

Grass River Connects: A Three Lakes Association and Grass River Natural Area Partnership

Grass River is a critical link in the Elk River Chain of Lakes (ERCOL). The 2.5 mile long Grass River connects Lake Bellaire to Clam Lake. It is surrounded by 1,492 acres of intact wetlands and forests that serve to filter fresh water into the river. These wetlands and forests are managed and protected by the Grass River Natural Area and are one of the last relatively pristine segments of a landscape highly fragmented by homes, resorts, golf courses, and agricultural lands.

Protecting, preserving and restoring this vital natural resource is the focus of the newly formed **Grass River Connects** - a collaboration between TLA and the Grass River Natural Area.

The goal of this group is to develop a long-term Management Plan for the Grass River watershed, which includes Grass River, its tributaries, shoreline and surrounding wetlands. This plan is intended to be a direct extension of the ERCOL watershed management plan (which is currently under final review, and was highlighted in the Feb '22 Newsletter). The plan will lay out specific solutions to remediate many of the pollutants, environmental stressors, structural hazards, and behavioral threats that compromise the Grass River. Solutions include reduction in sediment deposition, shoreline protection, wetland protection and

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Aerial View of the Grass River

preservation, invasive species management, road stream crossing upgrades, agricultural run-off mitigation, and climate change adaptation.

The Grass River Connects core team began a process of community engagement in the fall by launching a series of educational, consensus-building, and collaborative networking sessions. These sessions currently involve: land owners, local units of government, businesses within and near the watershed, and conservation groups.

We are are currently awaiting response from the Michigan Department of Environment, Great Lakes, and Energy (EGLE), about a grant we applied for to continue this work and accomplish the following goals:

- To build community engagement around action steps to improve the river's health.
- To collate all of the available data collected within the Grass River watershed and identify knowledge gaps.
- To build a strong sense of pride in and ownership of the Grass River watershed and its long-term health.
- To develop a ten-year management strategy for the Grass River that ensures its protection, preservation, and restoration and is consistent with the priorities of the ERCOL watershed management plan.

If awarded, the Grant will support the continuation of the community meetings GRASS RIVER continued on page 2



THREE LAKES ASSOCIATION

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Water Quality: Fred Sittel Membership: Todd Collins Education: Steve Laurenz Water Safety: Open Publicity: Open

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Executive Director Jeanie Williams

Administrative Assistant

Did you shrink wrap your boat for the winter? What are you going to do with that giant hunk of plastic? Did you know you could recycle it?

The Michigan Recycling Coalition has partnered with Dr. Shrink to make it easy.

What to do:

- Purchase a recycling bag from Dr. Shrink for \$7. This fee covers the bag, material collection, and recycling. Follow this link to get your bag: <u>dr-shrink.com/product/ez-fill-recycling-run-bag/</u>
- 2. Register your bag so it will be picked up by the Michigan Recycling Coalition. The registration form is at the link above.
 - a. Fill out the form and email it to: Katherine at <u>kfournier@michiganrecycles.org</u>

b. Return your registration by June 1, 2022.

- 3 You will then be contacted with details about how to schedule your pick up, or where you can drop off your bag.
- 4. Feel good about being responsible for thoughtful disposal of that big wad of plastic!



Grass River

Ccontinued from page 1

aimed at identifing and prioritizing water quality improvement projects and data needs, the development of a geodatabase to house all of the data we have and will produce within the Grass River Watershed, the creation of a media campaign to promote the importance of protecting and restoring the Grass River, and the development of a ten-year management plan.

With or without this grant, Three Lakes Association will work closely with Grass River Natural Area to ensure the Grass River remains pristine and navigable.



First Grass River Connects Community Meeting.

Torch, Clam, and Bellaire Lake Monitoring 2021: Crystal Clear

Submitted by Caroline Keson Tip of the Mitt Watershed Council

For nearly fifty years, volunteers have kept careful watch on Torch, Clam, and Bellaire Lakes. Cruising out to the deepest spots in each lake, volunteers have collected water samples and checked water transparency from early spring to late summer. Their work has provided a backdrop to many other studies over the years aiming to protect Torch Lake: from nutrient budgets and algae to fisheries and aquatic plants.

Water transparency was measured weekly by lowering a black and white Secchi disk into the water and recording the depth at which it was no longer visible.

Chlorophyll-*a*, a pigment found in all green plants and algae, was collected using a water sampler lowered to twice the depth of the Secchi reading. Water was then filtered and later analyzed at the University of Michigan Biological Station to estimate the density of phytoplankton in the water column. Higher chlorophyll-*a* concentrations indicate greater phytoplankton densities, which reduce water clarity.

These two parameters together can tell us about a lake's productivity, or ability to support aquatic life. Water that is clear contains less aquatic life. Most lakes in Northern Michigan are phosphorus-limited, meaning the growth of all living things in the lake is ultimately limited by the amount of phosphorus available. This is because phosphorus is an important nutrient for plant and algal growth, but is in short supply relative to other nutrients. This also means that too much phosphorus can cause algal and plant growth to spike, and reduce overall water quality.

All three lakes had characteristics of an oligotrophic lake in summer 2021, which means that they had few nutrients and represent good water quality.

Transparency on Lake Bellaire and Clam Lake is declining. Results from 2021 indicate that the two lakes are about as clear as they were in the late 1970s. The lakes may be rebounding from zebra mussel invasions in the late 1990s. Zebra mussels notoriously clear up water, but by doing so they change the natural equilibrium of water bodies and can ruin habitat on the lake bottom. Decreasing clarity in these lakes is probably a good thing.

Transparency on both basins of Torch Lake increased slightly, most notably in the North basin. It is unknown why clarity is increasing; however, invasive quagga mussels may be the culprit. Quagga mussels are similar to zebra mussels, but they can invade deeper waters, cover any substrate, and crowd out zebra mussels. TLA will be doing a survey on Torch Lake this summer to look for quagga mussels and quantify their densities. See the article on page 6 for more. Phosphorus is continuing to decrease on Torch Lake.

You can find the full report on the Home Page of the TLA website: <u>3lakes.com</u>

The Watershed Council is excited to improve our lake monitoring program in 2022 with a new database and electronic data entry for volunteers. We will be working with Three Lakes Association volunteers to implement the new system. We are also working with the Michigan Clean Water Corps (MiCorps) to improve their database.

Special thanks to our coordinating volunteer Cheryl Lynn Fields and monitoring volunteers Art Hoadley, Rick Myers, Norton Bretz, Mike Novak, and Christian Stoldt.

	Water Clarity (Feet below the surface)		Chlorophyll-a (ug/L)		Phosphorus (ug/L)	Overall
	Range	Average	Range	Average	September 2021	
Lake Bellaire	8-13	10.75	0.61-1.95	1.04	5.38	Low Nutrients
Clam Lake	7-13	10.2	0.53-1.42	1.01	6.41	Low Nutrients
Torch Lake North	36.5-41.5	39.1	0.003-0.14	0.036	0.48	Low Nutrients
Torch Lake South	22-50	32.6	0.03-0.32	0.19	.067	Low Nutrients

Summary of 2021 Water Quality Data:

New Members and Donations

We warmly welcome these new members:

Robert Anderson Beverly Clode Toby Beach – Fauver Family Cottage Adam & Cindy Grinde Gerald & Margaret Hummel Melanie Huttenga Raymond & Marguerite Karabin Wendy & Steven Kelley Donald & Camille Kurowski Murray Moore & Keene Guidry Mary Ann Porter Kristin & William Scarlata Jeffrey & Karen Swarbrick

A big thank you to these folks who recently gave \$200 or more:

Tim & Deb Broderick Beverly Clode Chris & Cindy Coble Brian Klaus Cliff Pixler Alan & Stacy Sollenberger Jeff & Karen Swarbrick

Evaluating the Groundwater Hypothesis for GBA

By Jan Stevenson, MSU Professor Lead TLA advisor on GBA

In this issue of the TLA Newsletter, I will continue to describe our investigation of the causes of the golden brown algae (GBA) on the bottom in Torch Lake and Lake Bellaire. I will focus this article on the Groundwater Hypothesis for GBA using the ecological assessment framework discussed in the February newsletter. In future newsletters I will describe other hypotheses for GBA and our research into those hypotheses.

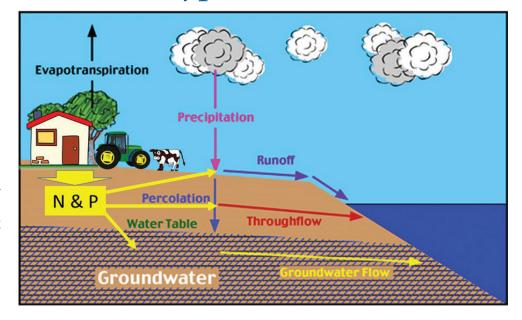
Our overarching goal when first approaching the GBA problem was to manage lakes for clear sands on the bottom. From there, we developed a conceptual model that could explain how many different factors could cause GBA. From that extensive conceptual model we developed a list of hypotheses for causes of GBA, including how groundwater contaminated with excess phosphorus could cause GBA.

We suspected phosphorus as a cause of GBA growth because excess phosphorus is the most common nutrient causing nuisance algal growth in regional lakes. Groundwater, versus surface water and atmospheric deposition, was targeted as the most likely pathway for nutrients that cause GBA to enter the lake because GBA grows on the lake bottom.

If phosphorus from streams, stormwater runoff, or atmospheric deposition were significantly stimulating GBA growth, it would be stimulating algal growth in the surface water (water column) of the lake, which had not been observed. Nutrients entering lakes via groundwater are known to cause algal growth on lake bottoms, so nutrients entering via groundwater is a plausible explanation for GBA growth in Torch Lake and Lake Bellaire where recent development of GBA has been observed.

One possibility was that riparian septic systems, lawn fertilizers and nearby agricultural and livestock operations could be contaminating groundwater with phosphorus and nitrogen. Research conducted in 2005 by TLA showed that groundwater is an important source of phosphorus to the lake. Groundwater carried about one third of all phosphorus entering Torch Lake with atmospheric deposition and tributary streams such as Clam River each providing a third.

Finally, groundwater contamination is an important hypothesis to evaluate because groundwater phosphorus contamination would be important to address as soon as possible. Groundwater moves slowly to the lake, so even if we stopped contamination at the 4



Groundwater flow paths from P source to lake. Nitrogen and phosphorus pollution from local sources, such as fertilizer and human and other animal waste, can enter lakes via surface water or groundwater (modified from an unknown source).

source, phosphorus pollution already in the groundwater would still enter the lake over many years.

Over the last 5 years we have gathered data to determine if we have evidence to support or refute the Groundwater Hypothesis. If groundwater phosphorus were causing GBA, we would expect the following:

- 1. Groundwater phosphorus concentration under the lake (lake floor groundwater) would be higher than phosphorus concentration in surface water;
- 2. Groundwater would be entering the lake through bottom sands and around cobble;
- 3. Phosphorus concentration would be higher at the sediment-water interface than in the water column, especially where GBA is present;
- Lake floor groundwater phosphorus would be elevated above natural background levels, indicating septic waste or fertilizer contamination;
- 5. Lake floor groundwater phosphorus would have increased from the time before the appearance of GBA to the time after GBA became noticeable; and
- GBA abundance would be related to increases in lake floor groundwater phosphorus concentrations, either spatially around the lake or temporally from before and after GBA appearance during the last 10 years.

We then developed a study plan to evaluate each piece of evidence for or against the Groundwater Hypothesis. The study plan was implemented over several years because we were constrained by cost and labor, but also because it would allow for what was learned to be applied from one season to the next.

Year by year TLA volunteers collected samples to stepwise address these hypotheses. Analyses of the samples provided chemical characterizations of lake floor groundwater, surface water, pore water in bottom sands, and well water.

Lake floor groundwater was sampled by using piezometers, which were narrow pipes pounded into the lake bottom and with tubing in the pipes that allowed us to draw water from 1 to 3 feet below the lake floor.

Surface water was sampled by dipping water out of the lake.

Pore water in bottom sands was sampled to indicate phosphorus concentrations immediately below the algae growing on the sand surface with two methods: from tubes lying horizontally under or at the sand surface or by extracting water from surface sand samples.

Well water samples were collected and compared to lake floor groundwater to determine if lake floor groundwater was contaminated by local human activities. Well water was considered to be representative of natural groundwater that has not been contaminated by riparian septic systems or fertilizers.

We also characterized the abundance of GBA in every sampling location to see if GBA abundance correlated to differences in phosphorus concentrations.

Groundwater

$Continued \ from \ page \ 4$

During the 2015-2021 sampling period, several lines of evidence indicated that groundwater was likely an important source of phosphorus for GBA.

- Phosphorus concentrations were higher in lake floor groundwater than in surface water.
- Water emerging from the tops of tubes inside piezometers indicated groundwater was entering the lake (in this case, through the tubes in piezometers).
- Phosphorus concentrations were higher in sand pore waters and at the sediment water interface where GBA occurs than in the lake surface water.
- In addition, we observed visual patterns of GBA in sands that indicated different lake floor groundwater flow paths could be affecting GBA (see aerial photo).

However, we did not find evidence that lake floor groundwater was contaminated with phosphorus from human activities as extensively as the occurrence of GBA around the lake would require.

- Phosphorus concentrations in lake floor groundwater were not higher than in well water at most locations studied, indicating that groundwater phosphorus was not contaminated with septic waste.
- In addition, lake floor groundwater phosphorus concentrations have not increased from 2005 to the 2015-2020 period, which we would expect if groundwater phosphorus caused the appearance GBA between 2010 and 2015, which is when we think GBA first started to grow and spread in Torch Lake.
- Finally, we did not observe a relationship between GBA abundance based on visual observations and measured phosphorus concentrations in lake floor groundwater. In fact, we observed GBA on structures like docks in the water and on rocks on the lake bottom that are not directly exposed to groundwater.

One other line of evidence indicates that groundwater phosphorus may not be causing GBA. I conducted an experiment that involved placing circular chambers of sand on the floor of Torch Lake. Open-bottom chambers allowed groundwater penetration to the sands in the chamber and closedbottom chambers blocked groundwater penetration to the sands. If groundwater were affecting GBA growth, we would expect that GBA in open-bottom chambers would be the same as GBA in the area surrounding the chambers, and GBA in closed-bottom chambers would be different from the surrounding sand and the open-bottom chambers. After incubation over winter, all 16 chambers had similar development of GBA in them, and the GBA thickness, color, and consistency were the same inside and outside all of the chambers.

Based on the evidence we have so far, all lines of evidence do not support the hypothesis that an increase in groundwater phosphorus from human sources has caused GBA. However, there is more to examine before rejecting this hypothesis completely. Lake floor groundwater phosphorus is likely related to GBA, because visual patterns of GBA on the bottom of the lake are associated with wave-like patterns of color on the sand. In addition, phosphorus concentrations are higher in lake floor groundwater than in surface water, so lake floor groundwater phosphorus likely does play some role in nutrient supply for algae growth on the bottom of the lake.

During the 2015-2020 sample period we also hypothesized that groundwater discharge into the lake was resulting in increased phosphorus in shallow nearshore regions, and that enrichment was causing GBA. After two years of sampling, we did not consistently observe elevated phosphorus concentrations in nearshore versus offshore surface waters. Therefore, we reduced the likelihood that that hypothesis explains GBA.

It is possible that groundwater stays very close to the lake bottom and does not mix readily with surface water because of differences in water chemistry and temperature. If this is true, it would explain GBA on docks and rocks and could still explain the persistence of GBA. However, it would not explain why GBA is present now, but was not present 20 years ago.

Also, perhaps we did not sample a sufficiently large number of locations around the lake to find relationships between lake floor groundwater phosphorus and GBA. Perhaps sampling more locations and in different ways would reveal results that support the Groundwater Hypothesis.

As likely as the Groundwater Hypothesis for GBA seemed to be at the start of this investigation, without sufficient consistency in lines of evidence supporting it, we should consider other hypotheses for the causes of GBA. Stay tuned for those ideas in future newsletters.



Jan Stevenson (on the ladder) pounding a piezometer into the lake bottom with Dean Branson and Trish Narwold.



This aerial photograph by Art Hoadley shows "waves" of algae that persist in shape and location from year to year.

2022 High School Internship Program

Each summer Three Lakes Association organizes high school students to study some aspect of our three lakes. TLA interns have studied the shoreline, the algae Cladophora, lake bottoms, water and phosphorus flows, E.coli, beach contamination, glacial relicts, groundwater, water quality depth profiles, and many other topics. To see the reports for all past projects visit <u>3lakes</u>. com/projects/summer-intern-reports/.

This year TLA will look at organisms living at the bottom of our deepest lake, Torch Lake. In 2007 TLA Interns collected samples from the deep lake sediment to determine if a certain tiny, shrimp-like crustacean, Diporeia, still lived there. This particular creature was first introduced to our lakes when they were still connected to the oceans literally millions of years ago and have found the environment welcoming ever since. They are also easy to see and count, and TLA has several previous studies with which to compare this year's observations, going back to the 1950s.

We are going to use small sampling dredges to take a few centimeters of sediment from the bottom, where Diporeia live along with a few other

species such as opossum shrimp and zebra mussels. And we need four high school interns to help us.

Students must attend high school in Mancelona, Bellaire, Elk Rapids, Central Lake or Kalkaska, have an interest in environmental science and be highly motivated. We will meet one morning per week all summer: June-July to collect and sort samples, and in August to write up the results into a formal report. Students will also create a presentation for the TLA Board of Directors and their school board.

Applications are available now and will be accepted until May 13. This is a competitive process, and a cometitive process. Successful applicants will participate in original research and get access to skilled scientists. They will learn professional sampling techniques and gain a thorough understanding of this part of Torch Lake. A cash stipend is awarded upon successful completion of the project.

All of the details and the application are available on our website: 3lakes. com/summer-internship-program-2022/ Please encourage the high school sophomores, juniors and seniors in your life to apply.

>0.5 mm <





Opossum shrimp





Zebra mussels



Activities at TLA

By Steve Laurenz Education Chair

One of the primary goals for the Three Lakes Association is helping preserve our precious water quality. This effort includes monitoring, understanding threats, and implementing safeguards to mitigate threats. But that alone is not sufficient.

The knowledge acquired needs to be passed onto our members and others in the community through education. This is done through adult educational events and, most importantly, educating our youth about our surrounding lakes and giving them knowledge about environmental stewardship.

We are excited to announce that TLA's educational efforts are being enhanced in 2022. By expanding our education team, we hope to address these needs. Established goals include:

- 1. Hosting one or two adult education events to communicate what TLA is learning. We will announce the dates for our events in the next newsletter, out the end of June.
- Helping to promote a boater safety 2. program in conjunction with the local Sheriff's office.
- 3. Promoting science education in our schools by providing financial grants for experiential environmental education (field trips, transportation, equipment, etc.). Grant Applications will be available in May and due in July.
- Provide a water-quality related high 4. school internship program for any curious and motivated student. See the related article on this page announcing the details of the project for 2022.

If you would like to help out with any of these projects, or the Education Team in general, we welcome your support. Please reach out to info.3lakes@gmail.com.



PONAR Dredge

The Tiniest Creatures

Submitted by Heather Smith, Baykeeper at The Watershed Center of Grand Traverse Bay &

Caroline Keson, Monitoring Programs Coordinator at Tip of the Mitt Watershed Council

Torch Lake is often talked about in grand fashion, as it is the deepest inland lake in Michigan and rated among the top most beautiful lakes in the world. The lake itself is large and so are its major inlets and outlets, the Clam and Torch rivers, which connect Torch Lake to the 75-mile Chain of Lakes. While many of us have boated or kayaked in these rivers, have you ever thought about the miniscule streams that feed Torch Lake? What about the tiniest creatures that live in them, act as indicators of stream health, and provide food for fish?

Streams like Eastport, Spencer, and Wilkinson creeks can contribute cold water and nutrients to the lake as well as provide for fish habitat. Within them live tiny aquatic creatures, called macroinvertebrates, that can tell us about water quality. Two organizations monitor those streams for macroinvertebrates and are looking for your help!

The Watershed Center Grand Traverse Bay (Traverse City, MI) and Tip of the Mitt Watershed Council (Petoskey, MI) work together to protect surface water in Antrim County. Both organizations have stream monitoring programs based on the Michigan Clean Water Corps (MiCorps), a statewide network of volunteers who collect and share water quality data. MiCorps protocols were developed by state water resource professionals to gather valuable data on stream

Mayflies are sensitive macroinvertebrates with gills on the outside of their bodies. Before they hatch into flying adults, their presence in streams can tell us good things about water quality. Photo courtesy of Tip of the Mitt Watershed Council.



A Stream Monitoring team readies a tray of macroinvertebrates for sorting. Photo courtesy of Tip of the Mitt Watershed Council.

health. By using MiCorp's protocols, The Watershed Center and Watershed Council compare stream scores across space and time to understand trends and identify potential issues. Each stream is assigned a score, which is based on macroinvertebrate sensitivity to organic pollution.

Previous macroinvertebrate monitoring on Eastport, Spencer, and Wilkinson creeks found that these tributaries range in quality from poor to good on a scale of very poor to excellent.

Eastport Creek runs 8.5 miles into the north end of Torch Lake. It was monitored from 2005 to the present by Watershed Council volunteers, earning a score of good.

From 2009-2011, Watershed Center volunteers monitored Spencer and Wilkinson creeks. Spencer Creek runs 5.5 mile before emptying into Torch Lake on its southwestern side. Wilkinson Creek connects



with Torch Lake on the lake's northern side and runs nearly 3 miles in length. While data is limited on these two tributaries, both streams fluctuated between "poor" and "fair" scores.

According to habitat surveys conducted in 2009, both Wilkinson and Spencer creeks have suitable in-stream habitat diversity; Spencer is dominated by silk/muck/detritus substrates while Wilkinson has more diverse substrates that include boulders, coble/gravel, sand, and silk/muck/detritus. Monitoring these streams again will allow us to assess whether their water quality has changed in any way.

Three Lakes Association is working with the Watershed Center and Watershed Council to recruit more volunteers to help monitor these streams.

The next training will be held by the Watershed Council in the Torch Lake area in September 2022, and all interested volunteers are encouraged to attend. Volunteers will learn the basics of stream monitoring before stepping into a pair of waders and using nets to collect macroinvertebrates.

There are additional volunteer tasks beyond collecting macroinvertebrates, such as sorting through macroinvertebrates and filling out datasheets. Visit <u>https://www. watershedcouncil.org/attend-an-event.html</u> to sign up or call the Watershed Council's office at 231-347-1181 to learn more.

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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. This newsletter printed on recycled paper