QUARTERLY

THREE LAKES ASSOCIATION SERVING LAKE BELLAIRE, CLAM LAKE AND TORCH LAKE IN NORTHWEST MICHIGAN AUGUST 2022

The Unstoppable Dean Branson

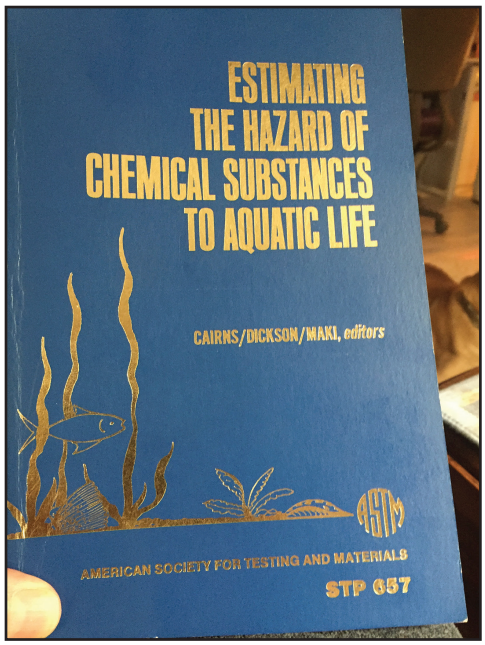
By Jeanie Williams with contributions from Norton Bretz, Tina Fields, Gary Knapp, Becky Norris, and Fred Sittel

Dean Branson's first inclination when he moved to Torch Lake was to start asking questions about water quality. If you know Dean at all, that sounds about right! Before long, folks pointed him in the direction of Jack Norris, TLA president at the time, and the two of them started talking about developing a predictive water quality model for Torch Lake based on phosphorus.

In his time as an environmental biochemist at Dow Chemical, Dean had done a lot of important modeling, so he understood the power of models in decision making. This model would study the phosphorus cycle in Torch Lake, in part to determine the impact development in the watershed might have on lake nutrient levels.

When Dean first stared at Dow his team was looking for a selective insecticide that would kill insects but not harm humans. He performed studies with rats to track where the chemicals they tested ended up (urine, fat, muscle, etc). This work on rats led him to questions about fish. He wondered, can you predict whether a fish will accumulate a chemical (any unknown chemical) in its tissues from laboratory studies? If so, this type of study could potentially prevent toxic chemicals from being released into the environment.

Turns out, Dean *was* able to develop techniques that could be used to screen chemicals for fish toxicity and his findings were part of a book published by a conference hosted by the EPA in Pellson, MI in 1978.



Cover of Journal where Dean's article on Fish Toxicity Screening was published.

Early years

Dean grew up in Montana and studied chemistry at the University of Redlands, near San Bernardino, CA. In summers, he worked with a professor to study lysozyme (an enzyme that breaks apart cells) as a cancer chemotherapy treatment. Part-way through his junior summer he was called home to Billings to be with his mother, who was in the last stages of terminal breast cancer.

Being unable to fully leave the research behind, he convinced the oncologists in Billings to let him use their lab after hours. The nurse taking care of Dean's mom, Sharon, brought Dean blood samples from patients throughout the hospital for him to analyze for lysozyme. With this test he could determine who had cancer and who did not. Needless to say, Sharon and Dean got well acquainted during these night shifts. Back at school Sharon and Dean exchanged letters to keep their relationship going, and they got married right after he graduated.

Sharon and Dean had three children: David, Doris and Dennis. The family liked to go camping and frequented the Torch Lake region in the summers. When it was time for Dean and Sharon to enter retirement, they purchased a house on Torch Lake - - maybe one year too soon, since Dean still had another year to go at GE in Indiana before he could retire. Dean could never be accused of dragging his feet!

Dean's last job at Dow was the highlight of his career. He was charged with implementing recycling programs in National Parks so spent his days in places like Mt. Rainier, Yosemite, and Everglades National Parks. He'd do that job again for free. Dean capped off his career at GE as a Product Stewardship Manager, helping GE use chemicals in a safe way.

A New Chapter on Torch Lake

Once committed to Torch Lake, Dean's boundless energy had fresh opportunities for play and the Phosphorus Lake Model was an ideal playground. Even though the Department of Environmental Quality typically focuses their resources on imparied waterways, Dean and his new Torch Lake friends were able to convince the DEQ to dedicate resources to instead determine how a pristine lake works.

Creating the predictive water quality model required a lot of homework and revealed some dead ends. It eventually involved many researchers and included a lot of data collection by TLA volunteers. Norton Bretz moved to Torch Lake about the same time Dean did and the two of them were deeply involved in the development of the model. One aspect was to document the profiles of temperature, salinity, pH, and oxygen in Torch Lake for every month of the year.

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Sneak peek

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Spring, summer and fall were relatively easy to do with a good boat or pontoon, but accomplishing this all winter was a challenge. Suffice it to say, they all survived, even though they were scared out of their boots when putting a hole in the ice resulted in a pressure crack and major boom!

Dean was also a significant driver in encouraging a PhD student on the Tufts University research team to develop a model for the calcium precipitation cycle that carries phosphorus to the bottom sediment. We now have a scientifically rigorous description of Torch lake that we did not have before.

TCE Plume

The phosphorus model was finished in 2006. Dean still uses it as a touchstone in nearly every project he is involved with. Shortly after the model was completed, Dean met Gary Knapp. Gary had a long career in criminal justice reform, and through his work in community development he became acquainted with the threats of an underground trichloroethylene plume (TCE) near Mancelona. Dean's background in environmental chemistry and his collaborative and persistent nature made him the perfect colleague in this undertaking.

TCE is an industrial solvent and a carcinogen, which was routinely dumped into the soil at the end of its useful life, resulting in a six-mile plume of contamination that impacted hundreds of residential and commercial drinking water wells. This, paired with a parallel five-mile plume of contamination stemming from the EPA Superfund Site known as Tar Lake, led local residents to organize for a solution.

Antrim County United Through Ecology (ACUTE) was formed in 1998 to address the contamination and take advantage of Technical Assistance Grants (TAG), administered by the EPA, in order to give affected communities "a seat at the table and a voice in the (cleanup) process."

Dean represented TLA in ACUTE and was a tireless and tenacious advocate, especially for nano-iron technology, which could render TCE harmless. Dean researched the technology exhaustively and talked to anyone and everyone who might know something about it. Unfortunately the problem, the largest TCE spill in the nation, was too large to practically use this solution.

In addition to advancing knowledge about this treatment option, the ACUTE community engagement process resulted in productive partnerships between local units of government and state and federal regulatory agencies, and the avoidance of a lot of litigation, which tends to support lawyers more than the environmental crisis at hand.

Most importantly, it resulted in providing potable water to those impacted by the two plumes through the creation of the Mancelona Area Water and Sewer Authority and a new, extensive municipal water system.

As President

Being community-focused and tireless, Dean was also thoroughly involved with the Elk Rapids Rotary. His enthusiasm once found him as president of both Rotary and TLA at the same time, something he definitely does not recommend!

During Dean's tenure as president, he got TLA involved in the Adopt-a-Stream program hosted by Grand Traverse Bay Watershed Center - - without consulting

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Building of Fish Shelters

Dean Branson *continued from page 2*

the board of directors! This was a good example of Dean's propensity to put his enthusiasm for a project ahead of organizational processes, but of course, the program was completely in-line with the TLA mission. It also generated important data on local streams and developed community knowledge on how to collect and identify stream macroinvertebrates and use them as indicators of stream health.

Also as president, Dean and his wife, Sharon, graciously hosted the whole TLA board for several delightful Christmas gatherings at their home on Torch Lake.

We could go on for pages about the ways Dean guided our high school interns, spoke up at meetings, scoured scientific literature, advised on woody debris restoration in Grass River, crafted an endless stream of possible studies, and contributed his time and pontoon boat over and over again. But we have space for just two more stand-out stories.

Fish Shelters

TLA's leading role in the Elk River Chain of Lakes Fish Shelter Project is well documented. The project engaged TLA with three other lake associations, the Antrim Conservation District, the Watershed Center of Grand Traverse Bay, Tip of the Mitt Watershed Council, quite a few Townships, the DNR Fisheries Division, many riparian property owners, a large number of construction savvy volunteers, and recreational fishing enthusiasts throughout the area.

What many people don't know is that the Fish Shelter Project originated due to the vision and hard work of just one person, then TLA President Dean Branson. Dean got wind of a state permit being issued to the Lake Charlevoix Association to place fish shelters at a large number of different locations around their lake. He arranged to meet with them on a gloomy late winter morning in 2011 and learned a lot from their difficult permitting experience.

A key takeaway from that winter morning gathering was to start the process with a pre-permit application meeting to which he invited representatives from DNR's Fisheries Division. This greatly upped the odds of permit issuance the first time around. Dean still uses this process each time permits are needed.

Dean then wondered, if a single permit could be had for many locations around one lake, why not submit an application for many locations around multiple lakes? Doing so would reduce paperwork and introduce economies of scale to material purchasing and construction of the shelter structures.

The first shelters were deployed in 2012, and ultimately placed at eighty predetermined locations across five lakes of the Chain of Lakes. You can find a map to all of them here, https://www.3lakes.com/fish-shelters-overview/.

Thanks to Dean's vision, the Fish Shelter Project ended up checking all the boxes: collaboration, community recognition, improved habitat, enhanced recreation, and volunteer development, to name a few. The fish shelters still attract fish, and fish-seekers, today.

Benthic Algae

This final story is ongoing. It is emblematic of everything you have learned about Dean so far. He sees a problem, researches it thoroughly, seeks out an opportunity (usually a big one), brings in many experts and collaborators, and makes it a robust and impactful project.

During the past eight years, Dean Branson, Becky Norris and others have collaborated on attempts to solve the puzzle of recent and extensive, orange-brown lake floor blooms of diatoms – the stuff we have been referring to as Golden Brown Algae (GBA). At the beginning, Dean found an expert in diatoms, Dr. Jan Stevenson from Michigan State University (MSU), to work on the problem, and since then has personally assisted in sampling lake water, ground water, and lake floor algae for analysis, and has recruited others to do the same. He was also the driving force that arranged a conference of scientists at MSU for a conversation about collected data and its relevance to hypotheses concerning the causes of the GBA. Dean has been calling for a repeat of that meeting for the past several years.

The diatoms are native (not invasive) and, so far as is known, not harmful. But their recent and increasing abundance are a biological change that may presage an impact on water quality.

The GBA phenomenon is not just present in the three lakes we most identify with; it is also found on lake floors of many lakes in northern Michigan, and very possibly a lot of other places, too! However, the Three Lakes Association is the only lake association consistently committed to understanding and, hopefully, mitigating the GBA presence.

Dean has always been TLA's most effective ambassador to other lake associations, sharing what we have learned and recruiting their collaborative efforts to study and understand the GBA phenomenon. Just this May he arranged a meeting with several lake associations in Leelanau County for this very purpose.

The Dean Branson Way

Few volunteers are as energetic, tenacious, and committed as Dean Branson to preserving and protecting the precious and excellent water quality of our regional lakes. And few are as effective in recruiting others to help with these tasks as Dean. If you have had the good fortune of working with Dean you also understand the tremendous value he brings to every project.

No matter what the unstoppable Dean Branson does next, his legacy is extensive and his influence enduring. We could never thank him enough. May his work on water quality be an inspiration and a road map to all who follow in his footsteps.

May 10 meeting at West Side Tavern with TLA, researchers Jan Stevenson and Steve Hamilton, chemist Helen Habicht and representatives of Leelanau County Lake Association to discuss the extent of GBA spread in area lakes.

Full Aquatic Plant Survey of Torch Lake Completed!

The full plant survey of Torch Lake funded by the Dole Family Foundation and conducted by the Tip of the Mitt Watershed Council in 2021 is now complete! This is the first comprehensive aquatic plant survey of the entire lake perimeter that has been completed for Torch Lake.

Plant Bed on the East Side of Torch Lake (from 2012 video footage by YouTube user Kurt Schuler.)

Background

The Eurasian Watermilfoil (EWM) Task Force was started in 2020 as a joint effort between Three Lakes Association and Torch Lake Protection Alliance. The objectives of this team were first to assess the growth of this invasive species in Torch Lake and then to develop a long term monitoring/treatment plan to keep it from spreading and to eliminate it where possible.

Initial steps to manage EWM were to determine sizes of known milfoil patches followed by chemical treatment of EWM patches. This bold action was important to prevent milfoil from spreading, however it was not the preferred long-term solution. Our team has now shifted its focus to evaluating non-chemical treatment options combined with native plant restoration as a more effective long term solution to control and potentially eliminate EWM infestation. To do that, we needed a comprehensive plant survey of the entire lake to confirm any new locations of EWM and to understand the composition and extent of all plant communities in Torch Lake.

This plant survey also serves to facilitate permit applications for future treatment methods, such as diver assisted suction harvesting, as required by state agencies, which often want detailed documentation of adjacent plant beds. Plant and algae growth are important indicators of lake aging (yes, even lakes age) so this survey would also provide an important baseline of all plant species and their locations that will help us track the ways Torch Lake is changing over time in a quantitative way.

Key Results

One of the most important findings of this survey was the fact that we did not find any new or previously unknown patches of Eurasian watermilfoil. It appears that the EWM that is present in Torch Lake, is limited to the 5-6 known patches on/near the lake that we have been monitoring and treating for the last few years. In addition, we did not find any other invasive aquatic plants in Torch Lake, which is really good news!

Secondly, we learned that 16 different aquatic plant species live in Torch Lake. Muskgrass (*Chara sp.*) was found at 47% of the sampling locations, and accounted for 97% of all of the vegetated area. Muskgrass is actually a native macro alga that is often finely coated in lime and smells a little musky. It often grows in monoculture and is an indicator of good water quality.

Most locations with plants were at a moderate or very light density, and the average number of species per location was just under 2.

Lastly, the majority of Torch Lake has no plants at all, which you probably already knew! Just under 2% of the littoral (or shallow) zone is covered in plants; more than 98% of the littoral zone is plant-free. There are no plants at all in the deep zones, which is typical for all lakes. This makes Torch Lake one of the least vegetated lakes in all of northern Michigan.

The survey also covered the Torch River lagoon located near the south end of Torch Lake. This area was created through dredging in the late 1800's and early 1900's. The substrate disturbance and shallow, slow-moving water, make it prone to plant growth and invasive species establishment; 37% of the lagoon is covered with aquatic vegetation.

Plant density was much greater in the lagoon than in the main lake. Plant diversity was also greater (20 species and an average of 3.5 species per location), as was the extent of EWM, which was found at nearly 50% of the sampling locations.

Places where sediment and debris can catch and collect will be more prone to plant growth; sheltered shores, depressions, obstructions and river mouths can all provide these conditions. Sediment disturbance, such as dredging will also encourage plant and especially invasive species growth. We did not find much growth in Torch Lake at river and stream mouths, but the rest of these conditions did foster aquatic plants.

Many more details on methods and findings are included in the full report that can be found on the TLA website at 3lakes.com. In addition, you can also find information on comparisons to other lakes and insights on how aquatic plant species and densities in Torch Lake may have changed over time.

Next Steps

Over the summer Tip of the Mitt Watershed Council will build a Story Map about the plant survey, which should be available by the time you get our next newsletter in October. A Story Map is an interactive website that includes maps and diagrams which allow the user to visualize the data and manipulate their view so they can explore the data in more depth.

The Story Map will also house data from our EWM monitoring volunteers who several times a year observe the growth rate of existing EWM patches and track the effectiveness of treatment methods. If you have an interest in volunteering as a member of this EWM monitoring team, please email us at 3lakes.info@gmail.com or call: 231-412-7551.

Thanks again to the Dole Family Foundation for funding this important plant survey and to you, Three Lakes Association members, for allowing us to co-sponsor this project along with Torch Lake Protection Alliance. We were motivated to do this study to protect Torch Lake from the encroachment of invasive species, especially Eurasian watermilfoil, but it also showed us another beautiful aspect of our lake. Small but very beneficial patches of native plant species like leafy pondweeds and billowing wild celery, shelter fish and create quiet and serene oases of greenery in an otherwise bright and glowing water body. We are getting to know and appreciate this less well-known part of Torch Lake too.

Announcing the 2022 Three Lakes Association Student Interns!

Many talented and passionate high school students applied for this year's internship program. We are delighted to announce the interns for 2022: Aaron Brown of Mancelona High School, Freddie Shannon of Bellaire High School, Maddie Birgy and Nevaeh Wise of Kalkaska High School, and Morgan Standfest and Nils Stoldt of Elk Rapids High School.

We asked each student to tell us one thing they want to try or learn this summer. Their answers included: make new connections, spend time on the water, learn new things about the lake, get some experience with science, and figure out what they want to do in college. We feel pretty confident all of them will get what they are hoping for!

The internship program will be led by a highly skilled team. Norton Bretz, Dean Branson, Gary Bart, Fred Sittel, and Jeanie Williams are TLA board members and riparians on each of our three lakes. They bring advanced skillsets from their professional lives (physics, education, chemistry, skilled trades, engineering, biology, and facilitation) and decades of experience living with, studying, and protecting lakes and streams. Experiential Ink will manage the logistical and social aspects of the program. Their team includes David Yuhaus, Katie Kraft, and Zac Roth, who bring backgrounds in camp management, outdoor education, biology, and neuroscience. Additionally Katie is a certified lifeguard and Zac is an EMT.

This summer we will be looking for the life on the bottom of Torch Lake. We expect to find invasive zebra mussels and small native crustaceans. We don't expect to find a lot of them though, because the crystal clear water of Torch Lake means it hosts relatively little wildlife. However we are curious to see if there have been any changes since the last time this study was performed in 2007, also by TLA interns.

We will also be looking for quagga mussels whose invasion of inland lakes has lagged far behind that of the related zebra mussel. So far there are no records of quagga mussels in Clam Lake or Lake Bellaire, and only a few sitings in Torch Lake. We hope nothing has changed.

New Members and Donations

Welcome to these new TLA Members:

Dr. Ana Clarkson
Gregory Cooksey & Kalli Carson
Benjamin Lane
James & Gail Straith

A big thank you to these recent donors who gave $200 or more:

Jack Spence & Katherine Yih
Brian Hayes

Help Needed to Keep Invasive Plant Species out of our Lakes

For the third year in a row, Torch Lake Protection Alliance (TLPA) and Three Lakes Association (TLA) have combined forces and funds to monitor and control Eurasian Watermilfoil (EWM), an invasive aquatic plant that poses a potential threat to Torch Lake. This green plant grows up toward the surface and has a feathery appearance. While not harmful to humans or animals, EWM can form large mats of floating vegetation that can shade out native aquatic plants and impede recreational activities such as swimming and boating. Some lakes have been completely covered by this invasive plant.

Milfoil collected from Torch Lake

As reported in a previous article on the Torch Lake plant survey, no new patches of EWM were found in Torch Lake in 2021. While that is good news, EWM spreads very easily when fragments of the plant re-root themselves in a new location. Because of this, vigilant monitoring and timely treatment is essential to control the spread of this invasive species.

We are asking for your help in our efforts to control Eurasian Watermilfoil. If you see plants growing in the lake that resemble those in the photo above, please email the Torch Lake Protection Alliance at TLPA@torchlake.com or Three Lakes Association at 3lakes.info@gmail.com and one of our volunteers will make arrangements to come check it out. Catching and treating EWM early protects the lake and is far more cost-effective than treating large, established patches.

Thanks in advance for your help in keeping our lakes free of invasive plant species for future generations!

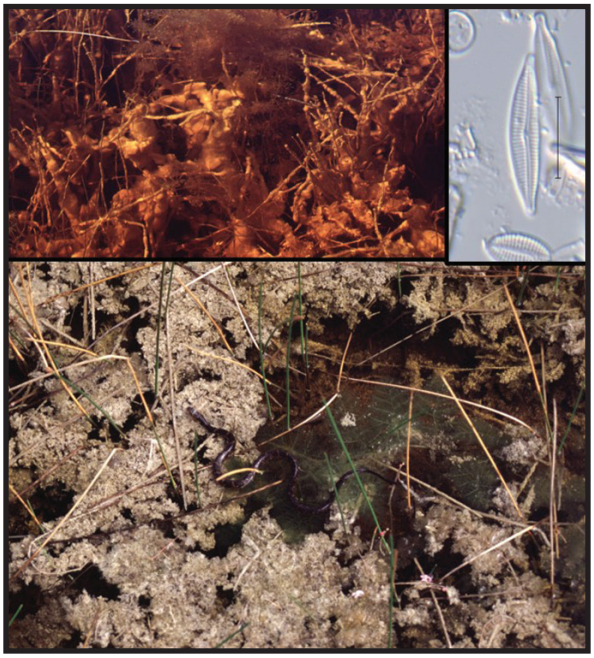
The Low Phosphorus and Nitrogen Deposition Hypotheses for GBA

By Jan Stevenson
Michigan State University

"What has changed in the lakes that could cause accumulation of golden brown algae on the bottom of Torch Lake and Lake Bellaire?" This was a key overarching question for our investigation.

During the first four years of research on GBA (2015-2018), we did not find strong evidence to support our original set of hypotheses (see July 2020 TLA Quarterly for the list), which included an increase in nutrients from runoff or ground water. Therefore, it was important to consider the counter-intuitive hypothesis that a decrease in phosphorus concentration in lake surface waters could have caused GBA. It was also important to investigate what caused phosphorus to decrease in lake surface waters, largely to inform ways to manage GBA.

The hypothesis that decreasing phosphorus was causing GBA seemed counterintuitive because phosphorus concentrations are often the most limiting resource for algal growth. Lower phosphorus supply should decrease the reproductive rates of algae and the amount of algae that accumulates in a habitat. However, slow growing algae can accumulate in low phosphorus habitats if physical disturbance and consumption of algae by herbivores (e.g. snails and insect larvae) is low. Two good examples of this situation are: thick mats of the diatom *Didymosphenia* that can become a nuisance in streams of the Northeast and Midwest and the natural calcareous algal mats of the Everglades in southern Florida.



Calcareous algal mats on plants (upper left) and floating on the water surface (bottom). Yes, that is a snake supported on the top of the floating mat in the bottom panel. Upper right) A picture of the glass cell wall of the diatom *Encyonema evergladianum*.

Didymosphenia geminata is a species of diatom that produces long mucilaginous stalks and forms thick mats on rocks in streams (Figure 1). These mats occur in streams with very low phosphorus concentration, and often develop in streams where phosphorus concentration has been reduced by human activities, such as dams that trap phosphorus or nitrogen fertilization of forests for timber production that causes greater sequestration of phosphorus. *Didymosphenia* mats are resistant to herbivores because of the dense mucilaginous matrix they form. In addition, the thick mucilaginous matrix traps particles from which nutrients can be harvested and recycled by the diatoms themselves, providing a nutrient supply for their reproduction.

The GBA mats in Torch Lake can take many forms. Dense GBA mats often closely resemble the calcareous algal mats in the Everglades (Figure 2). Calcareous mats of cyanobacteria and diatoms are a natural feature of many Everglades marshes, which have very low phosphorus concentrations. The calcareous algal mats grow on marsh plants and later in the season float at the surface of the water. They have sufficient structural integrity that you can pick them up in your hand, just like GBA mats in Torch Lake and Lake Bellaire. Some of the diatom species in the Everglades are also found in GBA accumulations in Torch Lake and Lake Bellaire, such as *Encyonema evergladianum*. This species is most abundant in the lowest phosphorus conditions of the Everglades. And like Everglades mats, calcium carbonate deposits are abundant in the GBA of Torch Lake and Lake Bellaire.

The calcareous algal mats of the Everglades do not appear in marshes that are exposed to pollution from nearby agricultural areas, which includes phosphorus and other contaminants in marshes. Experiments by three major research groups, one of which I worked with, showed that phosphorus enrichment was the contaminant causing loss of the calcareous algal mats. In fact, the disappearance of the floating calcareous algal mats of the Everglades occurred in a very narrow range of phosphorus concentrations, causing a sudden change in ecosystem condition along the phosphorus pollution gradient. Thus, a decrease in phosphorus in the surface waters of Michigan lakes could cause GBA, and that GBA development could occur suddenly as phosphorus concentration drops below a key concentration threshold.

Two environmental changes caused by humans could have reduced phosphorus concentrations in surface waters of lakes. Dreissenid mussels (Zebra and Quagga mussels) filter algae from the water column and can decrease phosphorus concentrations of lakes by removing algae from the water column. Zebra mussels invaded regional lakes soon after the earliest monitoring programs were started, so they could have caused the decrease in lake phosphorus recorded in data from Tip of the Mitt Watershed Council and Michigan's Cooperative Lake Monitoring Program. However, evidence also exists from study of lake sediments in other lakes that phosphorus concentrations started to decrease much earlier than zebra mussel invasion.

Paleolimnology, the study of past conditions in lakes, examines sediment cores from lakes, with the deepest sediments being the oldest. The age of these sediments can be determined and past environmental conditions can be inferred from the remains of organisms and chemistry of the sediments. The glass cell walls of diatoms are one of the important remains of organisms found in sediment cores. They are used to infer environmental change because they preserve well in sediments, there are many diatom species, and these species are sensitive to environmental changes, especially phosphorus concentration.

In a study led by Sherry Fritz (Univ. Nebraska) published in 1993, they observed a shift in sediments dated between the 1940s to 1950s from diatom species that require relatively high phosphorus conditions in sediments dated before the early 1900s to other species that live in relatively low phosphorus conditions. The relative abundance of low phosphorus species continued to increase in sediments from the 1950s to the youngest sediments evaluated, just before publication of the paper. This change in diatom species in lake sediments shows that phosphorus depletion in lake surface waters could have started long before zebra mussel invasion in the late 1990s.

One plausible cause of a decrease in lake

GBA continued on next page

GBA *continued from page 6*

phosphorus in the mid-1900s or earlier is atmospheric nitrogen deposition. Higher than natural nitrogen concentrations in rain have been observed in Michigan since the National Atmospheric Deposition Program was started in the 1980s. This is attributed to factors such as automobile exhaust and agriculture, both of which have upwind sources to the Torch-Bellaire region. The period when nitrogen fertilizers were first used in agriculture coincides with the period when phosphorus started to decrease in the paleolimnology study led by Fritz and colleagues.

The influence of atmospheric nitrogen on lake phosphorus concentrations has been investigated by several research groups in Scandinavia, where a north-south gradient in atmospheric nitrogen deposition has been associated with decreases in lake phosphorus and ecological changes in lakes. The same could be true in lakes of northern Michigan.

Thus, atmospheric nitrogen deposition, potentially coupled with zebra mussel filtration, provides plausible causes for phosphorus decreases in lakes that may have started before 1950. The hypothesis that thick calcareous algal mats, as well as other forms of abundant benthic algae, are caused by low phosphorus conditions is also plausible. All known evidence for GBA, and causal analyses to date, indicate atmospheric nitrogen deposition and possibly zebra mussels could have caused decreases in lake surface water phosphorus. Additionally, decreases in surface water phosphorus could have passed a tipping point that would cause development of thick GBA mats. This is why we are considering such an implausible and novel explanation for GBA.

(Upper left) Max Bothwell, leading worldwide expert on *Didymosphenia*, holding a rock with long mats of *Didymosphenia* attached in a New Zealand stream. Upper right) A picture of the large diatom *Didymosphenia geminata* with a long mucilaginous stalk (photo by Mart Schmidt cited in Luca Marrazi's blog (http://floridacoastaleverglades.blogspot.com/2016/08/diatom-of-month-august-2016.html). Lower right) Max Bothwell and I examining a rock with nodules of *Didymosphenia* before they developed into thick mats. Pictures with Max were from a trip in the early 2000s with Rex Lowe when Rex, Max, and I were visiting as Didymo advisors for Barry Biggs at New Zealand's National Institute of Water and Atmosphere.

We are still at an early stage of investigation of the nitrogen deposition and phosphorus decrease hypotheses for GBA. Although we have a plausible set of hypotheses based on some local evidence, much is based on observations elsewhere. Experiments are planned this summer to determine whether GBA is related to increases or decreases in phosphorus near the lake bottom. In addition, surveys of regional lakes are planned to relate lake phosphorus levels to presence of GBA and to the abundant algal species in GBA.

Much more work is necessary before lake management strategies are developed because they may generate unintended consequences. For example, rates of atmospheric nitrogen deposition have decreased in the last 20 years, even though they are still above historic more natural levels. One strategy for managing GBA is to wait for a slow increase in lake phosphorus, back to pre-GBA levels, as nitrogen deposition rates stay low. Of course, that would only work if GBA was caused by low phosphorus.

Adding phosphorus to lakes to reduce GBA would almost certainly reduce water clarity and create new problems, as planktonic algae grow. Additionally settling of plankton onto sediments may actually cause a different kind of benthic algae to grow. Lawn fertilizers could exacerbate the GBA problem because their relatively high nitrogen content could further reduce phosphorus supply. Any kind of fertilizer could cause more harm. Considerable research into GBA mitigation will be important to safely manage the problem. The research TLA is supporting on causes of GBA will be valuable for guiding that mitigation research and planning. In this case, waiting to act until we know more is the most prudent approach.

Meeting of Water Quality Experts on June 10

On June 10, Three Lakes Association, Torch Lake Protection Alliance, and Torch Conservation Center convened a large group of experts on water quality and benthic algae to discuss the future of scientific research and monitoring on Torch Lake.

There were close to 50 people in attendance, including Dr. Jan Stevenson from MSU, who is the researcher leading TLA studies on golden-brown benthic algae, Dr. Dale Robertson and a team of researchers from USGS, Dr. Jeff Schadlow director of research on Lake Tahoe, a lake with some important similarities to Torch Lake, Dr. Matt Ingle professor with the AuSable institute who is studying the extent of zebra mussels in Torch Lake, along with his 15 students, and representatives from several state agencies and local organizations. We brought together everyone we could think of that might be able to help!

We are currently engaging the experts to better understand material presented and to define specific action plans, including USGS recommended sampling to better track long-term trends in our lakes. Keep an ear out for more information on this exciting project.

This newsletter printed on recycled paper

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.

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