



# A Comprehensive Swimmer's Itch Control Program for Higgins Lake

Annual Report for Year 3\*

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by

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\*This report was written for the Higgins Lake Swimmer's Itch Organization (HLSIO), a non-profit 501 (c) (3) group tasked with managing and funding a comprehensive swimmer's itch control program on Higgins Lake.

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

## Executive Summary

Three short years ago, swimmer's itch was rampant on Higgins Lake. In January of 2015, SICON (Swimmer's Itch Control), LLC\* reached an agreement with the Higgins Lake Swimmer's Itch Organization (HLSIO) to conduct a three-year science-based program to significantly reduce swimmer's itch in Higgins Lake. This effort is part of a multi-lake pilot program that was designed to show that Dr. Harvey Blankespoor's successful swimmer's itch control programs in the 1990s (on Glen Lake, MI and Great Pond Lake, ME) could be replicated.

The work completed in 2017 represents Year 3 of our comprehensive, science-based swimmer's itch control program on Higgins Lake. The program included the following components: 1) locating possible common merganser nesting sites, 2) reducing the number of common merganser broods appearing on the lake by selectively choosing breeding common merganser hens for use in a scientific study, 3) conducting 8 extensive lake-wide bird surveys to further assess the effectiveness of Gerrish Township's spring harassment program, 4) trapping and relocating all common merganser broods that appeared on the lake, 5) an objective assessment metric (i.e., snail infection percentages), and 6) an educational/outreach component that included a mid-summer progress report, a presentation at the Higgins Lake Property Owners Association annual meeting, and interviews with local and national media outlets.

During the common merganser breeding season (April-May), we identified several candidate nesting sites, and witnessed common merganser hens flying into and out of cavities in four different trees. Video images of these four cavity interiors were captured, but we were unable to document the presence of any common merganser eggs. However, we were able to document the presence of common merganser eggs in 2 nest boxes on Treasure Island (Gerrish Township).

Throughout June and into July, Swimmer's Itch Solutions, LLC trapped and removed all 4 common merganser broods (56 birds in total) that appeared on Higgins Lake. Three of the 4 broods were captured in Gerrish Township. Five common merganser hens (4 of which were actively breeding) were lethally taken under our scientific collecting permit. Thus, we removed a total of 61 common mergansers from Higgins Lake in 2017. Those birds, combined with the 145 common mergansers that were trapped and relocated or lethally removed in the first two years of our control program, represent a 3-year total of 206 common mergansers removed from Higgins Lake by our team. Particularly noteworthy is the fact that all 206 of those birds were removed from the lake after the Gerrish Township program of harassment and lethal take had been completed in each spring.

In the summer of 2015, extensive analyses of over 10,000 swimmer's itch-carrying snails (*Stagnicola emarginata*) established a baseline lake-wide avian schistosome infection level of 3.01%. Similar analyses in 2016 revealed a summer lake-wide infection level of 0.28%. By August of this year, the lake-wide avian schistosome snail infection level on Higgins Lake was less than 0.05%. **Our three-year comprehensive swimmer's itch control program reduced the snail infection level on Higgins Lake by over 98%.**

We share 2 summary conclusions for 2017 and make 1 specific recommendation.

### Summary conclusions

1. Swimmer's Itch Solutions, LLC's 3-year comprehensive swimmer's itch control program has been extremely effective at reducing the number and severity of swimmer's itch cases on Higgins Lake.
2. Gerrish Township's harassment and lethal take program was not effective in reducing the number of nesting common mergansers on Higgins Lake or in reducing the infection level of snails that cause swimmer's itch.

### Specific recommendation

Organize a fall common merganser harassment/hunting program to test whether fall migrants are more heavily infected with avian schistosomes than spring migrants.

\*SICON, LLC was reconstituted as Swimmer's Itch Solutions, LLC. after the departure/retirement of Mr. Ron Reimink.

## 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, a 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 a 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 end-of-the-year summary reports required for the continuation of our federal (US Fish & Wildlife; US Geological Survey) and state (Michigan DNR) permits were completed and filed by December 31, 2016.

We have been working closely with the Higgins Lake Property Owner's Association (HLPOA), the Higgins Lake Swimmer's Itch Organization (HLSIO), and the Michigan Swimmer's Itch Partnership (MISIP) to encourage the Michigan Department of Natural Resources (MI-DNR) 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 HLPOA 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 still 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 contractors, helping to keep control program costs affordable.

Swimmer's Itch Solutions, LLC continued to work with the MISIP, which is currently composed of representatives of 24 lake associations in Michigan dedicated to fighting swimmer's itch. We were also under contract with the Crystal Lake & Watershed Association during the summer of 2017, and provided technical and other support for the MISIP including sharing its 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**

**Accompanying files:** HigginsLakeMap.pdf  
HigginsLakeCandidateCOMENestingSites.pdf  
HigginsLakeBirdSurveys2017.xlsx  
HigginsLakeNestboxes.pdf

**Summary of work completed:** Our work in 2015 revealed that only two avian schistosome species were cycling on Higgins Lake, both of which utilize the common merganser as their definitive host (Canada geese and mallards are not carrying the swimmer's itch parasites on Higgins Lake). For this reason, we focused our bird research and control program on common mergansers.

Breeding common mergansers begin to pair up immediately after ice-out. When nest prospecting and nesting, the pairs 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. We identified three areas (2 in Lyon Township and 1 in Gerrish Township), each with multiple candidate nest sites, and on four different occasions observed common mergansers flying into tree cavities. Using a modified-borescope apparatus that we designed, we were able to obtain video footage of the bottom of these four cavities. Although we were unable to confirm any of them as viable common merganser nests for 2017 (i.e., we couldn't find any evidence of eggs), we believe the cavities are prime candidates for future common merganser nests especially given the fact that hens are known to spend a year of more prospecting for suitable nesting sites.

Using the borescope, we were able to document that two nest boxes on Treasure Island each contained an active common merganser nest.

We are happy to provide photographs and GPS coordinates of the candidate nests that we identified, and are willing to assist property owners in any efforts to seal or remove the cavities.

### **Assessment of parasite loads in breeding common merganser hens**

**Accompanying file:** HigginsLakeBirdRemoval2017.pdf

**Summary of work completed:** For several weeks after ice-out, common merganser populations on Higgins 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. Eight complete lake bird surveys, conducted from April 18 to May 30, support these data.

Last year, after the migrating common mergansers flew north, we observed a daily average of 11 resident common mergansers on Higgins Lake for the two-week period from May 15-May 31. This

year, the daily average was 6 individuals over that same two-week period. These results are consistent with our claim that common mergansers ducklings trapped here and relocated to Lake Huron do not return to Higgins Lake the following year.

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 period (i.e., May 1 to June 15), we permanently removed five common merganser hens under the authority of our scientific collecting permit. Necropsies of these individuals revealed a wide range of avian schistosome infections (1 bird was heavily infected, 1 bird had a medium-level infection, 2 birds were lightly infected, and 1 bird was uninfected). The ovaries of four of the five hens contained eggs, at various stages of development, indicating that they were actively breeding on Higgins Lake this spring. Unlike breeding hens that are trapped and relocated with their brood, these five hens will not be returning to breed on Higgins Lake in future years.

#### **Removal of common merganser broods**

**Accompanying file:** HigginsLakeBroodTrapRelocation2017.pdf

**Summary of work completed:** From June 5 until July 6 we observed 3 common merganser broods on Higgins Lake. One of the broods was extremely large (i.e., 37 ducklings) and was the result of crèching behavior, or brood amalgamation, which commonly occurs in common mergansers. Although a clutch that large typically represents the joining of the 2-4 broods, we conservatively counted the group of 37 ducklings as only 2 broods. All 55 ducklings were removed, usually within a week of their appearance on Higgins lake, and relocated to a designated location on Lake Huron as described and permitted by Barb Avers (Michigan DNR). One brood (hen + 7 ducklings) was captured in Lyon Township (quadrant A4) and the other three broods (48 ducklings total) were captured in Gerrish Township (quadrants J10, P12, and P19). Captured hens were fitted with a USFWS leg band, and small uniquely-numbered web tags were placed on all captured ducklings. These web tags will provide a way for us to determine if any of the relocated ducklings return to Higgins Lake to breed in future years.

Additional bird surveys were routinely conducted until the end of July to ensure that no more broods were present on the lake. We continued to note significantly fewer numbers of resident common merganser adults on Higgins Lake compared to 2015 and 2016. This was not unexpected, and again, is consistent with our claim that common mergansers ducklings trapped here and relocated to Lake Huron do not return to Higgins Lake the following year.

**Observation:** *Using either trap/relocation or lethal take, 61 common mergansers were removed from Higgins Lake in 2017*

### Assessment of Snail Infection Level

**Accompanying files:** HigginsLakeSnailSites.pdf  
 HigginsLakeSnailCollections2017.pdf

**Summary of work completed:** In the first year of our control program, 10 snail collection sites were strategically chosen around Higgins Lake to give the greatest possible lake-wide coverage (see HigginsLakeSnailSites.pdf). Given that 2015’s avian schistosome species assessment identified *Trichobilharzia stagnicola* as the dominant swimmer’s itch causing species on Higgins Lake, only *Stagnicola emarginata* snails, its intermediate host, were examined this summer. At four different times, from mid-June to late July, a minimum of 150 snails were collected from each of the 10 sites and individually shed for avian schistosomes (Table 1). Collectively, these data provide an annual assessment of the avian schistosome infection level on Higgins Lake.

Table 1. Snail Infection Levels on Higgins Lake in 2017. The percentage of *Stagnicola emarginata* snails infected with swimmer’s itch at ten different locations and at 4 different times during the summer. The number in parenthesis indicates the total number of snails examined. Color of cell indicates infection level (■ = Ideal (<0.24%), ■ = Tolerable (0.25-0.49%), ■ = Moderate (0.5-0.9%), ■ = Severe (1.0-1.9%), ■ = Epidemic (>2.0%))\*

Location	June 13	June 28	July 10-11	July 25
Dragonfly House	0.0% (200)	0.0% (244)	0.0% (222)	0.0% (150)
Detroit Point	0.0% (200)	0.0% (171)	0.47% (214)	0.0% (250)
Yacht Club	0.0% (200)	0.0% (232)	0.0% (196)	0.0% (190)
Sam-O-Set Park	0.0% (200)	0.0% (212)	0.0% (202)	0.0% (161)
West Boat Launch	0.0% (200)	0.0% (220)	0.48% (210)	0.48% (208)
North State Park	0.0% (200)	0.0% (218)	0.0% (225)	0.0% (234)
Gerrish Township Park	0.0% (200)	0.0% (212)	0.40% (253)	0.0% (200)
Kelly Beach	0.0% (200)	0.0% (206)	0.0% (208)	0.0% (200)
Almeda Beach	0.0% (200)	0.0% (208)	0.0% (216)	0.0% (221)
South State Park	0.0% (200)	0.0% (197)	0.0% (239)	0.0% (239)
Lake-wide	0.0% (2000)	0.0% (2120)	0.14% (2185)	0.05% (2053)

\*While these various levels and categories (ideal, tolerable, moderate, severe, epidemic) might seem arbitrary, they are based on decades of professional experience working on swimmer’s itch on numerous lakes in the USA.

Because of the variability associated with sample sizes less than 200 snails, the most meaningful and relevant data are the lake-wide infection levels. In the summer of 2015 the lake-wide avian

schistosome infection level was 3.01% (the baseline metric). As a point of reference, the lake-wide snail infection prevalence on Glen Lake (Leelanau County, MI) when swimmer's itch cases were at their worse was a little over 2.0%. In the second year of the program (2016), a similar analysis on Higgins Lake revealed an infection level of 0.28%. By August of this year, the summer lake-wide snail infection level on Higgins Lake was less than 0.05% (we examined 8358 snails and found only 4 that harbored an avian schistosome infection). Our three-year comprehensive swimmer's itch control program reduced the snail infection level on Higgins Lake by over 98%. As is evident from Table 1, most of the snail infection levels at the ten collection sites on Higgins Lake fell within the ideal range for the entire sampling period.

**Observation:** *From a snail infection level perspective, swimmer's itch is at an ideal level on Higgins Lake in 2017. At present, there is no known control program or technology that can eliminate or eradicate swimmer's itch from a lake.*

### Educational Activities/Outreach Program

**Accompanying files:** HLSIOYear3Update1.pdf  
HLPOA2017July15PPT.pdf  
ScientificAmericanSIArticle.pdf

**Summary of work completed:** On our website ([www.swimmersitchsolutions.com](http://www.swimmersitchsolutions.com)) we maintained pages solely dedicated to swimmer's itch education, research, and control on Higgins 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.

There were only three swimmer's itch cases on Higgins Lake reported on our website in 2017 (Figure 1).



Figure 1. Locations of swimmer's itch cases on Higgins Lake (Roscommon, MI) that were reported on [www.swimmersitchsolutions.com/higginslake](http://www.swimmersitchsolutions.com/higginslake) from June 1 - August 31, 2017. Each red balloon represents a distinct location for a swimmer's itch case report.

In May, an article on swimmer's itch in northern Michigan lakes was published on Scientific American's 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 Higgins Lake. Additionally, Cheryl Holladay interviewed our team and wrote an article that appeared in the *The Resorter*.

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

**Observation:** *Misinformation about swimmer's itch abounds. Educational and outreach activities must be an essential part of any effective lake-wide swimmer's itch control program.*

## A Review of Last Year's Recommendations

In last year's annual report we presented the following 5 specific recommendations for 2017 and future years:

1. Transition into a less costly Comprehensive Swimmer's Itch Control Maintenance Program, which focuses on merganser brood removal and decreases the amount of time Swimmer's Itch Solutions, LLC is committed to conduct research and assessment activities on Higgins Lake.

**Status: Achieved.** Working together, Swimmer's Itch Solutions, LLC and the HLSIO were able to reach agreement on a control program for Higgins Lake for 2017 that was 40% of the annual cost of SICON, LLC's control programs in 2015 and 2016.

2. Remove all known common merganser nesting sites, including the nest boxes that were erected on Higgins Lake by Gerrish Township to attract breeding females.

**Status: Partially achieved.** Most of the nest boxes erected on Higgins Lake in 2016 by Gerrish Township were removed, but the two remaining nest boxes on Treasure Island both housed common merganser broods in 2017.

3. Remove or permanently seal the two confirmed common merganser nesting sites and all candidate nesting sites that we found in 2016.

**Status: Partially achieved.** One of the confirmed natural nest sites that we discovered in 2016 remains and it was used in 2017. The land owner does not want the nest covered or destroyed.

4. Retime the spring merganser harassment program to late summer/early fall to test whether it can help reduce merganser hours on the lake at a time of year when snails are more susceptible to avian schistosome infection.

**Status: Not achieved.** Gerrish Township insisted on maintaining its own swimmer's itch control program for 2017. However, we were told that they did not use any lethal take in 2017.

5. Transfer the responsibility for swimmer's itch research on further improving swimmer's itch control programs, lake infection assessment metrics, preventive lotions, and other swimmer's itch projects to the Michigan Swimmer's Itch Partnership (MISIP).

**Status: Achieved.** The HLPOA and HLSIO were the driving forces behind the formation of the MISIP and it was the coordination of those groups that played an essential role in convincing the Michigan Legislature to once again approve a very sizable appropriation (\$250,000) in next year's state budget to address the problem swimmer's itch is becoming in Michigan.



## Two Summary Conclusions

**Conclusion #1:** *Swimmer's Itch Solutions, LLC's comprehensive swimmer's itch control program has been extremely effective at reducing the number and severity of swimmer's itch cases on Higgins Lake.*

Over the past three years we have removed 206 common mergansers (including 19 broods) from Higgins Lake and reduced the lake-wide avian schistosome snail infection level in *Stagnicola emarginata* by 98% (from 3.01% in 2015 to 0.05% in 2017). Combined with the anecdotal evidence that shows a dramatic reduction in both the number and severity of swimmer's itch cases on Higgins Lake over the past 3 years, these results replicate those from our comprehensive swimmer's itch control program conducted successfully on Glen Lake in the 1990s. A key component of our program focuses on preventing common merganser broods from spending the entire summer on a lake. It's the flightless ducklings, with their very high individual parasite infection levels (most likely due to immature immune systems), that are primarily responsible for increasing the number of swimmer's itch causing parasites to cycle in a lake.

**Conclusion #2:** *Gerrish Township's harassment and lethal take program was not effective in reducing the number of nesting common mergansers on Higgins Lake or in reducing the infection level of snails that cause swimmer's itch.*

Not only have spring harassment programs been proven ineffective on other northern Michigan lakes (e.g., Glen Lake and Crystal Lake), but Gerrish Township's combined program of harassment and lethal take did not prevent common mergansers from nesting and rearing broods on Higgins Lake. Despite all of Gerrish Township's efforts, 19 common merganser broods (188 ducklings total) still appeared on the lake over the past three summers. Those ducklings are more than enough to seed the entire lake with hundreds of thousands of avian schistosome eggs and keep snail infection levels, and more importantly swimmer's itch cases, at epidemic levels. While the Gerrish Township program did reduce the spring population of common mergansers by 50 adults, detailed necropsies of the birds lethally taken under their permit showed half were males, most were non-resident birds, and nearly all were either not infected with the swimmer's itch parasite or only lightly infected.

Finally, if the Gerrish Township program had not been conducted at all, the adult mergansers they harassed and shot in early spring would not have meaningfully contributed to increasing the lake-wide snail infection level. Snail susceptibility to avian schistosome infection is very low in cold water, and most common mergansers leave the lake by mid-May once the breeding season is over. Finally, Swimmer's Itch Solutions, LLC would still have removed all of the broods from Higgins Lake before they reached the critical age (i.e., 4-6 weeks old) when they could start contributing to snail infection levels.

## A Specific Recommendation

**Recommendation:** *Organize a fall common merganser harassment/hunting program to test whether fall migrants are more heavily infected with avian schistosomes than spring migrants.*

**Rationale:** Over the last 3 years we've collected necropsy data that show most common mergansers on Higgins Lake are either uninfected or only lightly infected with avian schistosomes during the spring. However, a similar necropsy analysis of common merganser during the fall season has never been undertaken. Given that ducklings, on average, are ten times more heavily infected than adult birds in the summer, and that ducklings represent a significant percentage of the annual fall migrating population (unlike in the spring), one would expect the average avian schistosome load in fall migrants might be significantly higher compared to birds in the spring. Knowing if this indeed is true would increase the value and importance of investing resources in a fall common merganser harassment program. A fall harassment program would also have the added benefits of 1) helping reduce merganser hours on a lake when warmer water temperatures (compared to the spring season) make it more likely that avian schistosomes find and infect *S. emarginata* snails, and 2) having little or no adverse impact on our spring nest locating and summer trap and relocation program.