SWIMMER'S ITCH SOLUTIONS

The State of Swimmer's Itch on Crystal Lake (Benzie County, MI) in 2026

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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.

Executive Summary

In 2016 the CLWA contracted with SICON, LLC to collect extensive swimmer's itch (SI) baseline data. In the summer of 2017, under the authority of federal and state permits, all common merganser broods were trapped and relocated off Crystal Lake. Metrics of the swimmer's itch (SI) problem — snail infection levels and cases of SI (measured by reports to our website, and more scientifically, by the annual study at the Congregational Summer Assembly beach) – showed dramatic decreases in all years (2018-2022) following a summer of brood relocation.

However, in 2022 and 2023, the common merganser brood relocation program was suspended by MI-DNR because of highly pathogenic avian influenza (HPAI). With this suspension, it was expected that both metrics would return to pre-relocation levels. It only took one summer (2022) of common merganser broods growing up on the lake for snail infection levels to dramatically increase the following year (2023). Correspondingly, SI case reports to our website and in the CSA beach study also spiked in 2023. In 2024, snail infection levels and website reports were high, continuing the trend seen in 2023. These data strongly attest to the efficacy of the relocation program. Given that the relocation program was restored in 2024, we predicted that all metrics would fall again in 2025, and they did.

The ability to reliably predict the response of a system is considered a high achievement in science and demonstrates a strong understanding of the system. To do so in this context, with a complex parasitic life cycle taking place in a large lake ecosystem, is even more remarkable. **Last year, in 2025, the relocation program was again suspended due to HPAI concerns. We therefore predicted that all metrics of swimmer's itch parasites in 2026 would rise, and the reader will see that the 2026 data strongly confirm this prediction.**

About Swimmer's Itch

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 hundreds 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. If a cercaria accidentally penetrates human skin, it dies in the skin, and an immune reaction can result, usually causing a raised papule that can itch intensely.

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 utilizes the common merganser (*Mergus merganser*) as its definitive host and *Stagnicola emarginata* as its intermediate (snail) host.

Important Fact to Remember: *Given the life cycle of T. stagnicola. and the biology of its hosts, infected common merganser broods affect the **following summer's** snail infection levels.*

Bird survey

Summary of work completed: We completed a waterfowl survey of the entire shoreline of Crystal Lake on July 23, 2026 (Figure 1). Thirty-six Canada geese were spotted on the east side of the lake and 2 hooded mergansers hens were found on the north shore near the intersection of Warren Road and Crystal Drive. A total of 17 common merganser hens and 70 ducklings (of various ages) were observed at 7 different locations around the lake.

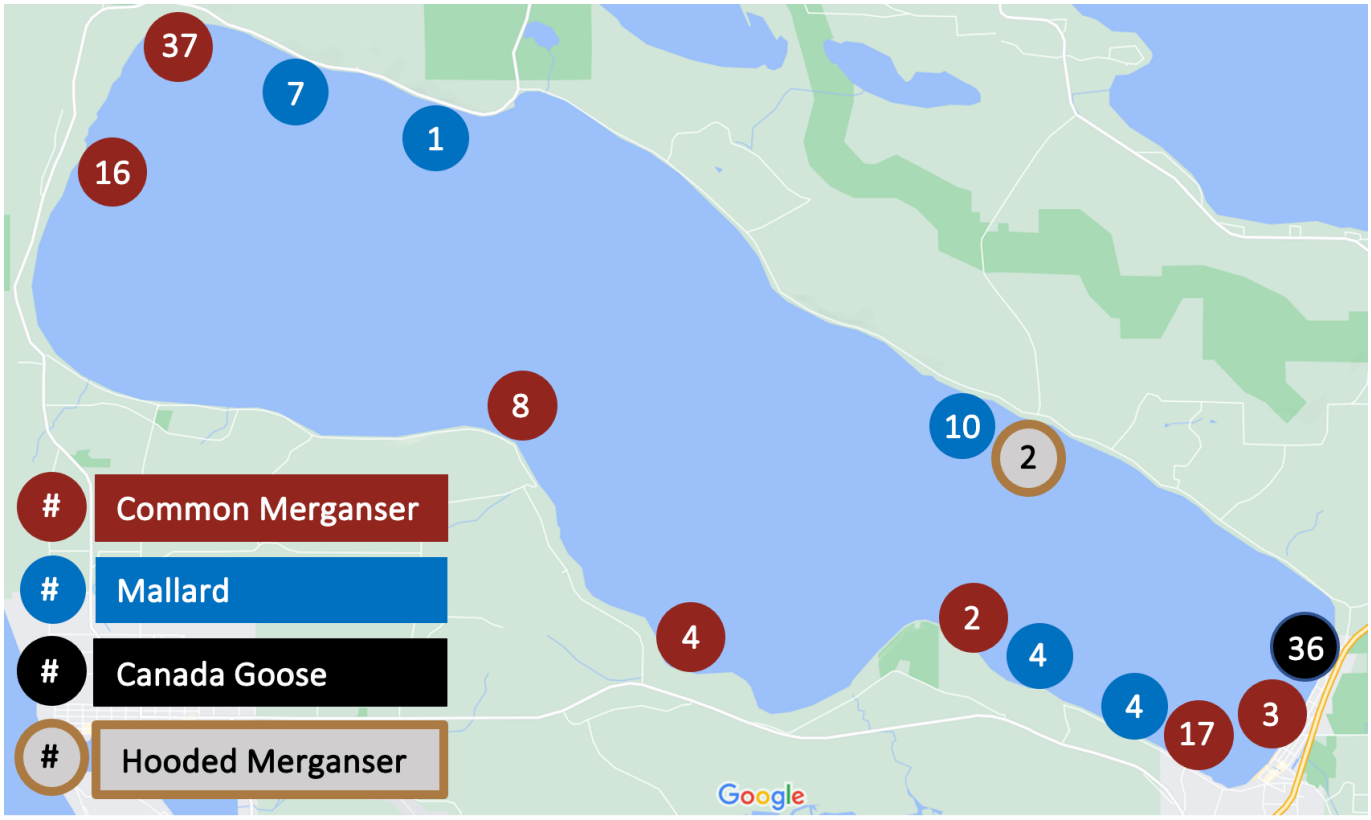


Figure 1. Number of common mergansers, mallards, and Canada geese, and hooded mergansers observed during a July 23, 2026 shoreline survey of Crystal Lake (Benzie County, MI).

Snail Infection Levels

Summary of work completed: A comprehensive avian schistosome species assessment in 2016 identified *Trichobilharzia stagnicolae* (carried in *Stagnicola emarginata* snails, by far the most numerous snail) as the dominant swimmer's itch causing species on Crystal Lake. Infection levels in this snail species were monitored every other year for the first few years of the program (2016, 2018, 2020) and then every year from 2022 to the present. **Relocation has been able to reduce snail infection levels to about 0.05% - and this has been true on both Crystal Lake and Higgins Lake. Since snail infection levels started at more than 1% and 3% respectively, at these lakes, these are reductions of greater than 95% (Crystal Lake) and greater than 98% (Higgins Lake). Truly remarkable results!**

On July 2 and 3 of this year, we collected and examined 1929 snails and found 5 to be infected with swimmer's itch parasites, for a snail infection level of 0.26% (Table 1). This is not as high as we have found in other years when relocation activities were suspended and it may be that the number of ducklings was lower in 2025. Still, it is relatively high compared to recent years when common merganser broods were relocated off Crystal Lake – 0.05% to 0.15% (2020, 2022, 2025, Table 1). In fact, the number of infected snails found in 2026 equals the number found in those 3 years combined (5 infected snails out of 6383 examined in 2020, 2022, 2025).

Table 1. Effect of common merganser brood relocation on *Trichobilharzia stagnicalae* snail infection levels in Crystal Lake (Benzie County, MI). Relocation efforts began in 2017, and continued for 5 consecutive years until the Michigan Department of Natural Resources suspended all trapping activities in 2022 and 2023 due to an outbreak of avian influenza. Trapping activities were again suspended for the same reason in 2025 and 2026. Arrow indicates breakdown of snail infection level by collection site. 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%))*

	Pre-Program Baseline			Relocation (R)					No Relocation (No R)		R	No R	
Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Number of Relocated COME Ducklings	0	0	0	126	143	93	89	90	0	0	73	0	0
Number of Summer Resident COME Ducklings	unknown	unknown	61	0	0	0	0	0	85	86	0	??	70
Lake-wide Snail Infection Level the Following Summer (Number of Snails Examined)		1.05% (2000)		0.28% (2112)	--	< 0.05% (2211)	--	0.15% (2029)	1.19% (2185)	0.67% (2234)	< 0.05% (2143)	0.26% (1929)	??

Collecting Location	July 20, 2016	July 13, 2018	July 6, 2020	July 13, 2022	July 12, 2023	July 8, 2024	July 8, 2025	July 2, 2026
River Outlet (L11)	1.0% (200)	0.0% (199)	0.0% (220)	0.67% (300)	5.45% (202)	2.03% (246)	0.0% (232)	0.44% (228)
Onkeonwe Rd (J11)	2.5% (200)	0.0% (200)	0.0% (212)	0.0% (250)	0.0% (218)	1.00% (200)	0.0% (212)	0.0% (208)
CBCA (G7)	1.0% (200)	0.0% (228)	0.0% (230)	0.0% (250)	0.0% (211)	0.0% (200)	0.0% (232)	0.0% (190)
CSA (A6)	0.5% (200)	0.46% (216)	0.0% (212)	0.0% (185)	0.43% (230)	0.40% (250)	0.0% (138)	1.61% (186)
Marquette Ct (A5)	3.5% (200)	0.46% (216)	0.0% (230)	0.0% (198)	2.27% (220)	0.40% (249)	0.0% (235)	0.44% (226)
Yacht Club (A3)	0.0% (200)	0.0% (216)	0.0% (220)	0.0% (197)	1.42% (212)	0.0% (249)	0.0% (217)	0.0% (264)
M6 Hotspot (M6)	1.0% (200)	1.38% (217)	0.0% (212)	0.45% (224)	0.46% (218)	2.00% (250)	0.0% (220)	0.0% (236)
Nichols Rd (O7)	0.0% (200)	0.0% (216)	0.0% (226)	0.0% (218)	0.00% (219)	0.50% (200)	0.0% (242)	0.0% (198)
Orchard Hill (R9)	0.50% (200)	0.0% (204)	0.0% (220)	0.0% (3)	0.91% (220)	0.0% (140)	0.0% (195)	0.0% (4)
Beulah Beach (Q13)	0.50% (200)	0.5% (200)	0.44% (229)	0.0% (204)	1.28% (235)	0.0% (250)	0.45% (220)	0.0% (189)

*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.

Conclusion: *The snail infection data from 2026 and the previous 10 years confirm these simple tenets: When common merganser broods are relocated off Crystal Lake, snail infection levels significantly decrease the following summer; when common merganser broods are allowed to remain on Crystal Lake, snail infection levels significantly increase the following summer.*

Website SI Reports

Summary of work completed: From the beginning of the relocation program, SIS has hosted a website where Crystal Lake residents and visitors can report SI cases. These data are only a rough measure of the SI issue on Crystal Lake because they do not include any reporting of times that individuals used the water *without getting SI.* In addition, the rate of reporting probably varies depending on the prior expectations of the person getting in the water, the severity of the case, and the motivation for reporting.

In Figure 2 below, the numbers of SI case reports from 2017-2026 are plotted by case severity (Mild = 1-10 papules, Medium-High = 11-99 papules, Severe = 100+ papules). Suspension of the brood relocation program in 2022 and 2023 produced record numbers of cases in 2023 and 2024 (320, 278), far higher than all other years (range 20-95, average 58 cases/yr). It also led to far higher numbers of severe cases (19, 17) than all other years (range 0-3, average 1.2 cases/yr).

As we reported last year, the return of relocation in 2024 led to a reduction in swimmer's itch in 2025, with only 66 cases, and a reduction in severity with only 1 severe case and a higher proportion of mild cases. There was also a significant drop in the number of people seeking medical attention: in 2024, 22 report filers consulted a medical practitioner and 2 visited a hospital, but in 2025 only 3 consulted a medical practitioner and 1 visited a hospital.

We expected a significant increase in cases in 2026, though we ended up with only a modest increase reported: 82 cases, include 3 severe cases and a higher proportion of medium-high cases. Four people consulted a medical practitioner and 2 visited a hospital. There is reason to believe that reporting fatigue affected website reporting: Ron Reagh reported that several people told him that they were no longer going to report cases to the website since 'nothing was being done'. The snail infection data and the CSA data (next section) indicate a more substantial increase.

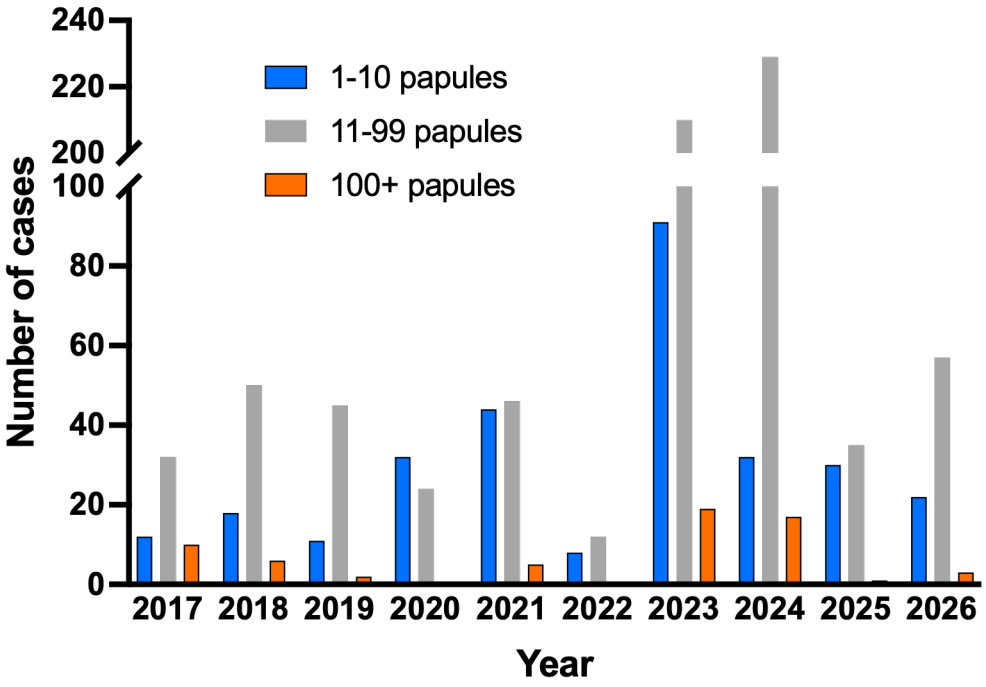


Figure 2. Crystal Lake 2017-2026 SI cases categorized by severity. Note the break in the y-axis which allows more detailed display of the years with SI control (they would appear even smaller otherwise). Also note that it is likely that cases in 2017 were underreported since it was the first year of making the website available.

Conclusion: *Though it is a modest increase in 2026 website reporting, suspension of the relocation program in 2025 once again led to an increase in SI.*

CSA study

CSA lifeguards and supervising personnel have collected data on swimmer's itch cases at their locality since 2013 and the data now include 72261 swimmers! This is an amazing dataset and by far the most comprehensive data on swimmer's itch cases ever collected. CSA usually collects 61 days of data from late June to mid-August. In 2026, 59 days were recorded because two days (7/16 and 7/17) had swimming restricted due to the smoke from wildfires in Canada.

In 2026, 7616 swimmers were counted and there were 510 cases of SI, for a case rate of 6.7%, up markedly from 3.5% the previous year (Figure 3). Though case rates did not bounce up as high as they had in 2023 and 2024, it is clear that the lack of brood relocation in 2025 again had a strong effect. In our published paper (2013-2020 data), the construction of a mixed-effects statistical model showed that brood relocation was a very significant factor determining the frequency of SI cases. We have continued to update the model with each year's data. **In fact, each year the model more strongly supports that relocation makes a difference (for those that understand statistics, the p-value is now at 0.000000005!).**

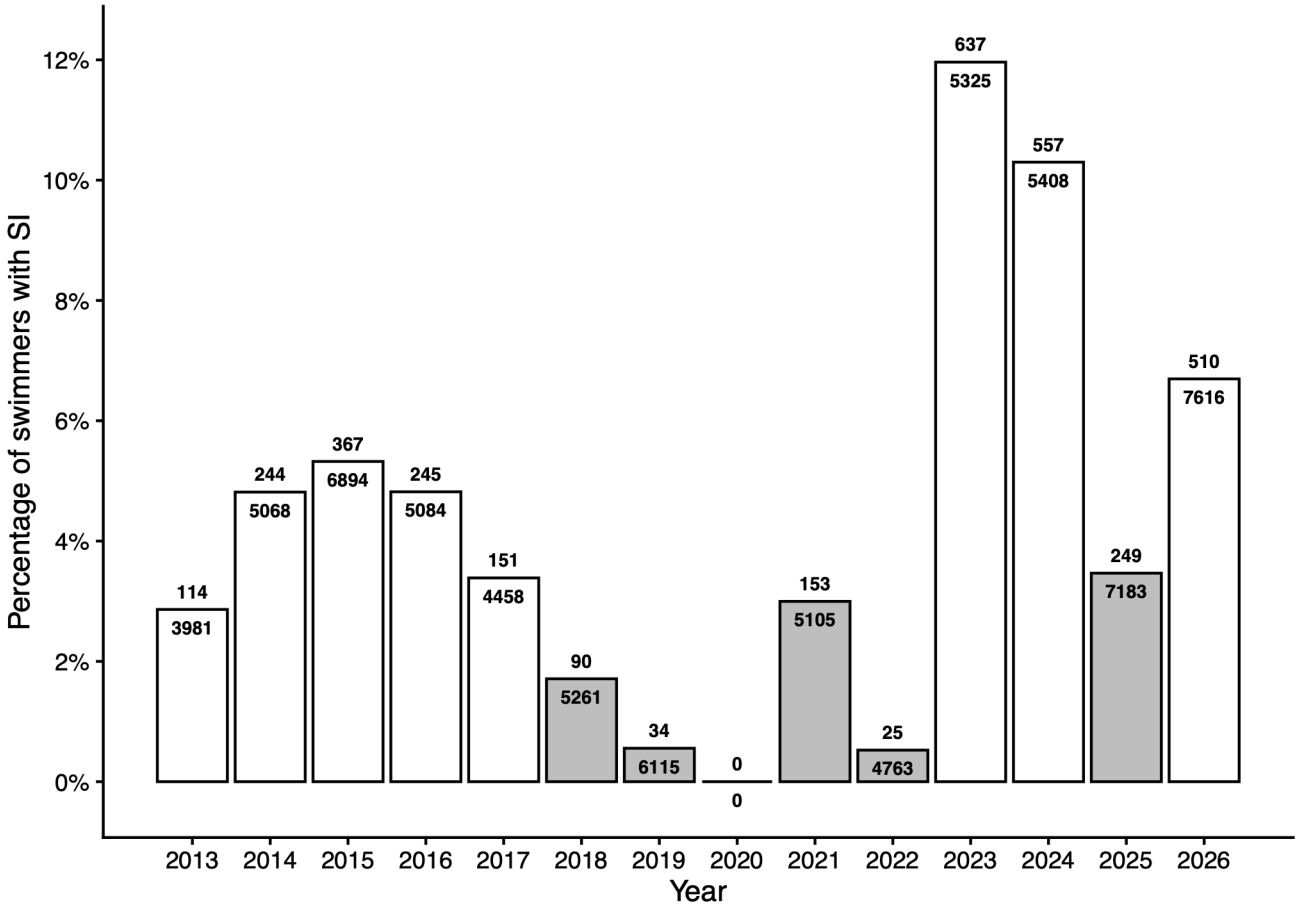


Figure 3. Percent of swimmers with SI at CSA beach at Crystal Lake, 2013-2026. Number of SI cases is above the bar and number of swimmers is below. Gray shading indicates years following relocation of common merganser broods. Data were not collected in 2020 due to the COVID pandemic.

A simpler look at the CSA data tells an equally strong story. The total number of cases during 8 years without relocation of common merganser broods the previous summer is 2825 (average of 353 per year) and the total number of cases in the 5 summers following a relocation year is 551 (average of 110 per year; Table 2). **110 is 31% of 353 -- in other words, relocation reduced the number of cases by 69% on average each year! If relocation had not been suspended in 3 of the last 4 years, the number of cases in 2023, 2024, and 2026 could have been reduced from 1704 to 528 - almost 1200 cases prevented!**

Table 2. Data totals from CSA beach study 2013-2026 comparing relocation and non-relocation years.

Prior Summer	Total swimmers	Swimmer's itch cases	Percent days with onshore (N, NE, NW) winds
No relocation allowed (8 years)	43834	2825 (6.44% of swimmers)	36.8
Relocation occurred (5 years)	28427	551 (1.93% of swimmers)	34.9

As has been known for decades, onshore winds increase the chances of contracting SI because the planktonic and phototactic larvae are near the water's surface and are pushed toward shore. At CSA beach in 2026, days with onshore wind account for a disproportionate number of cases: although 37.1% of swimming days had onshore winds, they accounted for 75.4% of all cases. Although the percentage of days with onshore winds varied from year to year (16-50%), averages of years with and without relocation are very similar (34.9 and 36.8%, respectively, Table 2), and the strong reduction from relocation is not correlated with less onshore wind. In fact, the two years with the highest number of cases (2023 and 2024) had the fewest onshore wind days (16 and 20%, respectively).

Since days with onshore winds (N, NE, or NW) have a disproportionate number of cases each year, our published paper took this into account, and we continue to take this approach in Figure 4 below. When plotted this way, the dramatic reduction in SI cases brood relocation can still clearly be seen, with and without onshore winds.

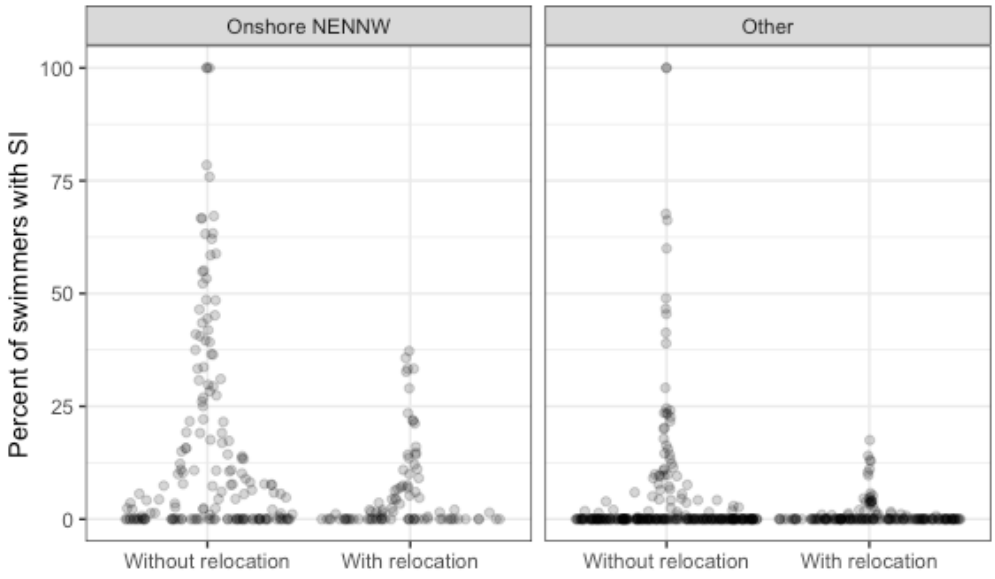


Figure 4. Percent of daily swimmers reporting swimmer's itch at CSA beach with and without common merganser brood relocation the previous summer, 2013-2026. Data aggregated by wind conditions: onshore winds (NE, N, and NW), and all other wind directions. Each dot represents a day. Since some days did not have swimmer's itch cases, they appear as overlapping zero values at the bottom of the plots.

Summary Conclusion and Recommendations:

All metrics (snail infection levels, website reports of SI, and CSA swimmer data) in 2026 were elevated, as was predicted. The datasets continue to grow and strongly support that common merganser brood relocation dramatically reduces swimmer's itch on Crystal Lake. **Each suspension of the relocation program has been another test of the hypothesis, and each has resulted in undeniable increases in snail infections and swimmer's itch cases.**

The ability to predict accurately in science is the best measure of whether a system is understood. While we would like to know other factors that might contribute, our ability to predict significant changes with a high level of certainty shows that common merganser brood presence is by far the most important factor in the system.

Due to the continued suspension of the relocation program and the presence of at least 8-9 broods (70 common merganser ducklings in total) on the lake this summer, we predict that all metrics will be at similar levels or higher in 2027.

We recommend the following action items for 2027:

1. The CLWA continue to assess/monitor swimmer's itch case reports on Crystal Lake (the CSA beach study does this very well).
2. The CLWA again fund a snail infection level assessment in 2027. This is critical data to have – we can only hope that the authorities start valuing data-driven science instead of hearsay.
3. The CLWA fund the small fee for the continued use of our website reporting system in 2027. This is valuable information and contributes evidence.