimmer's itch levels on Crystal Lake.
3. Continue to coordinate the CLWA's swimmer's itch control efforts with the Michigan Swimmer's Itch Partnership (MISIP).

Introduction

Swimmer's itch, also known as schistosome cercarial dermatitis, is a common problem in many recreational lakes throughout the northern United States and the world. It can be caused by any of over 70 different avian schistosome parasite species that mistakenly penetrate human skin instead of the skin of their natural definitive host. When this happens, the parasite dies at the site of penetration causing an inflammation of the skin and the formation of a papule. Swimmer's itch papules can itch intensely for up to 10 days.

Brief review of avian schistosome life cycles

All avian schistosome species have a similar two-host life cycle. As adults they live within a definitive host, most commonly a duck; when sexually mature the worms release their eggs, which make their way into the feces of their host. If these feces land in water, eggs of the parasite hatch into larval stages (miracidia), which are infective to an appropriate species of snail (the intermediate host). Upon finding a suitable snail, the miracidium will penetrate the soft tissue and develop within its digestive glands. Over the next 30 days it matures and then produces thousands of cercariae that are released into the water every day, especially during the warm-water summer months. If the cercaria locates the correct vertebrate host species, it penetrates and develops into an adult worm to complete its life cycle.

In many northern Michigan lakes, severe outbreaks of swimmer's itch have predominantly and most commonly been attributed to the avian schistosome, *Trichobilharzia stagnicola*. This parasite species typically utilizes the common merganser (*Mergus merganser*) as its definitive host and *Stagnicola emarginata* as its intermediate (snail) host.

Off-season Preparation/Research and Development

Summary of work completed: All necessary federal and state permits (US Fish & Wildlife, US Geological Survey, and Michigan DNR) were obtained for work on Crystal Lake (Benzie County, MI).

We have been working closely with the Crystal Lake & Watershed Association (CLWA) and the Michigan Swimmer's Itch Partnership (MISIP) to encourage the Michigan Department of Natural Resources to restructure the permitting process for swimmer's itch control programs that rely on trapping and relocating common merganser broods. On February 8, 2017, we accompanied representatives of the CLWA and MISIP to a full-day workshop in Cadillac, MI with the representatives from the MI-DNR. We also attended a follow-up workshop on July 10, 2017 in Roscommon, MI. Although the details need to be finalized, the MI-DNR will begin granting common merganser trap/relocation permits to lake associations in 2018. This will allow lake associations the ability to solicit bids from multiple duck trap/relocation contractors, helping to keep control program costs affordable.

Swimmer's Itch Solutions, LLC continues to work with the MISIP, which is composed of representatives of 24 lake associations in Michigan dedicated to fighting swimmer's itch. We were also under contract with the Higgins Lake Swimmer's Itch Organization during the summer of 2017, and provided technical and other support to the MISIP including sharing control and research results with member lake associations. We continue to work with leading experts in the field of swimmer's itch.

Control Program

Locating common merganser nest sites (Included in our control program at our expense)

Accompanying files: 051217EnteringNest0652pm.mov
051417LeavingNest0439pm.mov
COMENestwithEgg.jpg

Summary of work completed: Breeding common mergansers begin to pair up immediately after ice-out. When nest prospecting and nesting, common mergansers exhibit persistent and stereotypic behaviors. Although it takes hours of careful observations, often very early in the morning, these behaviors can lead to the discovery of nesting sites. Observant lakefront property owners can also be on the lookout for common mergansers flying into and out of trees. One Crystal Lake riparian (Sue Brown) called to our attention a tree cavity regularly frequented by common merganser hens. We set up video surveillance equipment to record activity around the tree cavity. Using a modified-borescope apparatus that we designed, we were able to obtain video footage that confirmed that the cavity was an active common merganser nest. We are happy to assist any property owners who wish to seal or remove any active or candidate common merganser nests before next year's breeding season begins.

Assessment of parasite loads in breeding common merganser hens

Accompanying files: CrystalLakeMap.pdf
CrystalLakeBirdRemoval2017.pdf

Summary of work completed: For several weeks after ice-out, common merganser populations on Crystal Lake include both resident birds (i.e., individuals that will spend the summer on the lake) and non-resident birds (i.e., individuals that stay a few days on the lake while they are still migrating north), with the latter usually outnumbering the former. This trend steadily declines until late-May when all the breeding males leave the lake and only the resident population remains.

The indiscriminate lethal take of common mergansers is not an effective method of reducing the number of broods on a lake (and therefore the number of swimmer's itch parasites cycling in a lake). In contrast, limited and targeted lethal take of common mergansers for scientific purposes, if done wisely and judiciously, can provide an added benefit to a swimmer's itch control program and add to the growing body of swimmer's itch scientific knowledge. Because hens return annually to lakes where they have successfully reared young, eliminating a breeding common merganser female would have the effect of reducing one brood annually for several years, or at least until her nesting site is discovered by another female.

During the prime egg laying and egg incubation periods, we permanently removed 8 common merganser hens under the authority of our scientific collecting permit. Necropsies of these individuals revealed a wide range of avian schistosome infection (3 birds were heavily infected, 1 bird had a medium-level infection, 2 birds were lightly infected, 1 bird was uninfected, and 1 bird was not examined). The ovaries of 4 of the hens contained eggs, at various stages of development, indicating that they were actively breeding on Crystal Lake. Unlike breeding hens that are trapped and relocated with their brood, these four hens will not be returning to breed on Crystal Lake in future years.

Four additional common mergansers (2 males and 2 immatures) were necropsied to determine their avian schistosome loads. Both males were lightly infected, while both immature birds harbored medium infections.

Removal of common merganser broods**Accompanying file:** CrystalLakeBroodTrapRelocation2017.pdf

Summary of work completed: From June 6 until July 19 we observed 14 common merganser broods (consisting of 126 individual birds) on Crystal Lake. All 14 broods were successfully trapped (Figure 1), usually within 2 weeks of their appearing on the lake, and safely relocated to a designate location on Lake Michigan or Lake Huron as described and permitted by Barb Avers (Michigan DNR).

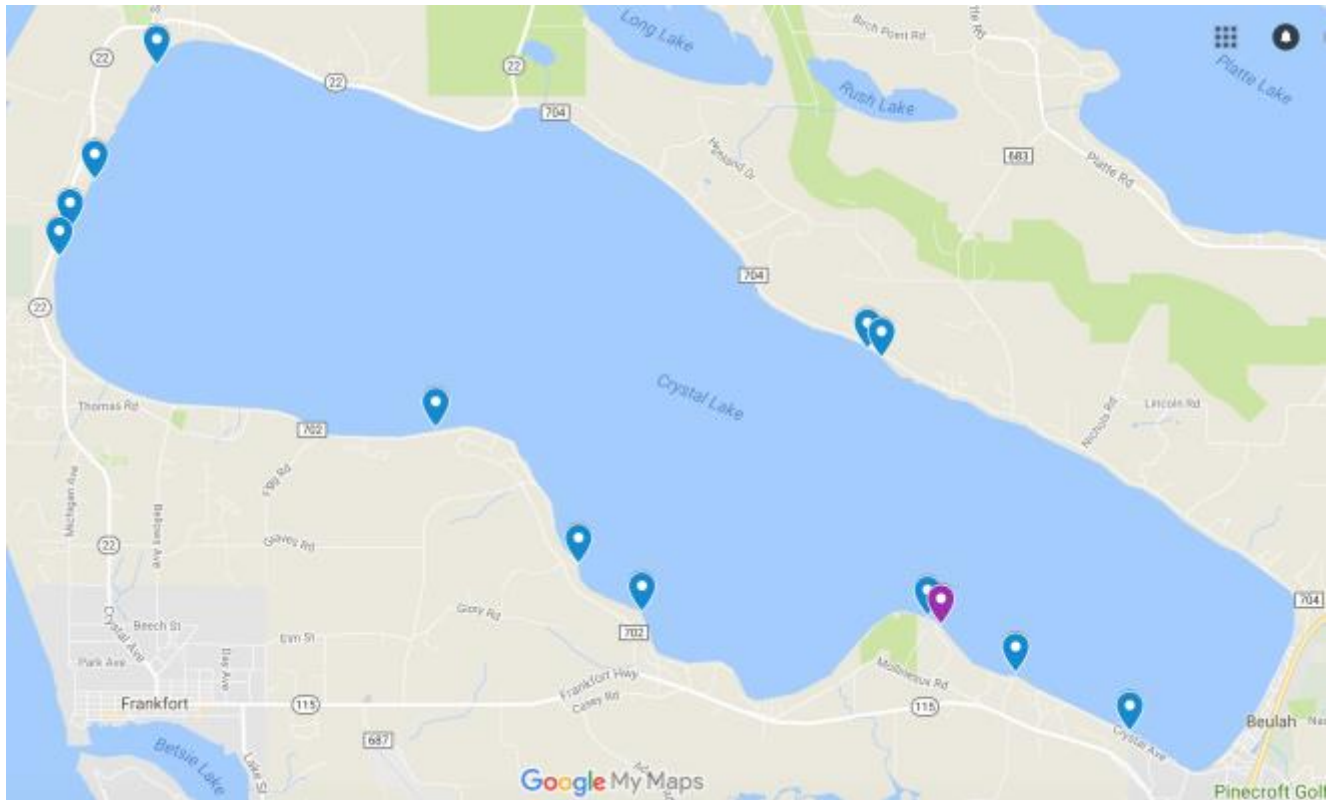


Figure 1. Locations on Crystal Lake (Benzie County, MI) where common merganser broods were trapped in 2017. Each balloon represents a distinct trapping site (blue = 1 brood tapped; purple = 2 broods trapped).

An additional survey was conducted on July 19 to ensure that no broods were present on the lake.

Observation: *Using trap/relocation and lethal take, we removed 138 common mergansers from Crystal Lake in 2017.*

Educational Activities/Outreach Program

Accompanying files: CLWAYear1Update1.pdf
 CLWA2017July22PPT.pdf
 ScientificAmericanSIArticle.pdf

Summary of work completed: On our website (www.swimmersitchsolutions.com) we maintained pages solely dedicated to swimmer's itch education, research, and control on Crystal Lake. These pages serve as a centralized repository to report swimmer's itch cases and common merganser nest sites and broods. They also provide important information that facilitates our efforts in providing the most successful comprehensive swimmer's itch control program possible.

Cases of swimmer's itch were reported at 34 different locations on Crystal Lake in 2017 (Figure 2). We chose to report distinct locations instead of individual cases because it avoids the duplication of data that arises with multiple reports by the same individual or in the same location.



Figure 2. Locations of swimmer's itch cases on Crystal Lake (Benzie County, MI) that were reported on www.swimmersitchsolutions.com/crystallake from June 1 - August 31, 2017. Each red balloon represents a distinct location for a swimmer's itch case report.

Observation: *Swimmer's itch was a prevalent and persistent problem on Crystal Lake in 2017.*

In May, an article on swimmer's itch in northern Michigan lakes was published on Scientific American

website. The article was very positive and complimentary of Swimmer's Itch Solutions, LLC's efforts to significantly reduce the occurrence of swimmer's itch on Crystal Lake.

Update reports were written upon request from the CLWA board and a comprehensive, informative presentation was given at the 2017 CLWA annual meeting.

Observation: *Many riparians don't have accurate information about swimmer's itch. Educational and outreach activities must be an essential part of any effective swimmer's itch control program.*

Recommendation for 2018

We have many reasons to be hopeful that an effective and long-term swimmer's itch control program on Crystal Lake is both possible and probable. We made great strides this spring and summer in educating a large number of riparians on the complexity of the swimmer's itch problem, while giving them a realistic hope for a viable solution. We removed every common merganser brood that appeared on Crystal Lake prior to July 31, the key for a successful control program that will begin showing dividends next summer. We have new and exciting research ideas that will make our future swimmer's itch control efforts even more effective. Because we worked closely with many members of the CLWA board, we are positioned to offer recommendations to ensure the CLWA meets or exceeds its goals for swimmer's itch reduction on Crystal Lake.

Recommendation #1: *Consider reinstating a modified spring common merganser pyrotechnics harassment/control program.*

Rationale: For the past few years CLWA has been helping coordinate a volunteer spring harassment program. At our request that program was suspended for 2017 to make our trapping of common merganser broods more efficient. The number of common merganser broods on Crystal Lake almost tripled from 5 last year to 14 this year. Additionally, lethal take most likely prevented another 4 broods from appearing on the lake. It is certainly possible that a thorough and dedicated lake-wide spring pyrotechnics program discourages common mergansers from breeding on Crystal Lake. We would like to work with the CLWA in 2018 to design a spring harassment program that scientifically tests that hypothesis.

Recommendation #2: *Strongly consider funding some form of scientific assessment of swimmer's itch levels on Crystal Lake.*

Rationale: Snails infected with avian schistosome parasites shed cercariae, and it is this larval form that penetrates human skin causing swimmer's itch. Common mergansers harbor the adult worms, which produce a different larval stage that is infective to the appropriate species of snail. Therefore, if the lifecycle of the parasites that cause swimmer's itch is interrupted by relocating common mergansers, the control benefits of doing so don't usually appear until the following spring and summer (when there are fewer snails infected). To adequately assess the benefits of our 2017 control program, some metric (e.g., snail infection levels or *qPCR*) should be applied in 2018. The metric doesn't have to be as involved as what was conducted in 2016, but the data from 2016 provides a wonderful baseline for comparison purposes.

Recommendation #3: *Continue to coordinate the CLWA's swimmer's itch control efforts with the Michigan Swimmer's Itch Partnership (MISIP).*

Rationale: Swimmer's itch is a serious health problem with significant economic consequences that extend well beyond the Crystal Lake shoreline and the geographic boundaries of Benzie County. In late 2014, 13 lake associations throughout Michigan formed the MISIP. The partnership's goals include sharing information about various swimmer's itch control programs on member lakes, educating the public about the problem of swimmer's itch, funding research programs, and supporting individual lakes in their science-based swimmer's itch control programs. The Partnership is committed to working collaboratively with the State to follow through on an aggressive strategy for protecting one of our most precious resources – our lakes. The MISIP also believes that continued work and research can lead to new ways to further control swimmer's itch.