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A Comprehensive Swimmer's Itch Control Program for Higgins Lake

Annual Report*

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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.

Executive Summary

In January of 2015, SICON (Swimmer's Itch Control), LLC reached agreement with the Higgins Lake Swimmer's Itch Organization to conduct a three year science-based program to control swimmer's itch on Higgins Lake. Using methods which have worked successfully in the past (Glen Lake, MI and Great Pond Lake, ME), we developed a program for Higgins Lake with the following components: 1) a thorough avian schistosome species assessment (i.e., an intensive bird and snail screening), 2) an objective assessment metric (i.e., pre-program snail infection percentages), 3) locating and eliminating common merganser nesting sites to prevent fledging success, and 4) trapping and relocating any common merganser broods that appeared on the lake. In early spring we secured all necessary federal and state permits to conduct this program.

Prior to the start of our program, Gerrish Township initiated their own swimmer's itch control program, consisting of harassing and shooting adult common mergansers and erecting nesting boxes to attract egg-laying hens. The Gerrish Township program began April 8 and concluded on May 20. Twenty-three lethal-taken birds were surrendered to us for analyses, as required by their permits. At most, only 8 of these birds could have produced broods on Higgins Lake in 2015 (2 were red-breasted mergansers, 6 were males, and 7 were non-reproductive females).

We conducted a thorough Higgins Lake bird survey on May 21, one day after the Gerrish Township program was completed. At that time we identified 24 adult common mergansers and 3 red-breasted mergansers present on Higgins Lake. We also observed 4 common mergansers and 1 red-breasted merganser that were wounded and unable to fly.

Throughout June and July we trapped and removed all 9 common merganser broods (88 birds in total) that appeared on Higgins. Another 9 common merganser adults were lethally taken under our scientific collecting permit. Thus, we removed a total of 97 common mergansers from Higgins Lake after the Gerrish Township program had been completed. Unfortunately, we were unable to locate common merganser nesting sites because the birds' characteristic flight patterns that we use to find nesting sites were disrupted by the Gerrish Township program.

Over the 15 weeks we spent working on Higgins Lake we collected over 20,000 snails and completed 10 extensive bird surveys. We share 5 key observations/conclusions and make 4 recommendations:

Observations/Conclusions

1. There are two species causing swimmer's itch on Higgins Lake. Both are carried by common mergansers.
2. With a lake-wide snail infection prevalence = 3.1%, swimmer's itch is at epidemic levels.
3. Spring harassment/depredation activities significantly hindered our work and effectiveness.
4. We successfully removed 97 common mergansers from Higgins Lake this summer.
5. Effective swimmer's itch control programs should include both a research component and an educational/outreach component.

Recommendations

1. Convince all outside agencies, including individual riparians, to suspend (or work in coordination with SICON) their perceived control activities so that the efficacy of the SICON program can improve.
2. Coordinate the efforts of the HLSIO with the Michigan Swimmer's Itch Partnership (MSIP)
3. Centralize the work on Higgins Lake, and possibly other lakes in the MSIP, by creating one comprehensive website.
4. Institute a late summer/early fall merganser harassment/control program.

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 near 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 parasites 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 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 one unique corresponding 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 second larval stages (cercariae), which are released into the water every day during the 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 Michigan lakes, severe outbreaks of swimmer's itch have predominantly and most commonly been attributed to the avian schistosome, *Trichobilharzia stagnicola*. This parasite species utilizes the common merganser (*Mergus merganser*) as its definitive host and *Stagnicola emarginata* as its intermediate (snail) host.

Off-season Preparation/Research and Development

Objective: To be fully prepared to implement and manage a comprehensive swimmer's itch control program on Higgins Lake beginning on April 15, 2015.

Data files: [BlankespoorUSFWSPermit.pdf](#)
[BlankespoorMIDNRPermit.pdf](#)
[ReiminkUSGSBandingPermit.pdf](#)

Summary of work completed: All necessary federal (US Fish & Wildlife; US Geological Survey) and state (Michigan DNR) permits were successfully obtained for 2015. Common merganser drive traps as well as snail collecting units were assembled and tested.

New and improved methods for trapping all ages of common mergansers were also explored.

Avian Schistosome Species Assessment

Objective: To determine what avian schistosome species are present on Higgins Lake.

Data files: HigginsLake2015SnailCollections.pdf

HigginsLake2015BirdSurveys.pdf

HigginsLake2015FecalSamples.pdf

Summary of work completed: Given that all 70 different species of avian schistosomes are very host-specific (i.e., they have unique vertebrate-snail host combinations), it is possible to determine which parasite species are present in an area by examining the local snail and avian populations. If a particular avian schistosome species is present, then one could expect to find infected representatives of both its duck and snail host species. Snails are always local to a given lake, while birds, often being migratory, are not. So the first step in our avian schistosome species assessment was to examine the snail fauna present in Higgins Lake.

Ten locations were strategically chosen around Higgins Lake to give wide coverage (Figure 1).



Figure 1. Snail collection sites

At each location hundreds of snails were collected and identified; only four species of snails were found at our collection sites: two pulmonate species (*Stagnicola emarginata* and *Physa integra*) and two operculated species (*Campeloma decisum* and *Pleurocera acuta*). None of the 70 avian schistosome species utilize operculated snails as hosts, so only pulmonate snails were individually isolated and examined. We found two avian schistosome infections—*Trichobilharzia stagnicola* in *S. emarginata* and *T. physella* in *P. integra*. Both these swimmer itch-causing species utilize the common merganser as their definitive host, which only confirmed our suspicions that common mergansers where the major players in hosting the parasites that cause swimmer's itch on Higgins Lake.

In order to estimate the number of resident common mergansers and to determine if other avian schistosome species were cycling in Higgins Lake, ten complete birds surveys were conducted along all 22 shoreline miles of Higgins Lake between April 15 and July 28. When possible fecal samples were collected from hatch-year (HY) birds 4 weeks of age or older and examined for avian schistosomes (Table 1)..

Table 1. Avian species observed on Higgins Lake bird surveys in 2015.

| Species | Brood present | Number of HY birds 4 weeks of age or older examined | Number of HY birds positive for avian schistosome infections |
|--|---------------|---|--|
| Mallard (<i>Anas platyrhynchos</i>) | Yes | 15 | 0 |
| Common merganser (<i>Mergus merganser</i>) | Yes | 0* | 0* |
| Herring gull/ring-billed gull (<i>Larus spp.</i>) | Yes | 0 [#] | 0 [#] |
| Canadian goose (<i>Branta canadensis</i>) | Yes | 16 | 0 |
| Red-breasted merganser (<i>Mergus serrator</i>) | No | N/A | N/A |
| Bald eagle (<i>Haliaeetus leucocephalus</i>) | No | N/A | N/A |
| Common loon (<i>Gavia immer</i>) | No | N/A | N/A |

*All HY birds were trapped and relocated to Lake Huron before 4 weeks of age.

[#]We did not examine any gulls because they are not suitable hosts for any avian schistosome species.

Although mallards and Canada geese can serve as hosts to certain avian schistosome species, none of the 31 local individuals sampled were found to be infected. These results are not surprising, given that we were unable to find the corresponding snail host species on Higgins Lake for these species of parasite.

Conclusion: *Trichobilharzia stagnicola* and *T. physella* are the only avian schistosomes present in significant numbers in Higgins Lakes. While these species share a common definitive host (*Mergus merganser*), they cycle through different snail host species, *Stagnicola emarginata* and *Physa integra*, respectively.

Objective: To determine a pre-control program, baseline avian schistosome infection level on Higgins Lake.

Summary of work completed: Snails were collected at the same ten sites as in Figure 1 at four different times in the summer and individually shed for avian schistosomes (Table 2). These data provide a baseline avian schistosome infection level on Higgins Lake and can be used to assess the efficacy of any control efforts in the future.

Table 2. Snail Infection Prevalences on Higgins Lake in 2015. 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 9-10 | June 24-July 2 | July 10-17 | July 24-27 |
|-----------------------|----------------|----------------|----------------|----------------|
| Dragonfly House | 0.5% (200) | 1.7% (179) | 4.2% (167) | 4.0% (200) |
| Detroit Point | 0.0% (192) | 2.0% (200) | 3.5% (200) | 3.2% (156) |
| Yacht Club | 0.0% (200) | 0.0% (200) | 0.5% (200) | 0.0% (200) |
| Sam-O-Set Park | 0.6% (168) | 2.5% (200) | 2.0% (200) | 3.5% (200) |
| West Boat Launch | 1.6% (187) | 4.5% (200) | 5.5% (200) | 4.5% (200) |
| North State Park | 1.7% (177) | 1.0% (200) | 1.9% (155) | 5.0% (200) |
| Gerrish Township Park | 7.4% (94) | 12.7% (181) | 6.2% (113) | 5.0% (200) |
| Kelly Beach | 3.5% (172) | 7.7% (65) | 2.5% (122) | 3.8% (158) |
| Almeda Beach | 1.0% (200) | 0.5% (200) | 0.5% (200) | 1.5% (200) |
| South State Park | 1.1% (189) | 8.0% (200) | 3.5% (200) | 8.0% (200) |
| Lake-wide | 1.4% (1779) | 3.7% (1825) | 2.9% (1757) | 3.9% (1914) |

*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.

The trend towards prevalences increasing from early June to late July is most likely a result of water temperatures also increasing over that time period. Because of the variability associated with sample sizes less than 200 snails, the most meaningful and relevant data are the lake-wide prevalences. As a point of reference, the lake-wide snail infection prevalence on Glen Lake (Leelanau County, MI) in the mid-1990s when swimmer's itch cases were at their worse was a little over 2.0%. As is evident from Table 2, the snail infection levels this summer help explain why swimmer's itch is a huge problem on Higgins Lake.

Not only are the snail infection levels high, but the geographic distribution of swimmer's itch cases in 2015 reported on our website is cosmopolitan (Figure 2).

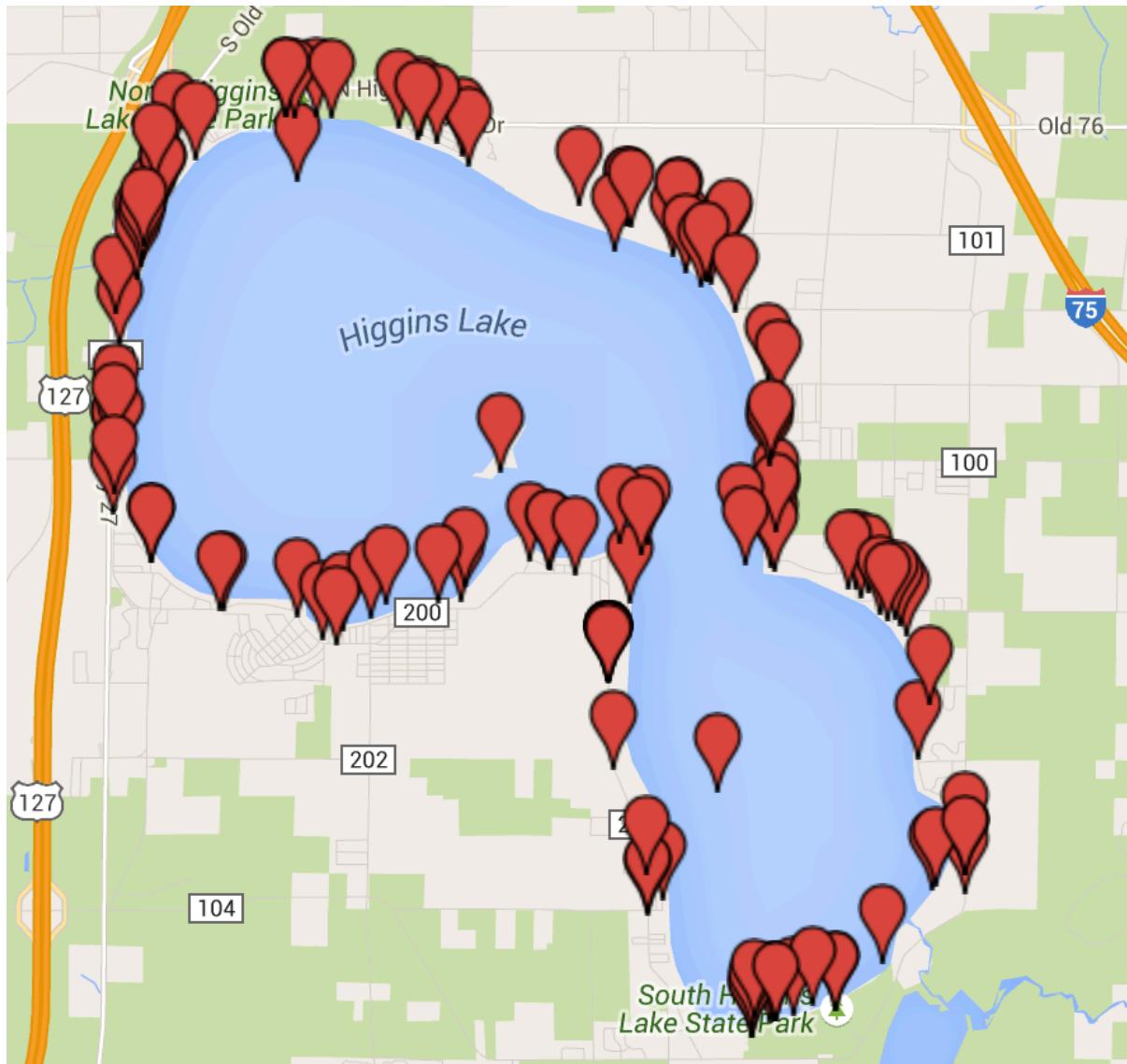


Figure 2. Geographic locations of swimmer's itch cases reported on www.swimmersitch.org/higginslake from June 1 - July 31, 2015. Each red balloon represents 1 website report (the number of individuals in each report varied from 1 to 18) of swimmer's itch.

Conclusion: From both a snail infection level perspective and a geographic distribution perspective, swimmer's itch is at an epidemic level on Higgins Lake in 2015

Bird Control Program

Objective: To determine the location of common merganser nesting sites on/near Higgins Lake.

Data file: HigginsLake2015BirdRemoval.pdf

Summary of work completed: When nest prospecting and nesting, common mergansers exhibit persistent and stereotypic behaviors. Careful observations of these behaviors can lead one to the location of a female's nesting site. Due to the unexpected addition of an alternate swimmer's itch control program by Gerrish Township, which included harassing and shooting common and red-breasted mergansers in the spring, we were unable to locate any nesting sites in 2015.

Conclusion: *Our ability to locate nesting sites for common mergansers is severely compromised by any spring common merganser harassment/depredation program.*

Objective: To reduce the number of avian schistosome eggs deposited in Higgins Lake.

Summary of work completed: From June 9 until July 29 we observed 9 common merganser broods (consisting of 88 individual birds) on Higgins Lake. All nine broods were successfully trapped, often within a day or two of their appearing on the lake, and safely relocated to a designate location on Lake Huron as described and permitted by Barb Avers (Michigan DNR). Two of the broods (21 birds) were captured in Lyon Township and seven broods (67 birds) were captured in Gerrish Township. An additional survey was conducted on July 28 to ensure that no more broods were present on the lake.

Additionally, we used lethal force (i.e., shotgun) to take 9 adult common mergansers, 5 of which had been previously injured, off Higgins Lake.

Conclusion: *Using either trap/relocation or lethal take, 97 common mergansers were removed from Higgins Lake in 2015*

Snail Removal Project

Objective: To determine the efficacy of snail removal efforts in controlling swimmer's itch in "hotspot" areas or in front of an interested riparian's residence.

Summary of work completed: All water samples are currently being analyzed by Tom Raffel's lab at Oakland University. An addendum to this report showing results of our snail removal project will be prepared and filed when data become available.

Educational Activities/Outreach Program

Objective: To be a helpful resource for Higgins Lake riparians who desire to learn more about what an effective comprehensive swimmer's itch control program entails.

Data file: HigginsLake2015SnailGuide.pdf

Summary of work completed: One hundred snail field identification cards were developed, printed and made available at the weekly open houses beginning in July. An electronic copy of these cards can be found and downloaded on our website (www.swimmersitch.org/higginslake)

Weekly open houses were offered at the Dragonfly Home (our summer residence) every Monday evening from 6-8pm over a 6-week period (June 15-July 27). Over 200 visitors attended.

Two Saturday town hall meetings were held from 9-11am at Lyon Township Hall on June 20 and July 11. Both meetings were well attended with approximately 20-30 attendees each session.

Update reports were written upon request from the HLSIO. Because we had continuous communication due to multiple presentations at various lake associations, it was not deemed necessary to write formal updates biweekly.

The local news station visited and conducted a short interview for the evening news. A writer from the local paper (*The Resorter*) visited twice and spent considerable time interviewing our team. A full-page article appeared shortly after.

A comprehensive, informative presentation was given at the HLPOA annual meeting.

Conclusion: *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.*

Recommendation for future years

We have many reasons to be hopeful that an effective and long-term swimmer's itch control program on Higgins 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 from the Higgins Lake in 2015, 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 lived on the lake and in the community full-time for 15 weeks, we are positioned to offer recommendations to ensure the HLSIO meets or exceeds its goals for swimmer's itch reduction on Higgins Lake.

Recommendation #1: *Convince all outside agencies, including individual riparians, to suspend (or work in coordination with SICON) their perceived control activities so that the efficacy of the SICON program can improve.*

Rationale: The addition of the Gerrish Township swimmer's itch control program, under the direction of Northpointe Fisheries, hampered our efforts in the following ways:

1. We lost the best opportunity to find natural merganser nesting sites due to their shooting and harassment activities. Our goal was to locate all natural nesting sites for common mergansers and render them permanently unusable. Those nesting sites remain undiscovered and therefore will be utilized by mergansers again next year. Unfortunately, those mergansers will be much more difficult to catch, making our job harder and possibly less effective in future years.
2. The addition of nest boxes runs counter to the goals of SICON. Scientific literature indicates that nest boxes for cavity-nesting birds (like common mergansers) *increase* population size. We are attempting to decrease the number of common mergansers utilizing Higgins Lake throughout the year and the addition of nest boxes around the lake will increase our workload.
3. We had to remove 5 wounded birds from Higgins Lake on June 10. They were all infected and would have spent the rest of their lives infecting snails on Higgins Lake. The birds had injuries consistent with previous gun shot trauma, likely inflicted by the Northpointe Fisheries group or vigilante riparians.
4. Gerrish Township, getting information from Northpointe Fisheries, provided the public with misleading information about swimmer's itch. Education is an important part of what we do in our comprehensive program and the dissemination of this false information can be detrimental for years to come.
5. Having an alternate website under Gerrish Township complicates the reporting of both merganser sightings and swimmer's itch cases, making our work more cumbersome and less effective.
6. The addition of an alternate program of swimmer's itch control contributed to a loss of "community" on Higgins Lake and was divisive in nature, making it much more difficult for fundraising, education, community-building, and contributed an inordinate amount of negative energy to our program.

Recommendation #2: *Coordinate the efforts of the HLSIO with the Michigan Swimmer's Itch Partnership (MSIP).*

Rationale: Swimmer's itch is a serious health problem with significant economic consequences that extend well beyond the Higgins Lake shoreline and the geographic boundaries of Gerrish and Lyon Townships. In late 2014, 13 lake associations throughout Michigan formed the MSIP. 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 MSIP also believes that continued work and research can lead to new ways to further control swimmer's itch.

Recommendation #3: *Centralize the work on Higgins Lake, and possibly other lakes in the MSIP, by creating one comprehensive website.*

Rationale: All riparians and visitors could access up-to-date, cutting edge information on swimmer's itch by utilizing one website. As we experienced on Higgins Lake, two websites are confusing (especially when one promotes misinformation) and create extra, less efficient effort in accumulating data (i.e. swimmer's itch cases, reporting of mergansers, etc.). One website, acting as a clearinghouse for all swimmer's itch activities, would also empower the HLSIO and the MSIP to seek local, state, federal, and/or private funding from large corporations.

Recommendation #4: *Institute a late summer/early fall merganser harassment/control program.*

Rationale: A major goal for swimmer's itch reduction is to reduce "merganser hours" on the lake to break the parasite's life cycle. The number one component of any control program is to remove all summer resident mergansers, a feat we accomplished in 2015. Adult mergansers that remain on the lake, as well as new ducks that fly in (often in large flocks), have the potential to create swimmer's itch "hotspots", even when the infection rate has been lowered for the entire lake. SICON may be able to offer help in this area with the development of novel traps for these birds and/or the coordination of a science-based harassment program. It also may be possible to convince Gerrish Township to focus their efforts on this control component instead of their spring program.