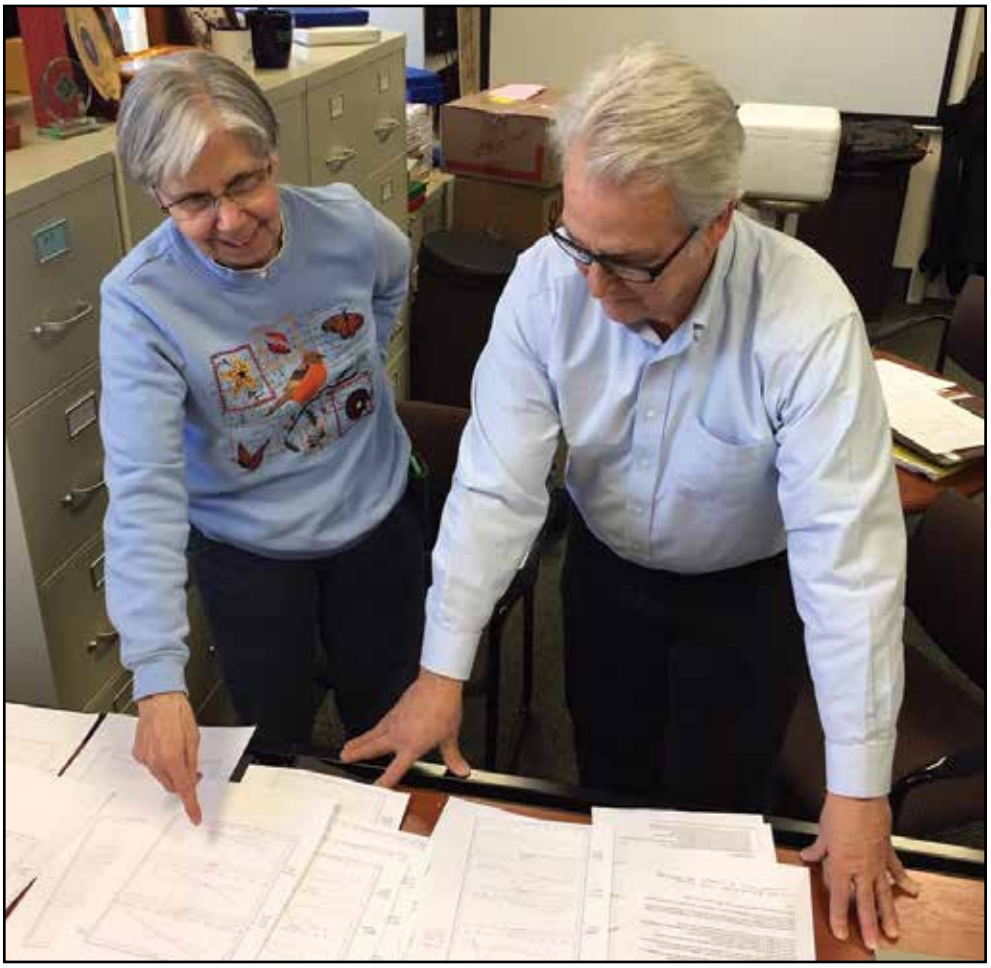
QUARTERLY

THREE LAKES ASSOCIATION SERVING LAKE BELLAIRE, CLAM LAKE AND TORCH LAKE IN ANTRIM COUNTY, MICHIGAN APRIL 2019

Golden Brown Algae Project Update

By Becky Norris and Rick Doornbos

The Three Lakes Association (TLA) has been working since 2015 to understand what has caused a substantial increase in the orange-brown diatom growth (Golden-Brown Algae, GBA) on the floor of lakes in this region. We began looking into this because people were noticing this material coating what had previously been clean white sand and because the Caribbean-blue color of the water was being distorted by the GBA. We initially obtained advice from three experts, Drs. Rex Lowe (University of Wisconsin), Patrick Kociolek (University of Colorado), and Jan Stevenson (Michigan State University), on developing a list of possible explanations for the GBA proliferation. The most likely explanation was deemed to be an increase in nutrients (primarily phosphorus and nitrogen), so this has been our primary focus over the last few years including working to determine where these increased nutrients might be coming from. Potential sources include surface water runoff, groundwater entering the lake, decomposition of organic material (including mussel tissue), and atmospheric deposition. This approach has led us to generate seasonal data on nitrogen and phosphorous levels, the two key nutrients upon which GBA growth depends. Thanks to the permission of a number of landowners, we have been able to collect GBA and water samples from several sites throughout the last four years. We have collected surface water samples, groundwater samples, and water samples at the interface of the lake water and lake floor, right where the GBA grows. In addition and thanks to the tireless efforts of one of our members, Art Hoadley, we have collected aerial photographs of the entire shoreline of Torch Lake taken monthly during the summer from 2015 through 2018. These photographs allow for an unbiased assessment of the extent of the GBA and changes over time.



Jan Stevenson and Becky Norris reviewing the 2018 phosphorus data from the GBA study.

Recently, members of the TLA Water Quality Team met with our primary consultant, Dr. Jan Stevenson, to review our findings to-date and work on plans to further our understanding of the GBA phenomenon. The following paragraphs summarize some of our observations from our 2018 activity.

A survey of 14 northern Michigan lakes was completed in 2018. The results of this survey confirm that GBA is known to be present in 50% of the lakes, especially those that have clear water where the visible

GOLDEN BROWN ALGAE continued on page 3

Sneak peek

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President's Message

Message from the President

I see green grass popping through the snow. Summer will be here, sooner rather than later.

We have actually had a busy winter. Your Board has been busy preparing for our summer programs. We have met with numerous organizations whose missions align with our mission, to pursue programs and projects that benefit us all.

This is your newsletter. If you would like to contribute and add pictures send them to tinanfields@torchlake.com.

As promised in the fall newsletter, I will tell you a little bit about myself. My wife and I reside in Custer Township on my wife's family homestead. When her parents passed away in the mid-2000, we purchased the farm from the other siblings to maintain its character and to assure that it remains in the family. We have been married 39 years this June.

We have one son, who is currently residing in Jacksonville, North Carolina. He is a Professor at North Carolina Coastal Community College. He teaches Anatomy and Physiology, Bioscience to Nursing Students, and Paramedics. He actually will be coming up this summer to assist with farm chores.

This 80 acre farm has been in the family since 1892. I have a creek that meanders through the farm and eventually enters into Lake Bellaire. Yes, what I do on this property can affect the quality of Lake Bellaire and its tributaries.

My wife and I are both Registered Nurses. I am the lucky one, retiring from my position as a Director of Emergency Services in Michigan and California. My wife is currently the Pediatric Manager at Munson Medical Center in Traverse City. I have served on numerous boards and commissions in the past. Currently, with my present position on the TLA Board, I also serve on Antrim County's 911 Board, the Township Ambulance Authority Board, and as President of the Mancelona Rotary. That term will be completed in June. There is life after retirement.

As I previously stated in the last newsletter, our initiatives will follow from last year as well as a new assessment of the three lakes on swimmer's itch, our intern program, our SEOP program, new boater safety regulations education, liaisons with Grass River Natural Area, and Paddle Antrim, to name a few.

We are going to have a busy summer. Please feel free to contact us if you have questions, thoughts, or suggestions. Please do not forget to renew your membership, as this is the foundation that allows us to continue our mission. Note in the Events Calendar the Annual Meeting Aug 1, 2019. Please mark it on your calendar. A location to be determined soon.

Lastly our new Executive Director, after serving one month has stepped down from that role, due to personal reasons. So, we will be looking to fill that position soon. Anyone interested can contact me at info@3lakes.com.

Until next time, be safe and enjoy our wonderful lakes.

Sincerely, Mike

New Members and Donations

New:
Gregg & Judy Blaszak
Brian & Laura Bosgraaf
Steve Cojei
William Dvorak
Caryn Edwards
David & Marian Geohegan
Kim & Lisa Hubert
Kurt & Amy Ieuter
Robert & Evelyn Isgrigg
Susan Judson
Mark & Kerry Kurowski
Michael Lucido
Jane Mercurio
Donna Miliano
Josh Reed
Tony & Anne Schmidt
John & Karen Seefeldt

Large donations:

William & Judith Owen	$300
David & Marian Geohegan	$300

memorial for Margery Geohegan
Carrying on the long family tradition of TLA membership

Brian & Laura Bosgraaf	$500
Robert Hockenberger	$500
Chris & Cindy Coble	$1,000

2 to 1 matching grant!

Golden Brown Algae *Continued from page 1*

growth of GBA on lake bottoms is readily observable. Of the lakes not reporting the presence of GBA, most are lakes with low visibility, dark lake floors, and high turbidity making it difficult to observe if GBA is present on the lake bottom.

Surface water samples, taken fairly close to shore, show, as expected (due to shore land influences) a slightly greater concentration of phosphorus than those obtained well offshore, over the deep basins. One sees a maximum phosphorus level with surface runoff due to snow melt in early spring and a slight falloff throughout the summer growing season, suggesting that overland phosphorus inputs are unlikely to be the primary driving influence of the GBA growth.

The groundwater samples, collected with little well points driven about two feet into the lake floor, have phosphorus concentrations higher than those of the surface water samples. These also show a slight falloff over the summer season, possibly due to dilution from water seeping into the ground from rain, lawn sprinkling, and septic drain fields. The fact that the higher concentration of phosphorus in groundwater entering the lake from below does not cause the surface water phosphorus level to increase is supportive of the possibility that the GBA is consuming it as nourishment to grow.

The interface water samples have been collected using an equilibration technique called peepers. The peepers we use are baggies made of dialysis tubing filled with distilled water and placed into rigid perforated plastic mesh tubing for protection. These are placed either directly on the lake floor or buried a couple of inches into the lake floor sediment and left in place for one or more days. Over this time, through diffusion, the levels of phosphorus inside and outside the baggies become equal. The interface phosphorus levels tend to be lower than the groundwater samples and higher than the surface water samples, again suggesting that consumption of phosphorus by the GBA is occurring.

Our data are consistent with the conclusion that phosphorus from groundwater seeping into the lake floor sediment is serving as a nutrient source for the GBA. However, we still have no data to determine the origins of the groundwater phosphorus. Human-associated possibilities that come to mind include agricultural and residential fertilizers and septic drain field effluents. One of our possible approaches to assessing septic drain field effluents as an important source of phosphorus in groundwater would involve collecting groundwater at intervals between the lake and the drain field, something that we have considered but not as yet attempted.

One of the particularly interesting findings from our seasonal data is that there is a fairly sharp drop in the phosphorus concentration of all of our sample locations in September, and that is the same timeframe when the GBA seems to be fading, its appearance having typically peaked in July or August.

We also have preliminary evidence that the diatom species composition of the GBA appears to be changing over the growing season, something suggested by diatom counts done on samples from 2015 and 2016. Typically, the lake floor sand contains lots of diatoms that are not visible to us. The visibility of the GBA is due to diatoms growing on the surface of the lake floor, some of which may have migrated from within the lake floor sand in search of nutrients. As the nutrients are consumed during the summer season, those diatoms that are the most able to grow in nutrient-poor conditions should become predominant. Diatom counts from the 2017 and 2018 samples will be very helpful in confirming if this change is occurring.

We do plan to continue to study the GBA for at least one more season, doing the same collections of GBA samples, water nutrient samples, and aerial photography. In addition, there are some other approaches underway or in preparation that may give us more understanding of what is driving the GBA.

A lake floor study that is currently underway seeks to determine the contribution of groundwater source nutrients on the growth and diatom composition of the GBA. Carefully constructed housings have been installed on the lake floor that allow the diatoms access to nutrients only from the overlying surface lake water or from both the surface lake water and the groundwater seeping up through the lake floor. A first harvesting of the samples from this experiment is anticipated in early summer this year (2019). Additionally, we have completed a similar study using a water bath under controlled conditions from which the samples are awaiting analysis. Lake sand was placed in housings bathed in harvested lake water and the diatoms allowed to grow. Some of the containers were exposed only to the nutrients in the lake water and serve as controls; some were provided additional nutrients only from underneath, to mimic groundwater as the source of nutrients; some were provided additional nutrients only from above, to mimic the impact of additional nutrients in lake water; and some were provided additional nutrients from both above and below. This study was conducted in duplicate, using two different sets of lake sand, one from a location with little visible GBA and the other from a location with abundant visible GBA. When analyzed, this study should demonstrate diatom species composition changes in response to these nutrient manipulations. The results of these studies should go a long way to determining the relative impacts of groundwater and surface water nutrients supporting the GBA growth.

Diatoms are at the bottom of the food chain; they are consumed by grazers, such as snails, by filter feeders such as mussels, by macroinvertebrate bugs, by crayfish, and by fish. A decline in the populations of any of the organisms that eat diatoms could result in an increase in the GBA. This is an area that we have not as yet explored. We may get some help this summer on testing this hypothesis from activity on a different project, swimmer's itch. A quantitative study of the snail population will be a part of the swimmer's itch effort. While this study will represent only a single point in time, it will at least allow us to know the current status of snail populations in our lakes. Future snail surveys could be done in association with documentation of future GBA appearance for comparison to the current status to see what trend, if any, is occurring.

One of the questions that we are often asked is whether the GBA is getting better or worse. To answer that question, we are asking for your help. We will be making the aerial photographs available for a number of sites and asking that people put them in rank order, from least to most apparent GBA. The photographs will be from different years and different months and you will not know which is which while doing your ranking. The compiled results (not identifying anyone in person) will help us to reach an unbiased assessment of any change over time.

We welcome your comments, questions, and feedback. Please contact us at info@3lakes.com.

Aquatic Invaders – We Pay Now or We Pay More Later

By Ed DeRosha

"A stitch in time saves nine" - this adage is particularly relevant when we consider the costs associated with meeting the threats posed by aquatic invasive species. The past several decades have witnessed an accelerated introduction of exotic plants and animals to the Elk River Chain of Lakes watershed. Curly-pondweed, Eurasian watermilfoil, purple loosestrife, invasive phragmites, zebra mussels are prime examples of exotics that have established themselves as invasive, since they negatively affect the ecological and economic health of the region. These species are known to reduce the diversity and resiliency of lake and stream ecosystems by crowding-out native species, disrupting food webs, and degrading habitat for associated insects, fish, birds and terrestrial animals.

The zebra mussel has provided an important lesson in the value of preventing the intrusion of invasive species. This species has transformed the ecology of our lakes after its relatively recent introduction from contaminated Great Lakes vessels in the 1980s. With its voracious filter feeding on phytoplankton and zooplankton, it has disrupted the base of the freshwater food web. By increasing the water clarity of the lakes, the zebra mussel has increased the growth of near-shore aquatic vegetation and bottom-dwelling algae, degrading water quality. The downstream effect is fewer fish, fewer waterfowl and fewer fishermen. In addition, anyone who has received a cut from inadvertently stepping on a zebra mussel while wading can attest to its ability to impair the recreation on the lakes. These effects negatively impact our local economy

AQUATIC INVADERS continued on page 5

What you can do to protect our waters from invasive species

• Limit nutrients running off your property by avoiding the use of fertilizers and maintaining a greenbelt of native plants at your shoreline

• Practice good boating and fishing hygiene: "Clean, Drain, and Dry" all watercraft and equipment between launches and stream entries (see placard)

• Become invasive aware and monitor your lake for aquatic invasive species described in either of the following identification guides and report any observations as instructed https://cdn.cloud1.cemah.net/wp-content/uploads/sites/63/2018/04/AIS-WatchList-2018.pdf or

https://www.watershedcouncil.org/uploads/7/2/5/1/7251350/ais-card-packet.pdf or

pick up a free set of waterproof aquatic invasive identification cards at the CAKE CISMA office at 4820 Stover Road in Bellaire 231-533-8363 Ext 5

• Especially important is the reporting of watchlist species (priority species that have not yet been reported in our area) Visit www.Mi.gov/invasivespecies for details or call Michigan DEQ Water Resources Division, 517-284-5559. You can also visit the Midwest Invasive Species Information Network (MISIN) website at http://www.misin.msu.edu/report/misin/?project=misin (A phone app for reporting is available at http://www.misin.msu.edu/tools/apps/#home)

• JOIN THE THREE LAKES ASSOCIATION'S VOLUNTEER NETWORK AND BECOME TRAINED IN INVASIVE SPECIES IDENTIFICATION AND REPORTING! Training will be held in in May. Contact your local Three Lakes Association zone director or inquire at info@3lakes.com

Aquatic Invaders *Continued from page 4*

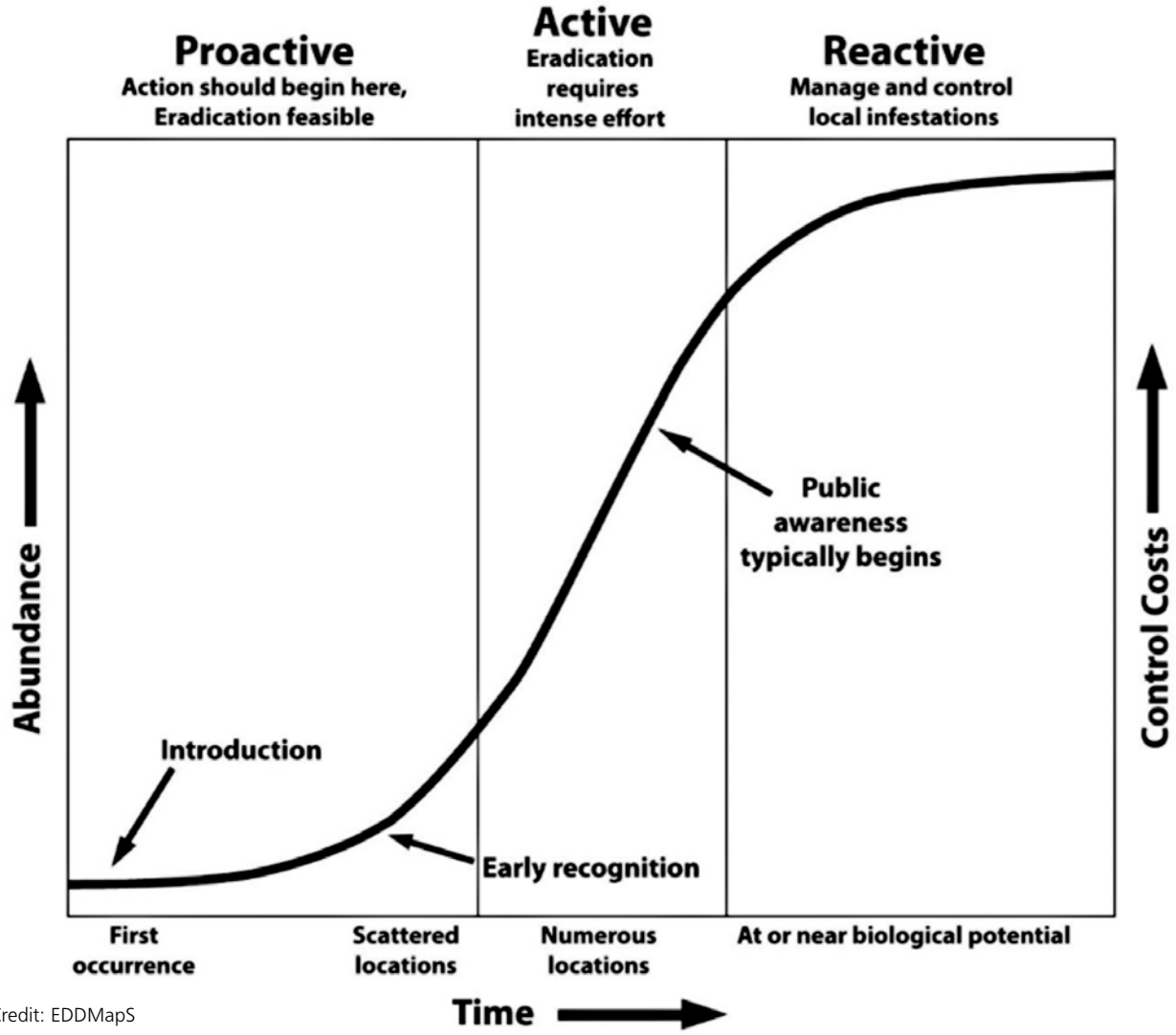
by discouraging tourism and hurting property values in our region. To compound the problem, no cost-effective, practical means of reducing the present density of infestations is currently available, nor is one anticipated. "The horse is out of the barn," so to speak. However, we can slow the spread of this and other aquatic invasive species, including Eurasian watermilfoil and curly-leaf pondweed, by cleaning, draining, and drying our watercraft and equipment before and after launching them. This is especially important in respect to boaters and fishermen who visit multiple lakes and streams.

In another instance, the story of invasive phragmites (Phragmites australis) in northern Michigan has demonstrated the value of early detection and control in the management of an invasive species. While some downstate areas are continuing to confront large expenditures of time and money to control phragmites due to delays in detection and action, our area has initiated control earlier in the growth curve of infestations. This has increased the effectiveness of control measures, reduced their associated costs, and decreased the rate of the plant's spread in our watershed. While phragmites still represents a threat to shoreline habitat, it appears to be controllable with persistent monitoring and treatment. The limiting of nutrient runoff to waterways is also important for the control of phragmites and other aquatic invasive plants such as Eurasian watermilfoil and curly-leaf pondweed.

The fact that purple loosestrife continues to spread in our watershed illustrates that spotty and inconsistent monitoring and control are a recipe for failure. Making substantial progress on this invasive plant will require consistent year-to-year monitoring and treatment with strategic use of biocontrol (Galerucella beetles), and aquatic-approved herbicides. Restorative seeding may also be helpful in some instances to discourage reemergence of purple loosestrife.

Knocking at the Door

Two of the most ominous threats that loom include the quagga mussel (think of a hardier zebra mussel) and the New Zealand mud snail. Both threaten to catastrophically disrupt freshwater food webs. Starry stonewort is a macroalgae that can form dense mats that degrade fish habitat and impair boating and other recreational use of waterways. Hydrilla is an invasive plant that forms dense mats, displacing other aquatic vegetation and also inhibits water recreational activities. Like most other aquatic invasive algae and plants, both these species can spread by fragmentation and are dispersed by watercraft and waterfowl. None of these invaders has yet been found in our watershed, so prevention is still possible.



Credit: EDDMapS

Phases of Invasive Species Invasion and Control

A Powerful New Tool for Water Quality Monitoring

By Ron Reimink
Freshwater Solutions, LLC

EDITOR'S NOTE: Ron Reimink is the owner and lead scientist with Freshwater Solutions LLC (FWS). He collaborates closely with Dr. Patrick Hanington from the University of Alberta. Together they bring the latest technological advances along with their seasoned field experience to battle swimmer's itch and other water quality concerns in Michigan. In anticipation of TLA's working with Freshwater Solutions beginning the summer of 2019, we asked Ron to provide a synopsis of several recent publications accepted for publication in peer-reviewed journals that showcase the use of a new tool they have pioneered for measuring the swimmer's itch parasite in water samples taken from swimming areas.

Introduction

Due to the generous funding from many Northern Michigan lake associations and recent methodological advances that make it easier than ever to implement molecular biology methods outside of large research labs, we have been able to make significant advances in our understanding of swimmer's itch in Michigan. The goal of all of our work/research is to publish the data and our interpretation of it in respected peer-reviewed scientific journals. The peer-review and publication process makes the information accessible; it also provides credibility that stems from the fact that experts in the field have reviewed our work.

Foundational to our swimmer's itch control and assessment efforts, as well as our research, is a process called quantitative polymerase chain reaction (qPCR). This method magnifies and, more importantly, quantifies target DNA from specific target organisms in a water sample. Using qPCR, we can take a known volume of water and accurately estimate the number of itch-causing parasites (cercariae), a direct measure of risk for swimmer's itch. An assay developed and published in 2015 quickly became the industry standard for measuring the cercariae of all species of parasite that cause swimmer's itch. This assay allowed us to unlock mysteries of the swimmer's itch parasites that have troubled scientists for decades.

What's even more exciting for those of us who care deeply about the quality of our water resources in Northern Michigan, is the usefulness of qPCR technology for other concerns such as enteric bacteria assessment and detection of invasive species. The labs of Freshwater Solutions serve as proof that implementation of qPCR methods in this way can be achieved, and more importantly, relied upon to provide accurate data on waterborne and water-based organisms of interest. Over the past two years, Freshwater Solutions has worked towards implementing a long-term vision for swimmer's itch control, assessment and research that is evidenced by our recently published manuscripts, and others that have been submitted for peer-review.

2018. Use of qPCR-Based Cercariometry to Assess Swimmer's Itch in Recreational Lakes. Rudko, S.P., Reimink, R.L., Froelich, K.L., Gordy, M.A., Blankespoor, C.L., Hanington, P.C. *EcoHealth*, p827-839.

Here we report discoveries using data from five lakes in Michigan. Included are findings regarding quantification of cercariae at various levels in the water column, effects of wind on accumulating cercariae along shore, and variances of cercariae in the water as a function of time of day. qPCR validation as well as water collection technique is also reported. FWS paid $3,000 to publish this as an Open Access document, which allows anyone with internet access to read our results. You can find it here: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6267424/

2019. Evaluation of Targeted Copper Sulfate ($CuSO_4$) Application for Controlling Swimmer's Itch at a Freshwater Recreation Site in Michigan. Froelich, K.L., Reimink, R.L., Rudko, S.P., VanKempen, A.P., Hanington, P.C. *Parasitology Research* (citation details in progress).

Killing the snail intermediate hosts by applying $CuSO_4$ to a swim area has been a common method of control for swimmer's itch in Michigan for decades. However, questions about the adverse effects of $CuSO_4$ to the water ecosystem have been mounting. We used qPCR technology to count the number of "worms in the water" (and therefore a direct measure of risk for swimmer's itch) for days before and weeks after the application of $CuSO_4$ to a swim area on South Lake Leelanau in 2017. Our results showed $CuSO_4$ to be effective at killing snails but had no significant effect on reducing cercariae counts, most likely due to the wind blowing cercariae back into the swim area.

Ron Reimink

2019. Species-specific qPCR Assays Allow for High-resolution Population Assessment of Four Species of Avian Schistosome that Cause Swimmer's Itch in Recreational Lakes. Rudko, S.P., Turnbull, A., Reimink, R.L., Froelich, K.L., Hanington, P.C. *International Journal of Parasitology: Parasites and Wildlife*. (*Submitted 12 February, 2019*).

Counting the total number of all species of itch-causing cercariae in the water revealed new information useful for exploring alternate methods of control. Dr. Hanington's lab, using a host of samples FWS collected in 2018, developed new cutting-edge technology in the fall of 2018, where we can now not only count the number of cercariae, but also determine the relative amounts of each species of parasite. These new assays will allow us to answer additional questions, thereby optimizing control.

2019. A New Schistosome Species Shed from *Helisoma* sp. Snails in Michigan and Alberta. (manuscript in progress)

In the life of a scientist, discovery of a new species ranks as one of the greatest thrills. What makes our discovery of a new schistosome in 2018 from five lakes in Northern Michigan and one in Alberta, Canada even more profound, is the cercariae were shed from a genus of snail (*Helisoma*) never before considered a host. Not only are we preparing a manuscript for publication of this new discovery, but we will be presenting our findings at the 2019 Annual Meeting of the Canadian Society of Zoologists at the University of Windsor in May. More research needs to be completed in 2019, but this discovery could have implications for swimmer's itch control methods in Michigan.

Groundwater: *The Sixth Great Lake*

From Flow's March 19th Newsletter: FLOW = For the Love of Water

There is enough groundwater in the Great Lakes Basin to equal the volume of Lake Huron, but this vital resource is threatened. FLOW stressed the importance of protecting Michigan's abundant groundwater resources during National Groundwater Awareness Week, March 10-16. Our groundwater package includes a video, two podcasts, blog posts, and other materials designed to educate about the source of drinking water for 45% of Michigan's population. Groundwater also provides up to 40% of the volume of the Great Lakes, yet has been allowed to deteriorate under Michigan policy. Visit http://flowforwater.org/sixth-great-lake/ for these materials.

There are 6,000 groundwater contamination sites for which little cleanup funding is available, 130,000 leaking storage tanks, and more than 2,000 contaminated groundwater sites that have been declared off limits for human consumption. FLOW is working to educate the public and decision makers in order to strengthen the state's groundwater laws and programs.

New Michigan Laws to Prevent Spread of Invasive Species

Submitted By Rick Doornbos

Effective March 21, 2019, the State of Michigan has implemented several new boating and fishing laws to help prevent the spread of invasive plant and animal species in Michigan waterways. Here is the full URL to view an article from the Michigan DNR that details these changes: https://www.clickondetroit.com/all-about-michigan/new-michigan-boating-and-fishing-laws-take-effect-march-21-what-to-know

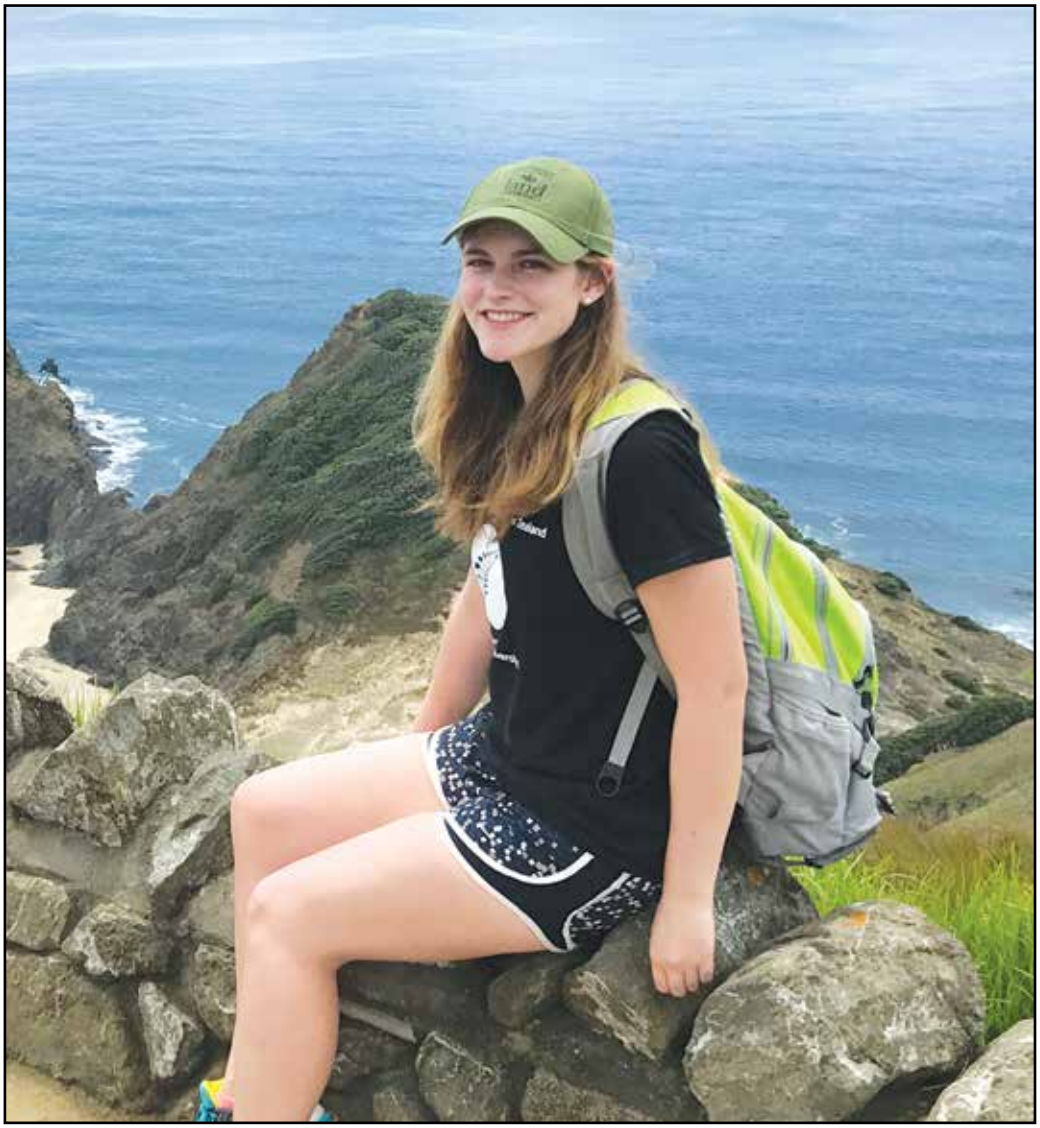
Here is a Tiny URL version to the same article: https://tinyurl.com/y5uhf5ds

2014 Summer Intern and MSU Grad accepts a position in Montana

By Haley Dole

In the summer of 2014, I was a high school intern for Three Lake Association. I worked closely with Executive Director, Leslie Myers, and TLA's Water Quality Chair, Becky Norris, who taught me a lot about freshwater ecology and the role of a nonprofit organization like TLA, in protecting and safeguarding this watershed. Every day was an outdoor adventure; collecting water samples, netting electro-shocked fish, and hiking up creeks to monitor macroinvertebrate populations. The fieldwork was fun and a great learning experience. I would recommend it highly for high school students looking to get their feet wet (literally and figuratively) with aquatic ecology and conservation.

Following my summer internship with TLA, I studied at Michigan State University. As an undergraduate, I worked in a plant-insect interaction lab, volunteered with salamander research, and studied Conservation Medicine abroad in New Zealand. In December 2018, I graduated with a B.S. in Environmental Biology/Zoology. I recently accepted a position with the University of Montana's Biological Station on Flathead Lake to gain further research experience. I plan to continue on to graduate school to study ecology in the future.



Haley Dole in New Zealand, during her term studying abroad.

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The mission of the Association is to provide leadership to preserve, protect, and improve the environmental quality of the Elk River Chain of Lakes Watershed for all generations with emphasis on Lake Bellaire, Clam Lake, Torch Lake and their tributaries.

Membership counts!

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Three Lakes Association is a 501(c) (3) corporation. Your dues and other contributions are tax deductible. Call for further information.

To join Three Lakes Association,

please visit our website 3lakes.com or return this form with your check to:

THREE LAKES ASSOCIATION, P.O. Box 689, Bellaire, MI 49615