
PREVENTING SWIMMER'S ITCH

WITH 2020 VISION

EDUCATE <> EMPOWER

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PROLOGUE

Humans began battling swimmer's itch once the general lifecycle of the responsible parasites was discovered by William Cort¹ (1928). The middle decades of the 1900s saw literally tons of copper sulfate applied to recreational lakes in Michigan alone in an effort to destroy the snail intermediate host from which the itch-causing larvae (cercariae) are shed. The application of copper sulfate has since lost favor and even been outlawed in some states due to its toxicity on non-target species and negative long-term ecological impacts on freshwater ecosystems. Scientists from Freshwater Solutions (FWS) and the University of Alberta (UA) showed copper sulfate application to a 1000 ft. section of a Michigan lake shoreline had no impact on reducing risk of contracting swimmer's itch (Froelich et al.², 2018), adding more reason for discontinuing this control method.

From late in the 20th century until present, a few lake associations in Michigan have attempted to disrupt the life cycle of one dominant itch-causing species by trapping and relocating common mergansers, a major definitive host on some lakes. This control initiative started when Dr. Harvey Blankespoor and Ron Reimink discovered mergansers played a major role in transmission of one species of itch-causing parasite in 1983 (Blankespoor & Reimink³, 1991). Removing summer resident common mergansers proved effective in reducing this particular itch-causing species on a few lakes, but FWS and UA have since identified multiple species of schistosomes that cause swimmer's itch in Michigan (Rudko et al.⁴, 2019), making reduction of just one species less effective. More recent work by FWS and UA (paper in progress) suggests migratory waterfowl contribute significantly to parasite transmission and abundance. This, coupled with new data documenting no real reduction for some lakes, even after several years of merganser trap and removal, has caused these lake associations to discontinue their trapping efforts in 2020.

Over the years riparians have employed a variety of self-help strategies such as toweling off after swimming or using various lotions and creams. None of these strategies have been proven scientifically, so results remain anecdotal.

The State of Michigan, with pressure from lobbyists, allocated \$750,000 of tax-payer money over 3 years (2017-2019) to battle swimmer's itch in Michigan. The MDNR worked with a loosely knit and unincorporated group of lake associations (Michigan Swimmer's Itch Partnership) and interested scientists to create a common merganser nuisance control permit, which allowed associations to hire trained personnel to trap and relocate their summer resident mergansers. In 2017, this appeared to be the best path forward. The newest data suggests otherwise for many lakes in Michigan.

Although a large portion of the state-allocated funds went towards conducting lake assessments and removing common mergansers, advances and discoveries were made with monies set aside for research, along with additional funding from supportive lake associations. These advances are providing hope and optimism by empowering individuals to prevent swimmer's itch in their own swim area. FWS and UA have been the major contributors towards scientific discovery, innovative control measures, and cost reductions in the battle against swimmer's itch these last 3 years. This document serves to educate lake front owners, municipal beach directors, lake associations, and government agencies on recent advances and strategies that give hope to all in our fight to prevent swimmer's itch in 2020 and beyond.

PREVENTION STRATEGIES

C. Everett Koop, Surgeon General during the Reagan Administration who led a frightened America through anxious times when HIV/AIDS came on the scene, was a man with conservative moral convictions, yet someone who let scientific data dictate policy. Research eventually showed condoms prevented AIDS, so Koop promoted their use, along with sex education in schools. He made this memorable closing remark during a timely Public Service Announcement broadcast to an anxious America after summarizing the new research results: "So, you don't have to get AIDS if you don't want to." That statement helped ease the fears of a nation.

We have good news! We have made enough progress and discovery these last three years to modify Koop's address: "So, you don't have to get *swimmer's itch* if you don't want to!" Like AIDS, we continue to work on a lake-wide cure. However, through education and implementation of various lakefront and/or individual strategies, we are confident lake-lovers of all ages can swim and enjoy the water beginning in 2020 without fear of ruining a vacation due to swimmer's itch.

The chart below lists pros and cons of most current prevention strategies that have some level of scientific support. A brief description of each strategy follows. Readers should understand no strategy can give 100% assurance of success and certainly no strategy is guaranteed.

<p>Disclaimer: All content in this document is created for informational purposes only. It is not intended to be a substitute for professional medical advice and should not be relied on as health or personal advice. None of the prevention strategies presented in this document are guaranteed to prevent swimmer's itch. These strategies are presented for educational purposes only and reflect the latest scientific data for preventing swimmer's itch. Employing any of these strategies, alone or in combination, can not guarantee prevention success and swimmers are warned they swim at their own risk.</p>		
Prevention Strategy	Pros	Cons
Swim After Lunch	<ul style="list-style-type: none"> • Usually warmest time of day 	<ul style="list-style-type: none"> • Limits swim time
Swim with Offshore Wind	<ul style="list-style-type: none"> • Parasite density lower 	<ul style="list-style-type: none"> • Limits swim locations
Adjust Swim Location	<ul style="list-style-type: none"> • Parasites more dispersed or non-existent in certain locations 	<ul style="list-style-type: none"> • Limits swim locations • Less convenient
Wear a Rash Guard	<ul style="list-style-type: none"> • Instant protection to covered skin • No mess or smell • Some with UV protection • No foreign chemicals to skin • No foreign chemicals to water 	<ul style="list-style-type: none"> • Limits fashion choices

Install a Swim Baffle	<ul style="list-style-type: none"> •Near instant protection •Protection for many swimmers 	<ul style="list-style-type: none"> •Added structure in water •Needs additional validation
Employ a Parasite Skimmer	<ul style="list-style-type: none"> •Near instant protection •Repeatable as needed 	<ul style="list-style-type: none"> •Some physical labor required •Needs additional validation
Trap and Relocate Common Mergansers	<ul style="list-style-type: none"> •Whole or partial lake prevention hoped for 	<ul style="list-style-type: none"> •Relatively expensive •Unknown ecological impact •Only controls 1 species •1-year lag time for results •Ineffective on some lakes •Becomes more difficult each year •May introduce problem to other locations

SWIM AFTER LUNCH

FWS/UA scientists were able to quantify the risk of contracting swimmer's itch as a function of time-of-day (Rudko et al.⁵, 2018). Since most of the itch-causing cercariae exit the snails in the morning and only live for a day, you would expect fewer cercariae to be around in the afternoon due to movement by wind, predation, natural mortality, etc. FWS/UA documented that riparians greatly reduce their risk of being exposed to virulent cercariae as the day progresses.

SWIM WITH OFFSHORE WIND

FWS/UA scientists were able to show a strong correlation between wind direction (onshore, offshore, alongshore) with cercariae concentration (Rudko et al.⁵, 2018), with significantly higher concentrations found with onshore winds.

ADJUST SWIM LOCATION

Results from work done in 2018 (Project '18 Final Report⁶) show cercariae numbers increasing near shore with an onshore wind, with very high numbers found within 1 meter from shore. Very few cercariae were found in deeper water when samples were taken at regular intervals on a straight line transect from shore to deep water with either an offshore or onshore wind. Some find relief by traveling to and swimming in nearby waters where the parasites are absent or greatly diminished. Others find blow-up kiddie pools placed down by the water an acceptable alternative for infant to 3-year-olds.

WEAR A RASH GUARD

Rash guards are tight-fitting one or two-piece swimsuits fashioned from combinations of polyester, nylon, lycra, or spandex for stretch, breathability, and quick-drying properties. They are relatively inexpensive and protect against most water-borne invaders, including the cercariae that cause swimmer's itch. Rash guards remove the need for creams and/or sunscreen (except to face), which eliminates foreign chemicals being applied to skin or added to the water. Additionally, rash guards work against all species of parasites.

INSTALL A SWIM BAFFLE

FWS/UA scientists innovated and conducted research on this prevention strategy in both 2017 and 2018. Results were very promising at multiple study sites and reduced risk by 90+ percent (Project '17 and '18 Final Reports^{6,7}). Different configurations were tested and optimized. The biggest advantage is in creating a safer swim area for multiple riparians (such as a public beach or popular swimming beach). Improvements can be made to lower costs, improve appearance, and increase effectiveness if additional funds become available.

EMPLOY A PARASITE SKIMMER

FWS/UA scientists created and conducted research on this prevention innovation in both 2017 and 2018 as well (Project '17 and '18 Final Reports^{6,7}). Since cercariae are mostly shed from snails in the morning and travel to the surface for the rest of the day, most can be easily "skimmed" off the water surface before swimming, similar to skimming leaves from a pool. This technique can be employed alone or in conjunction with a swim baffle.

TRAP AND RELOCATE COMMON MERGANSERS

This technique has the potential to impact the largest number of riparians on a lake. Effectiveness data are conflicting, with a couple of Michigan lakes reporting some prevention success while others are abandoning this technique due to minimal, if any, improvement. This technique requires costly initial assessment to obtain a nuisance permit from the MDNR and costly brood removal each year. Some associations are questioning the ecological impacts of removing an entire population of top-tier predators from a lake ecosystem; more study needs to be done in this area. Positive results take at least a year before they are realized. Research conducted by FWS/UA scientists in 2019 shows spring and fall migrants play a significant role on some lakes, making this technique less effective (paper in progress). Recent research shows relocated mergansers travel great distances from their release sites and swimmer's itch is now being reported in the Great Lakes near release sites. Additionally, some relocation sites show cercariae in the water (Relocation Site Analysis Final Report 2019⁸), which brings into question the sustainability of this technique.

SHIFTING PARADIGMS

Since Cort discovered the life cycles of common avian schistosomes in 1928, the established control paradigm has been on a lake-wide basis. Nearly a century later we still cling to this whole-lake paradigm, even with its limited application or success. Fortunately, private funding the past three years (2017-2019) from lake associations, coupled with public money from the Department of Natural Resources, has produced unprecedented progress in understanding many of the host/parasite dynamics. New findings are, out of necessity, driving a control paradigm shift, one which empowers individual riparians to achieve prevention success on their own beach without the need to rely on associations or government agencies. Work will likely continue on improving lake-wide control techniques, but fortunately, enough progress has been made so individual riparians can effectively reduce swimmer's itch beginning in 2020.

To better understand the emerging control paradigm shift for swimmer's itch, it is helpful to examine how we have learned to manage mosquitos and use it as an analogy for how we can better manage the itch-causing cercariae. Mosquitos were once viewed as worthless insects, serving as vectors for disease and a nuisance to those hoping to enjoy the great out-of-doors. Large-scale eradication efforts that introduced toxic chemicals into the environment were once employed in an attempt to wipe out whole populations of these pests. We've since learned mosquitos play a vital role in aquatic and terrestrial ecosystems, providing food for many higher animals. Mosquito control in the United States, in the form of mosquito bite *prevention*, is now left largely to the individual.

Controlling mosquitos on the patio or deck in order to enjoy a summer cookout comes with many options. Some find success burning citronella torches or fogging the area with a repellent. Others apply repellent, often containing various amounts of DEET, to exposed skin. Some will screen off part of the patio or deck to provide a mosquito-free environment. Others plan their social time when mosquito densities are lowest and move inside when environmental conditions favor the mosquitos. Still others will relocate their social event to areas less conducive to the biting pests. Maybe the simplest prevention measure used is to cover exposed skin with clothing and apply repellent to face and hands. Regardless of the prevention measures used, the paradigm for mosquito bite prevention is one that belongs to individuals, not associations or municipalities.

The parallels between mosquito bite prevention and swimmer's itch prevention are strikingly similar. For example, while most regard itch-causing cercariae as worthless, the newest research is revealing cercariae from snails may play a vital role in aquatic systems (*like mosquitos*), providing food for many higher animals. Creams and lotions (*like DEET repellents*) have been developed that anecdotally reduce swimmer's itch for some. Physical barriers in the water (*like screening off part of the patio*) in the form of baffles holds promise for creating large safer swim areas. Avoiding onshore winds and the morning hours (*like avoiding still, humid evenings for mosquitos*) will reduce the chance of getting swimmer's itch. Taking the kids to swim in nearby beaches where swimmer's itch is less prevalent (*like relocating the social event*) can also be effective. Maybe the simplest prevention measure for swimmer's itch is to cover exposed skin with a rash guard swimsuit (*like wearing protective clothing for preventing mosquito bites*).

The benefits of shifting the control paradigm towards empowering individuals to prevent swimmer's itch are many. Lake associations are battling many other concerns that can decrease enjoyment of our recreational lakes, such as invasive species, nutrient loading, and failing septic systems polluting the water. Lake associations often have limited financial resources. A paradigm shift toward empowering individual prevention

of swimmer's itch can free up larger amounts of money to battle these other pressing concerns. This makes even more sense for a lake association, since it's commonly reported that less than half of their members are susceptible to swimmer's itch to begin with.

Giving control of swimmer's itch prevention to individuals who are susceptible will assuage their fear of not knowing whether it is safe for the kids to swim on any given day, since they will have complete control over the outcome. Additionally, all the complexities of these itch-causing parasites, such as which waterfowl, which snails, and which species of parasites are involved become moot points. This reduces the need to spend money on additional assessment and research on these topics. Finally, bird watchers, nature lovers, and all riparians can enjoy watching the ducks, geese, and swans without concern they are contributing to swimmer's itch.

The good news is enough progress has been made in our battle against swimmer's itch these last three years to shift the paradigm towards individual prevention, allowing us to again paraphrase and repeat C. Everett Koop: "So, you don't have to get *swimmer's itch* if you don't want to."

GETTING INVOLVED

Riparians can educate themselves on the progress we've made these last three years and choose the prevention strategies that best fit their own situation. FWS and UA plan to embark on a large prevention technique assessment initiative across Northern Michigan beginning in 2020. We hope to recruit many riparians, from numerous lakes and locations, who are using these prevention strategies singly or in combination, to assess their effectiveness. Please contact your lake association for updates and to learn how you may become involved.

LITERATURE CITED

1. Cort, W.W. Further observations on schistosome dermatitis in the United States (Michigan). *Science*, 1928, 68 (1760): 388.
2. Froelich, K.L., Reimink, R.L., Rudko, S.P., VanKempen, A.P., Hanington, P.C. Evaluation of targeted copper sulfate (CuSO₄) application for controlling swimmer's itch at a freshwater recreation site in Michigan. *Parasitol. Res.* 2019, 118(5):1673-1677.
3. Blankespoor, H.D., Reimink, R.L. The control of swimmer's itch in Michigan: Past, Present, and Future. *Michigan Academician* 24: 7-23.
4. Rudko, S.P., Turnbull, A., Reimink, R.L., Froelich, K., and Hanington P.C. Species-specific qPCR assays allow for high-resolution population assessment of four species of avian schistosome that cause swimmer's itch in recreational lakes. *International Journal of Parasitology: Parasites and Wildlife*, 2019, 9:122-129.
5. Rudko, S.P., Reimink, R.L., Froelich, K., Gordy, M.A., Blankespoor, C.L., and Hanington, P.C. qPCR cercariometry as a method to quantify larval avian schistosome abundance and assess environmental and biological drivers of their concentration in recreational waters. *EcoHealth*, 2018, 15(4):827- 839.
6. Project '18 Final Report – Submitted to Glen Lake Association, Lime Lake Association, Lake Leelanau Lake Association, 2018.
7. Project '17 Final Report - Submitted to Glen Lake Association, Lime Lake Association, Lake Leelanau Lake Association, 2017.
8. Relocation Site Analysis Final Report – Submitted to Tip of the Mitt Watershed Council, 2019.

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IMPORTANT QUESTIONS AND ANSWERS

1. Would a paradigm shift from whole-lake management towards individual prevention mean progress towards an effective whole-lake control method would end?

No. Many people don't know that the avian schistosomes that cause swimmer's itch in Michigan serve as model organisms for studying schistosomiasis, a life-threatening parasitic disease afflicting 225 million people worldwide. These adult worms grow and reside in humans as their definitive hosts instead of waterfowl, causing death and disease to millions. Advances in our battle against swimmer's itch in Michigan may one day provide inspiration for life-saving techniques against this horrible human disease worldwide. This provides additional and more urgent incentive towards discovering a whole-lake cure for swimmer's itch. The good news is, enough progress has been made to where we can empower all riparians to prevent swimmer's itch with minimal effort now, while continuing our work towards broadscale control.

2. Is swimmer's itch control still the top priority for many lake associations in Michigan?

Yes. Many associations remain committed to helping their members swim without fear of getting severe cases of swimmer's itch. However, achieving this goal by simply removing summer resident common mergansers has not proven effective for some lakes and is not a viable strategy for most Michigan lakes. In fact, some lakes are discontinuing expensive merganser removal as a control method. Recent research shows migratory waterfowl contribute a significant amount to the problem. We are learning other species hosted by other waterfowl are also contributing to the problem. New species from snails never considered to be carriers are even being discovered. Some associations are questioning the wisdom of removing an entire population of waterfowl from the lake ecosystem. Others are concerned the problem is being transferred to the merganser relocation sites on Lake Michigan and Lake Huron. Additionally, research in 2019 showed at least half of all relocated hens with tracking devices did not survive the summer and mortality of the ducklings is unknown. This presents added concern for this prevention strategy. All told, this data suggests other ways to prevent swimmer's itch need to be explored.

3. Is there scientific evidence common merganser removal is not working as a control measure on some lakes?

Yes. Lime Lake in Leelanau County is just one example. Each summer for the last 5 years, all merganser hens and broods have been removed from Lime Lake. Yet swimmer's itch in 2019 posed a significant problem as measured both by estimating the number of parasites in standard water samples (half of the

collection sites showed severe levels) and by the number and severity of reported cases. Unsolicited reports from riparians in 2019 included *"...we are getting clobbered with swimmer's itch again this year...we had 5 people out of 6 get it yesterday, and it's our third case of the year in 3 attempts to swim..."*, and *"I just thought I'd report a horrible case of swimmer's itch to my whole group of family and friends after staying on Lime Lake for a week..."* Other lakes in the region report similar results after trapping all summer resident mergansers for the last 3 years.

4. We understand swim baffles can shield a swim area from the floating parasites. Will that make swimmer's itch worse for those swimming outside the baffle?

Right now, possibly. The baffles used to test this innovative prevention technique in 2017 and 2018 are made to control oil spills in the ocean. They proved effective in shielding the swim area from drifting cercariae and providing a safer swim area. However, the parasites do accumulate outside the barriers, which could pose a threat for water immediately outside the barrier. Fortunately, new designs are being considered that actually trap the floating parasites instead of just shielding them. New innovations in the near future promise to lower the cost, increase the effectiveness, and improve the appearance of this prevention method.

5. Why can't we just get permits to trap and relocate all species of waterfowl in the summer to help control swimmer's itch?

Waterfowl are viewed by the USFWS and MDNR as a public resource to be enjoyed by all, whether it be for bird watching or hunting them as a source of food. Obtaining a permit to remove all waterfowl from a lake ecosystem is not likely and would undoubtedly have negative impacts on the ecosystem. Since less than half of the swimmers react to the parasites and, it is likely the majority of riparians would be opposed to removal of all birds. Additionally, the costs for such a program would be prohibitive, even if permits were available.

6. Should I continue to report common mergansers in our area and even harass them to get them to leave?

With this prevention paradigm shift, you can enjoy watching the waterfowl in your area, knowing you can still prevent swimmer's itch for your family and friends. There is no need to harass or report any species of waterfowl unless specifically requested by your lake association as part of a research project. Remember, harassment of any waterfowl is illegal unless you have state and federal permits.

7. Should I reduce my giving to the lake association if swimmer's itch prevention is put into the hands of each riparian instead of being the responsibility of the association?

No! An added bonus of this paradigm shift is more lake association money is now available to combat important lake health issues such as nutrient loading, failing septic systems, and invasive species. These big

issues affect everyone, whereas swimmer's itch affects less than half the membership. We strongly encourage you to support your lake association, both financially and through volunteer efforts.

8. Do we know the ecological consequences of removing all mergansers from a lake?

Not yet. FWS, UA, and another U.S. scientist are seeking NSF funding to study the ecological impacts of removing entire populations of top predators from aquatic ecosystems. Proven ecological principles would lead us to predict there would be substantial disruption to an ecosystem if top predators are removed. Because of the novelty of this control method, science has not taken the time to evaluate the ecological consequences of merganser removal.

9. Why aren't prevention creams included in your prevention strategies?

To our knowledge, only anecdotal evidence exists for creams and lotions on the market today. Some people report prevention effectiveness while others claim little improvement. New products are being developed that may improve this option. All lotions and creams eventually end up in the water, but few if any studies have been done on their collective ecological impact. More research is needed in this area.

10. How can we learn more about the recent discoveries and innovative swimmer's itch prevention strategies presented here?

References for some of what is presented here can be found in the Literature Cited section of this document. Additionally, many lake associations have annual reports posted on their websites where you can read about recent progress in battling swimmer's itch and learn about some of these prevention techniques. If you have trouble with access, please contact your lake association and they will provide documents detailing our research and prevention strategies. Also check out websites for FWS ("freshwatersol.com") and UA ("swimmersitch.ca") to learn more.

FINALLY, ON A MORE PERSONAL NOTE...

Ron Reimink and Patrick Hanington both have "skin in the game" (literally!). Ron and his wife own a lakefront cabin in NW Michigan and have two young granddaughters who they want to come up and enjoy itch-free swimming. Patrick and his wife own a summer home on a lake in Western Alberta and want their young daughter to experience the same thing there. Both scientists continue to devote most of their professional lives to scientific discovery and expect continued progress towards successfully battling schistosome parasites around the globe. Some of the prevention strategies described above will be used in Ron's swim area in 2020, as he fully believes "you don't have to get swimmer's itch if you don't want to".