



# A Swimmer's Itch Control Program for Higgins Lake

Annual Report for Maintenance Year 1

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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

Last summer marked the end of SICON, LLC/Swimmer's Itch Solutions, LLC's three-year Comprehensive Swimmer's Itch Control Program for Higgins Lake. **That program resulted in over a 98% reduction in the lake-wide snail infection level on Higgins Lake from a pre-program level in 2014.** As promised in December 2014, the transition from a comprehensive swimmer's itch control program to a maintenance control program was to be completed by the summer of 2018.

This summer, Swimmer's Itch Solutions, LLC partnered with the Higgins Lake Swimmer's Itch Organization (HLSIO) in the implementation of a swimmer's itch control maintenance program on Higgins Lake with the following components:

1. trapping and relocating all common merganser broods on Higgins Lake.
2. training three individuals (2 from the Crystal Lake area and 1 from the Higgins Lake area) so that by the end of summer 2018 they will be equipped and qualified to trap and relocate common merganser broods from Higgins Lake in 2019.
3. providing one standard common merganser trap (net and supporting equipment) to be shared between the HLSIO and the Crystal Lake & Watershed Association (CLWA).
4. giving a presentation at the HLPOA annual meeting.
5. writing a comprehensive final report.

Additionally, as part of a research project funded by the Michigan Swimmer's Itch Partnership (MISIP), water samples were collected from Higgins Lake and the number of avian schistosome cercariae in each sample was determined using qPCR analyses. In an effort to determine if snail infection levels are correlated with the number of cercariae (larval parasites) present in lake water, *Stagnicola emarginata* snails were also collected at the same time, and in the same locations, where the water samples were obtained. **No avian schistosomes were detected in any of the 460 snails examined. Five of the 12 water samples collected were negative for avian schistosomes, and the cercarial counts in all the positive samples were in the ideal or tolerable range.** These data provide two consistent, albeit limited, swimmer's itch assessment metrics for Higgins Lake in 2018, and were obtained at no additional cost to the HLSIO.

In early spring, Swimmer's Itch Solutions, LLC secured all necessary federal and state permits to conduct this maintenance program. **During June and July, we trapped and removed all 2 common merganser broods (18 birds in total) that appeared on the lake.**

Although the number of Higgins Lake swimmer's itch cases reported on our website in 2018 did not significantly change from last year, anecdotal evidence from riparians and data collected on Facebook suggest that the significant reductions in the number and severity of swimmer's itch cases obtained on Higgins Lake in 2017 continued to occur in 2018.

**Looking ahead to future summers, the HLSIO is well positioned to successfully trap and relocate common merganser broods without the need to hire an external contractor.** We have equipped the HLSIO with a standard common merganser trap (to be shared with the Crystal Lake & Watershed Association) and 3 individuals (1 local to the Higgins Lake area, 2 local to the Crystal Lake area) have completed the training necessary to successfully catch common merganser broods without our assistance.

We share 3 summary conclusions for 2018 and make 3 specific recommendations for 2019.

### **Summary conclusions**

1. Swimmer's Itch Solutions, LLC's swimmer's itch control program has been extremely effective at maintaining, and possibly even further reducing, the number and severity of swimmer's itch cases on Higgins Lake in 2018.
2. Common mergansers are the only birds harboring the swimmer's itch parasite species that occur in Higgins Lake.
3. Our scientific discoveries on Higgins Lake over the past 4 years strongly indicated that the most likely source of the remaining low level of swimmer's itch infection in Higgins Lakes are spring and fall common merganser migrants ("fly-throughs").

### **Specific recommendations**

1. Continue to promote and manage a "maintenance-level" swimmer's itch control program for the foreseeable future.
2. Continue to monitor which avian schistosome life cycles are present in Higgins Lake, thereby determining which waterfowl species must be included in future swimmer's itch control programs and strategies.
3. Continue to support swimmer's itch research project, particularly one's that have direct application to new and improved swimmer's itch control strategies, including but not limited to:
  - a. Banding or putting web tags on all common mergansers captured on Higgins Lake.
  - b. Organizing a fall common merganser harassment/hunting program to test whether fall migrants are more heavily infected with avian schistosomes than spring migrants.

### **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 Higgins Lake (Roscommon County, MI).

Swimmer's Itch Solutions, LLC continues to work with the MISIP, which is composed of representatives of 31 lake associations in Michigan dedicated to fighting swimmer's itch. We were also under contract with the Crystal Lake & Watershed Association, the Platte Lake Improvement Association, and the Larks Lake Association during the summer of 2018, 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**

### **Assessment of current and new potential common merganser brood relocation sites**

**Accompanying file:** COMEReleaseSiteAnalysisTawas.pdf  
COMEReleaseSiteAnalysisHuronSunriseTrail.pdf  
COMEReleaseSiteAnalysisDuncanBay.pdf

**Summary of work completed:** Critical to any swimmer's itch control program based on trapping and relocating common merganser broods is finding suitable release sites for the captured ducks. Great care must go into the selection of these locations to ensure that their use as a release site does not present a risk of spreading swimmer's itch to new geographical areas. As part of the common merganser policy permitting process, Swimmer's Itch Solutions conducted a thorough scientific assessment of Tawas Bay, Lake Huron and provided documentation to the MI-DNR evaluating Tawas Bay as an ideal relocation site for common merganser broods.

Given the tremendous success of our swimmer's itch control efforts on Higgins Lake over the past four summers, we anticipate that several other lake associations in Michigan will want to pursue applying for a common merganser trapping and relocation permit. For this reason, the MISIP recently asked Swimmer's Itch Solutions to find additional release sites that might be used in the summer of 2019 and beyond. In late September, we submitted two release site report analyses to the MI-DNR for approval—Lake Huron (Sunrise Trail area) and Duncan Bay (Cheboygan State Park).

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

**Accompanying file:** HigginsLakeCOMETrapRelocate2018.pdf

**Summary of work completed:** From June 26 until July 19 we observed two common merganser broods (each consisting of 8 ducklings) on Higgins Lake. Both broods were successfully trapped (Figure 1), within 2 weeks 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).

One of the hens was previously banded, allowing us to determine that this was the fourth summer in succession that we have trapped her. The other hen was fitted with a USFWS leg band after capture. Small uniquely-numbered web tags were placed on all 16 captured ducklings, bringing the two-year total of ducklings from Higgins Lake equipped with an individually identifiable marking to 71. 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.

A full bird survey was conducted on August 8 to ensure that no COME broods were present on the lake.

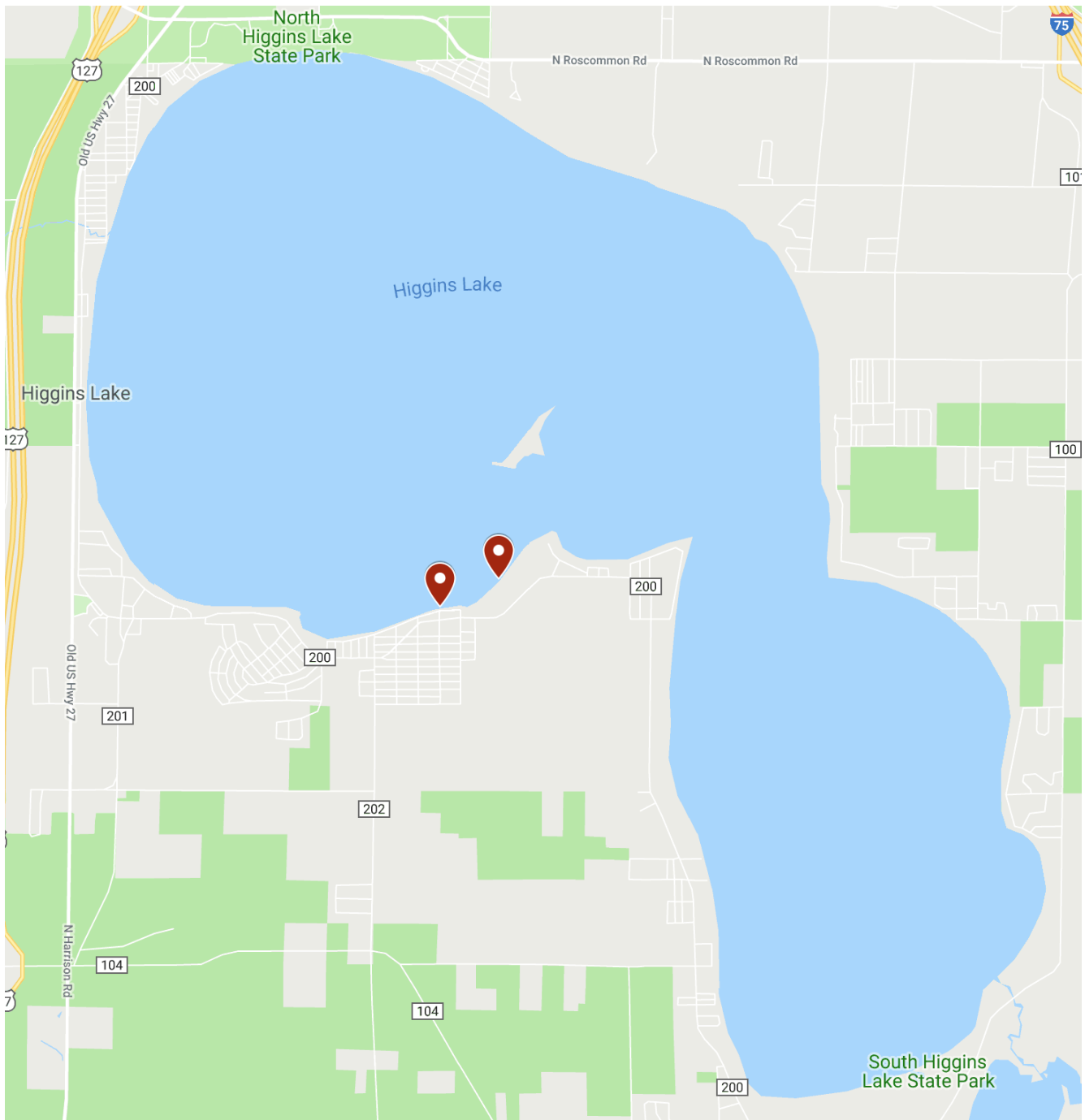


Figure 1. Locations on Higgins Lake (Roscommon County, MI) where common merganser broods were trapped in 2018.

## Research Projects

### Tracking common merganser hens with GPS

**Summary of work completed:** Common mergansers are a cavity-nesting species and hens typically lay their eggs in trees near a body of water (e.g., pond, lake, river). Mating pairs form almost immediately after ice-out, and hens that have successfully raised a brood in a previous year often show a strong preference to return to the same specific nesting site (as evidenced by the number of hens we recaptured over the past 4 summers). Very little is known about the daily behavior patterns of reproductively active hens.

As part of a two-year project to locate common merganser nesting sites, we equipped 4 hens with Lotek GPS PinPoint tags ([www.lotek.com](http://www.lotek.com)). The tags, which have a precision of measurement within 10m<sup>2</sup>, were preprogrammed to record locations at specific times and on specific days. Once a hen wearing one of these tags is recaptured next summer, the data will be collected and analyzed, hopefully allowing us to locate her specific nesting site.

The knowledge gained from this project will improve our understanding of common mergansers in northern Michigan. Long-standing assumptions about mating and nesting could be tested and substantiated with data. The new knowledge gained will help the development of more efficient and cost-effective common merganser trapping techniques. Additionally, any active nest sites that are discovered can be destroyed or otherwise rendered unusable for future years.

A separate report addressing the results and conclusions of this project will be completed in 2019.

### Snail infection level-*q*PCR correlation study

**Accompanying files:** HigginsLakeCorrelationStudyData2018.pdf

**Summary of work completed:** Given that the comprehensive avian schistosome species assessment conducted in 2015 identified *Trichobilharzia stagnicola* as the dominant swimmer's itch causing species on Higgins Lake, only *Stagnicola emarginata* snails, its intermediate host, were examined from Higgins Lake this summer. On July 19, two locations (Sam-O-Set Park and South State Park) were selected as sampling sites for our research project. The particular locations were chosen because of their close proximity to a public beach and because they both were used as snail collection sites from 2015-2017. A total of 304 snails and 8 water samples were collected from these two sites. On August 3, a total of 156 snails and 4 water samples were collected from the shoreline of two private residences. All 460 snails were individually shed for avian schistosomes, and no infected snails were found (Table 1). All water samples were subjected to a *q*PCR protocol that detects all swimmer's itch-causing parasites, and is the test most commonly used to detect total parasite levels. Any positive samples were further analyzed using *rhAmp* tests that identify which of 4 avian schistosome species are present: *Trichobilharzia stagnicolae* (common merganser), *Trichobilharzia physellae* (common merganser and mallard), and unknown schistosome 'AD' (unknown vertebrate host but present in a Glen Lake snail), and *Dendritobilharzia pulverulenta* (known from mallard and Canada goose). Seven of the 12 samples were positive for *T. stagnicolae* and distinctly negative for the other 3 species. Because *T. stagnicolae* was easily detected and the other species were negative, it is very likely that other species are not contributing to swimmer's itch outbreaks on Higgins Lake. Two of the four sites were negative for cercariae, and the average parasite count for all 12 water samples was 2.67 cercariae/25 L water (Figure 2). Collectively, these snail and water sample data provide a limited, but consistent, assessment of the avian schistosome infection level on Higgins Lake.

Table 1. Snail Infection Levels at select locations on Higgins Lake in 2018. The percentage of *Stagnicola emarginata* snails infected with swimmer’s itch at four different locations during the summer of 2018. 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	July 19, 2018	August 3, 2018
Sam-O-Set Park	0.0% (101)	N/A
South State Park	0.0% (203)	N/A
Private Residence 1	N/A	0.0% (71)
Private Residence 2	N/A	0.0% (85)

\*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.

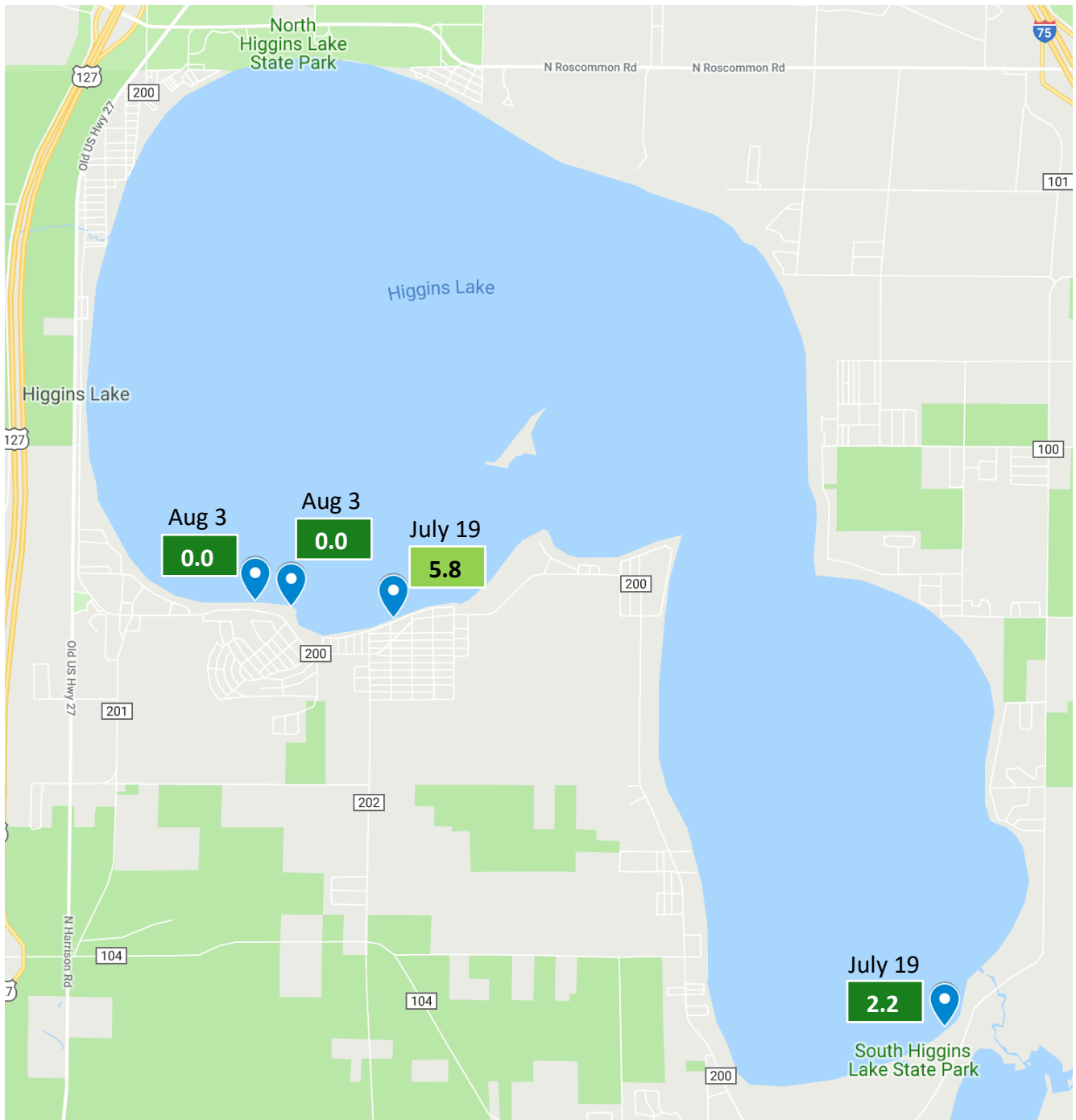


Figure 2. Average number of avian schistosomes/25 mL water in samples taken from Higgins Lake (Roscommon County, MI) in 2018. Analyses were done with *q*PCR; sample size = 2-4; dates of collection given above results. Color of cell indicates infection level (■ = Ideal (<5), ■ = Tolerable (5-9), ■ = Moderate (10-29), ■ = Severe (30-99), ■ = Epidemic (>100)).

**Observation:** Both commonly-used swimmer's itch metrics indicate that cases of swimmer's itch should remain at a low level on Higgins Lake in 2019 as a result of the removal of all common merganser broods from the lake in 2018.



## Training Program

### Training of a Higgins Lake Swimmer's Itch Organization representative

**Accompanying file:** HigginsLakeCOMETrapTraining.pdf

**Summary of work completed:** From May 17 until July 19, Chuck Schepke, a HLSIO-appointed representative, participated in approximately 50 hours of on-the-job training activities related to trapping common merganser broods. These training activities occurred on both Higgins Lake and Crystal Lake, and included Crystal Lake & Watershed Association personnel, Tim Reznick and Tom Thorr. Equipped with a complete trap (net and supporting equipment), the trainees successfully captured a common merganser brood of 8 ducklings on July 3, which was their first attempt at trapping without any assistance from us. Again, without any help from us, they captured 3 additional common merganser broods (23 ducklings total) on July 18 and July 19.

**Observation:** *Having both hunted and operated boats for most of their adult lives, all three men have the ideal temperament and expertise to lead future joint HLSIO/CLWA common merganser trapping programs.*

## Educational Activities/Outreach Program

**Accompanying files:** HLSIO2018July21.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.

Cases of swimmer's itch were reported at 3 specified and 8 unspecified locations on Higgins Lake in 2018 (Figure 3). 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. These data represent a slight, non-significant increase from 2017 in the number of swimmer's itch cases reported on our website. The most plausible explanation for this increase can be attributed to the observed difference in weather this summer. In 2018, the summer weather was ideal with more "swimmable days" compared to the prior four years. Many more people were observed in or on the water on these warm days, compared to the past few years when the summer weather was less ideal. Additionally, more swimmers were getting into the water this summer because the perceived risk of getting swimmer's itch was significantly lower when compared to the previous few years. Despite this significant increase in lake use (i.e., more "swimmable days"), which increases an individual's "exposure time" to swimmer's itch causing parasites, the small number of case reports on our website, the anecdotal testimonials from Higgins Lake riparians, and the overwhelmingly positive reviews on various social media platforms, all show the continued success of our control program.

Update reports were written upon request from the HLPOA board and a comprehensive, informative presentation was given at the 2018 HLPOA annual meeting.

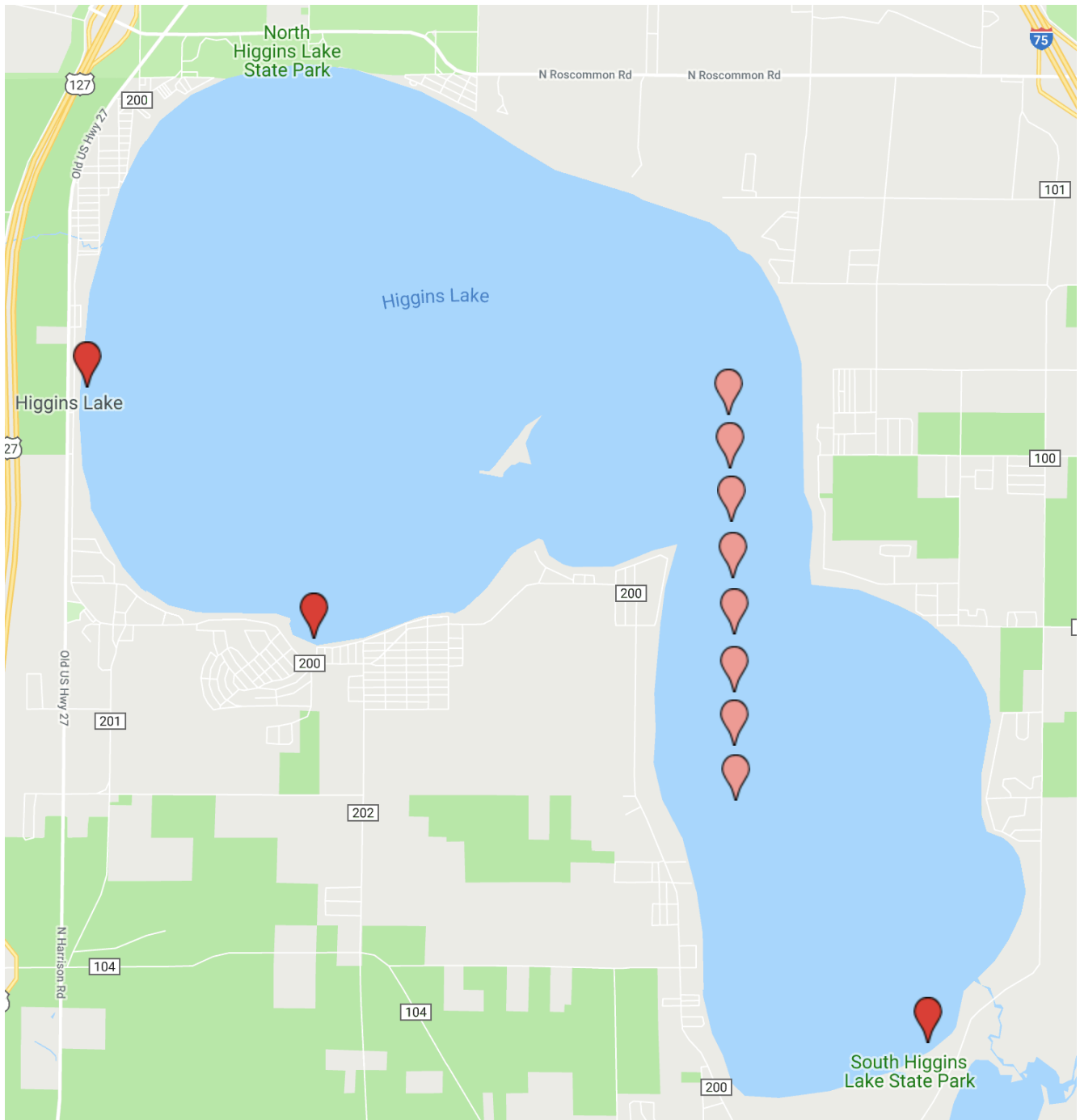


Figure 3. Locations of swimmer's itch cases on Higgins Lake (Roscommon County, MI) that were reported on [www.swimmersitchsolutions.com/Higginslake](http://www.swimmersitchsolutions.com/Higginslake) from May 29 - August 31, 2018. Each dark red balloon represents a distinct location for a swimmer's itch case report; each pink balloon represents a swimmer's itch case that was reported without an accompanying location specified.

### Three Summary Conclusions

**Conclusion #1:** *Swimmer's Itch Solutions, LLC's swimmer's itch control program has been extremely effective at maintaining, and possibly even further reducing, the number and severity of swimmer's itch cases on Higgins Lake in 2018.*

From 2015-2017, we managed a comprehensive swimmer's itch control program on Higgins Lake that 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). Because of this significant reduction, the HLSIO decided that 2018 was a year to transition into a more affordable and sustainable maintenance control program, one that didn't require an annual, comprehensive lake-wide assessment of swimmer's itch on Higgins Lake. Only 2 common merganser broods appeared on the lake this summer, and both broods were quickly and successfully trapped and relocated. As expected, this year's anecdotal evidence continued to show most recreational lake users had "itch-free" experiences on Higgins Lake in 2018.

**Conclusion #2:** *Common mergansers are the only birds harboring the swimmer's itch parasite species that occur in Higgins Lake.*

Modern molecular techniques (*q*PCR and *rhAmp* tests) confirm what was initially discovered in SICON's comprehensive Avian Schistosome Species Assessment in 2015— common mergansers are the only birds harboring the swimmer's itch parasite species that occur in Higgins Lake. The only avian schistosome species that we found cycling in Higgins Lake in 2018 was *Trichobilharzia stagnicolae*, which live as adult worms in common mergansers. For now, Canada geese and mallards are not spreading swimmer's itch on Higgins Lake.

**Conclusion #3:** *Our scientific discoveries on Higgins Lake over the past 4 years strongly indicated that the most likely source of the remaining low level of swimmer's itch infection in Higgins Lakes are spring and fall common merganser migrants ("fly-throughs").*

Thousands of migrating birds, during the early spring and late fall, spend short periods of time on Higgins Lake. Currently, no control strategies exist that can prevent these individuals from newly inoculating snails with swimmer's itch causing parasites. Therefore, the most likely source for the persistent, low levels of swimmer's itch infection currently in Higgins Lake are spring and fall common merganser migrants. It is primarily because of these fly-through populations of birds, that no known control program or technology that can completely eliminate or eradicate swimmer's itch from a lake.

### Three Specific Recommendations

**Recommendation:** *Continue to promote and manage a "maintenance-level" swimmer's itch control program for the foreseeable future.*

Since 2015, the Higgins Lake community has made a sizable and significant investment in a comprehensive, multi-year swimmer's itch control and research program on their lake. This effort, and specifically the support from the HLSIO, HLPOA, and the Roscommon County Commission have positioned Higgins Lake as the premier leader of a state-wide battle to control swimmer's itch on all Michigan lakes. Now that the "heavy lifting" of swimmer's itch control has been accomplished (i.e., a data-supported reduction on swimmer's itch from an epidemic level to a tolerable, if not ideal, level), it is of paramount importance to continue to support and manage a "maintenance-level" swimmer's itch control program moving forward. The goal of such a program should be to maintain, and possibly even further reduce, the low lake-wide swimmer's itch infection level. Currently, after the first year of a three-year MI-DNR Common Merganser Control Policy permit given to the HLSIO, the swimmer's itch infection level on Higgins Lake is significantly lower than the qualification requirement threshold for that permit. Critical to the continued success of swimmer's itch control program on Higgins Lake (and other lakes) are changes that need to be made in the threshold metrics of that policy.

**Recommendation:** *Continue to monitor which avian schistosome life cycles are present in Higgins Lake, thereby determining which waterfowl species must be included in future swimmer's itch control programs and strategies*

Other lake associations in Michigan are reporting that some of the swimmer's itch on their lakes is being traced back to parasites living in multiple species of snails and ducks (e.g., Canada geese and mallards). While those species appear to be absent on Higgins Lake, this needs to continue to be monitored going forward. This could be done most efficiently by water samples subjected to molecular methods to detect and identify any parasites in addition to *T. stagnicola*.

**Recommendation:** *Continue to support swimmer's itch research projects, particularly projects that have direct application to new and improved swimmer's itch control strategies, including but not limited to:*

- a. Banding or putting web tags on all common mergansers captured on Higgins Lake.*
- b. Organizing a fall common merganser harassment/hunting program to test whether fall migrants are more heavily infected with avian schistosomes than spring migrants.*
- c. Testing whether snail infection occurs under in the fall or under fall-like conditions.*

Over the past 3 summers, the recent, dramatic 3-year reduction in the lake-wide avian schistosome snail infection level that Swimmer's Itch Solutions, LLC obtained on Higgins Lake would not have been possible without the scientific knowledge gained from numerous swimmer's itch-related scientific research projects. Most of the scientific research we conduct leads to more effective and financially-sustainable swimmer's itch control strategies. For this reason, such projects need to be supported and incentivized in the years ahead.

One research question that remains unanswered is where relocated ducklings choose to reproduce once they reach sexual maturity. They either return to their natal sites (i.e., where they hatched from eggs), return to the area where they were released after capture (i.e., where they fledged), or to some geographical area unrelated to their experiences as a duckling. For this reason, all captured common mergansers should continue to be banded or equipped with web tags in order to help us answer that important question. Knowing the answer to this question will have significant implications on many future control program decisions (e.g., how far apart do the capture and release sites need to be in order to discourage ducklings from returning to their natal sites to breed?)

Some of the other lake associations in Michigan that trap and relocated common mergansers opted not to band hens or mark ducklings in 2018. Once a brood is captured, the banding itself requires only minimal extra effort, and the potential benefits gained from this research work would have high value for future control efforts. In fact, we strongly suggest that banding hens and web tagging ducklings be a requirement for securing any MISIP funding for common merganser control activities.

Over the last 3 years we've collected necropsy data that show most spring migrant common mergansers on Higgins Lake and Crystal Lake are either uninfected or only lightly infected with avian schistosomes. 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.

Determining the extent to which snails are susceptible to naturally acquiring new avian schistosome infections in the fall, when lake water is still relatively warm, is another research project that should be funded as it would further inform future swimmer's itch control strategies.