QUARTERLY

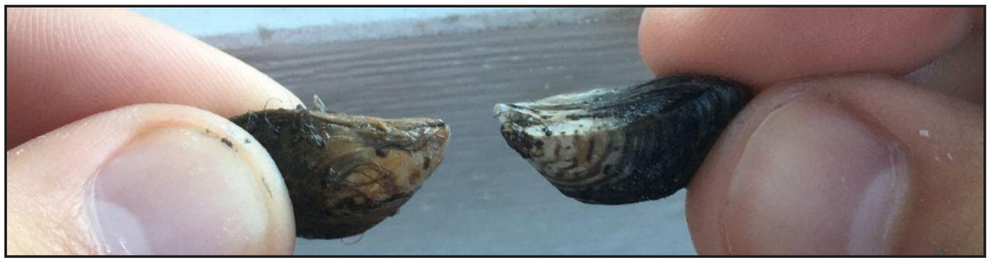
THREE LAKES ASSOCIATION SERVING LAKE BELLAIRE, CLAM LAKE AND TORCH LAKE IN NORTHWEST MICHIGAN WINTER 2024

The TLA Quarterly is published by the Three Lakes Association
Please direct comments or questions to:
P.O. Box 689
Bellaire, MI 49615
3lakes.info@gmail.com
231-412-7551

Sneak peek

Invasive Mussels in Torch Lake

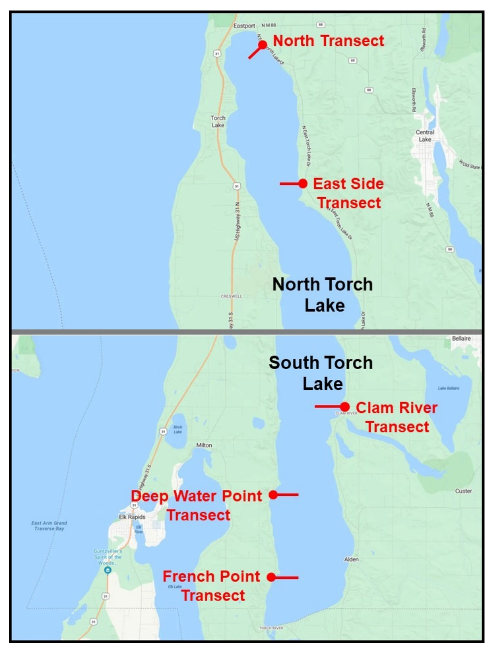
Data and plots presented in this article were taken from the 2023 intern report to the TLA board.



Quagga mussels (Dreissena bugensis) and zebra mussels (Dreissena polymorpha) are invasive species which have caused ecological changes in the Great Lakes and hundreds of freshwater lakes and streams across the United States and Canada. They were first found in Lake Michigan in the early 1990s. Since then, the ecology of Lake Michigan has changed in large part due to the water filtering capacity of these mussels. They remove nutrients in the form of microscopic plant and animal life from the water column and transfer those nutrients to the lake bottom in the form of mussel biomass and the wastes they released to bottom sediments.

The Michigan Department of Environment, Great Lakes, and Energy did a survey of Torch Lake in 2015 looking for invasive species and reported finding quagga mussels. Although this survey established the presence of quagga mussels in Torch Lake for the first time, it did not provide much information about mussel quantities or distribution.

During the months of June and July last summer, TLA's three high school interns, their volunteer boat captains, an MSU undergraduate advisor and project leader Jeanie Williams, conducted a study of Torch Lake to gain more information about mussel quantities and distribution. A device called a Ponar dredge was used to collect samples from bottom sediments within each of five depth zones ranging around target depths from 10 feet to 175 feet deep along five lake transects. These transects were widely distributed around the lake. Duplicate samples were collected from each depth zone along the transect except for one transect, where only a single sample was successfully retrieved from the depth zone of 175 feet. Additionally, three samples were collected at separate locations in the deepest parts of the lake estimated to have been around 275 feet deep.



Lake transects along which samples were retrieved from depth zones ranging from 10 to 175 feet.

Invasive mussels continued on page 2

Message from the Board

It is late January and the first ice fishing of the season on our three lakes was observed recently during a winter where so far ice coverage, particularly safe ice, has been very hard to find. Unless the plan calls for fishing, x-skiing or snowmobiling on a lake, most people aren't thinking a lot about our freshwater resources this time of year. That could not be more different for your TLA Board of Directors which is already hard at work after the first regular meeting of 2024. Less than a month into the new year, our board members are engaging local Townships on master plans and zoning, attending EGLE permit hearings, coordinating our water quality monitoring volunteers and preparing for this year's lake research, intern program and education events. We are also continuing work with our partners at Grass River and TLPA. And, of course, bringing you the Winter edition of TLA Quarterly!

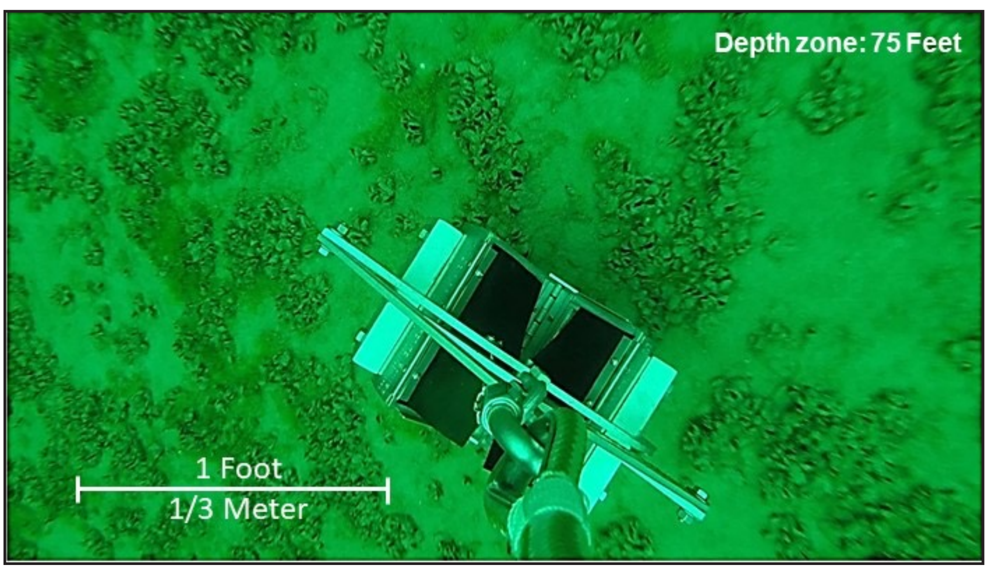
This edition presents findings from our 2023 intern program which investigated the quantity and distribution of invasive mussels in Torch Lake. Retrieving sediment samples from hundreds of feet below the surface is not only challenging, it requires strong arms and determination. That is exactly what our interns delivered by collecting over fifty samples containing more than 1,500 mussels from various depths and locations around the lake. Also, we look back at TLA's water quality protection heroes at work in the early 2000's when the Quarterly was still published in black and white. We hope you enjoy this compilation of articles from past editions which describe what was the most comprehensive look into nutrients and water quality in our three lakes that has ever been done.

If you manage to find safe ice on our three lakes this season, drill a hole and catch a fish, remember to take a picture and enter it in TLA's photo fishing contest. You can win bragging rights or even a prize! A link to upload your photo is published in these pages. Whether it is in a pair of winter boots, waders, or just riding in a boat, we hope to find you outdoors enjoying the beauty of one of our wonderful lakes this year!

Fred Sittel
President, TLA Board of Directors

Invasive Mussels in Torch Lake *continued from page 1*

The Ponar was lowered with jaws open and was triggered to close after coming to rest on the lake bottom. Once successfully brought back to the surface with a sample, its contents were emptied into a bin, photographed, mixed with lake water, and poured through a sieve with openings large enough to pass bottom sediments, collecting any mussels present. Mussels from each sample were placed in labeled jars and later identified as either zebra or quagga, counted and then measured using calipers.



Ponar approaching lake bottom. Dense patches of mussels are evident.

Fifty-two samples which contained a total of 1,546 mussels were retrieved from the various transits and depth zones. Ninety-four percent of the mussels collected were quagga mussels. This result was not unexpected because zebra mussels do not thrive well on soft surfaces and beyond the near shore zone the bottom of Torch Lake is mostly very fine sand, clay, and silt. It also fits the pattern seen in many other lakes inhabited by both zebra and quagga mussels where zebra mussels are often the first to enter the system and their populations expand rapidly, but over time, quagga mussels become dominant.

Forty-two percent of the mussels collected were quagga mussels 10 mm in length or less. Only four quagga mussels were in the 30 to 35 mm range. All the zebra mussels were less than 25 mm. The mussels were preserved in alcohol to allow for further analysis.

Almost no mussels were collected from the depth zone of 10 feet even though many suspected zebra mussels were observed in shallow areas along the shoreline where rocks and other hard surfaces such as dock pilings provide secure attachment points. In the slightly deeper water of the near shore zone wave action may stir up bottom sediments making it difficult for mussels to stay in place. The greatest number were found in samples from the depth zone of 75 feet. Nearly two and a half times the number of mussels came from that depth zone compared to the next most populated depth zone of 30 feet. It is not clear why there were so many mussels at that depth. It could be because the bottom there is typically sloped and further away from wave action but still receives more light than deeper regimes. The median number of mussels per sample by depth zone was plotted because a single sample from the depth zone of 125 feet contained five times the number of mussels in any other sample from that depth zone, skewing the average.

Samples from the North transect contained the fewest mussels while the Deep Water Point transect contained the most. The distribution of the average number of Mussels by depth appears similar

Continued on page 3

among the transects except for the Deep Water Point transect. Along that transect the average was skewed by a single sample from the depth zone of 125 feet which contained 206 mussels.

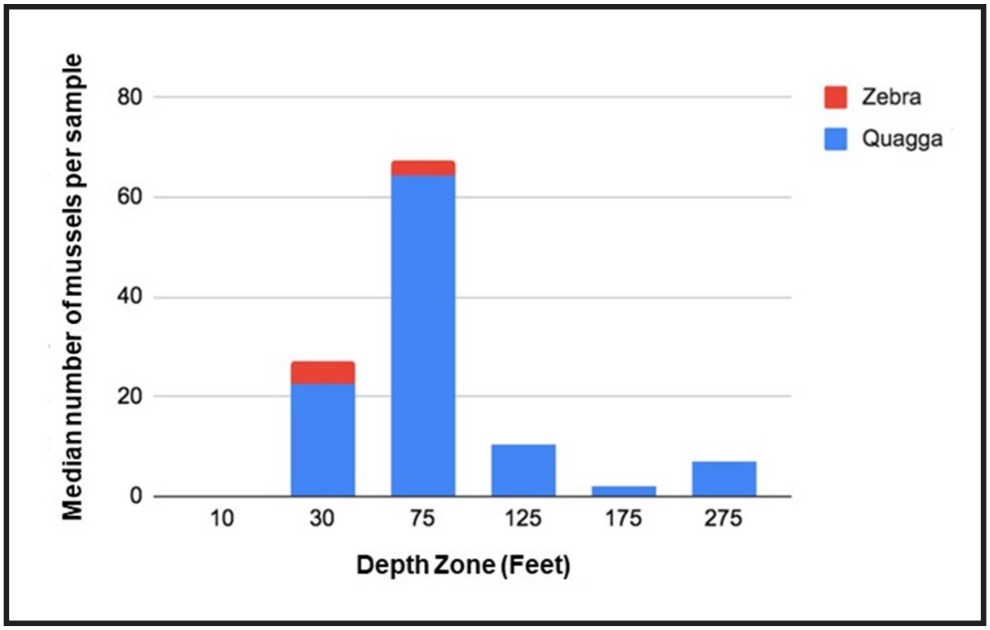
Mussels were also found in three samples from three locations in the deepest water the project team could find, estimated to have been around 275 feet deep. Which is not surprising, Lake Michigan is much deeper than Torch Lake and supports very high densities of quagga mussels even at its deepest points. This suggests the deepest depths in Torch Lake could also be very habitable for quagga mussels.

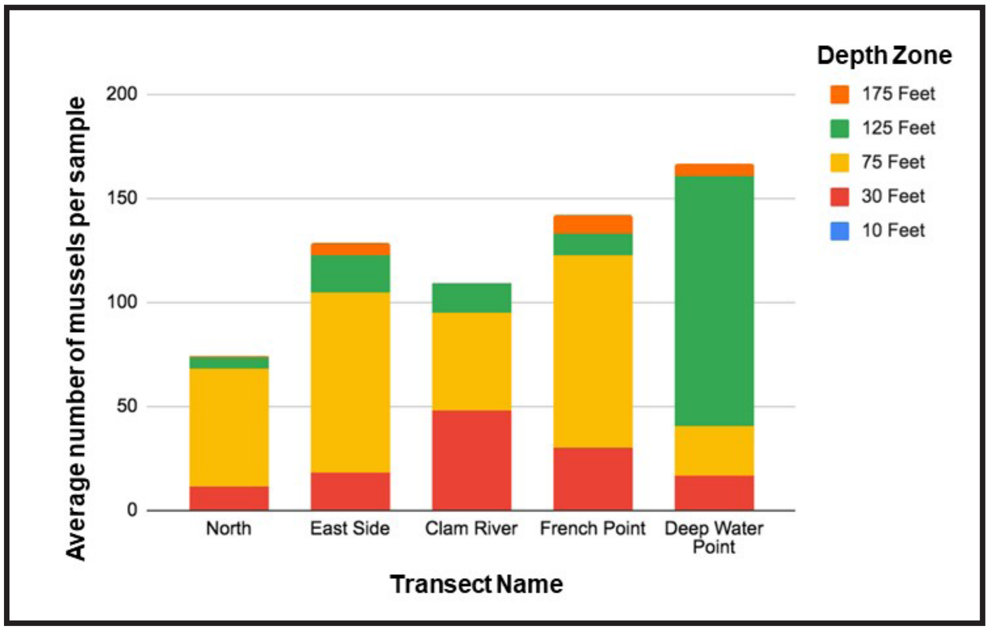
Fifty-two samples from a lake as large as Torch Lake are too few to develop a representative overall mussel density for the lake. However, the interns were encouraged to use the information they gathered to come up with estimates of mussel density at the depths and locations sampled to give them experience with data analysis and reporting, which are important goals of the summer intern program. The area of bottom sampled by each drop of the Ponar and the number of mussels found in the resulting sample were used to calculate mussel density at that location.

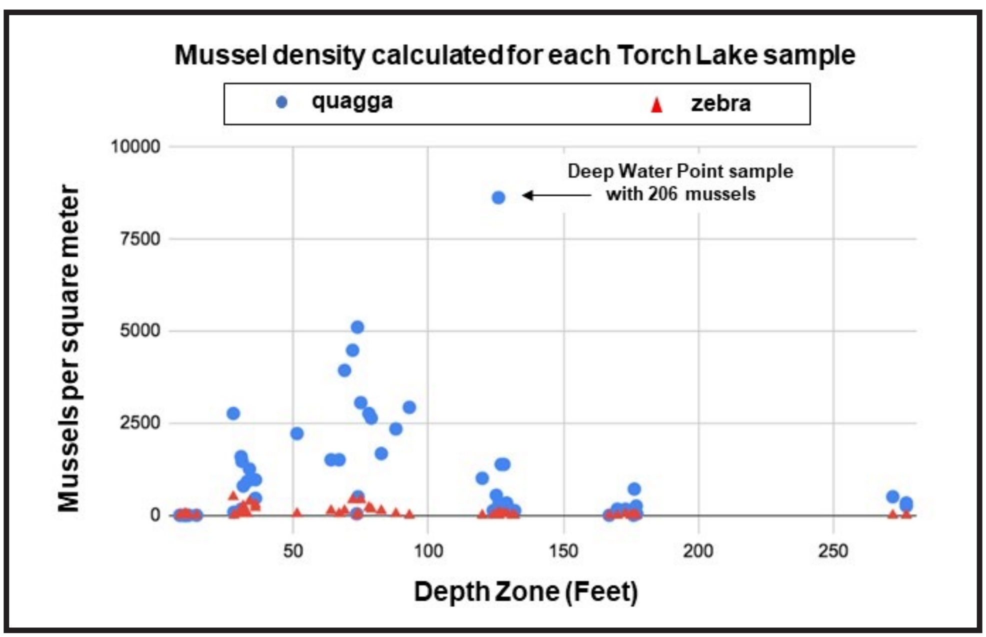
The actual area sampled by the Ponar is a fraction of a square meter but the calculations were normalized to mussels per square meter for comparison to mussel densities published for other lakes, including Lake Michigan. In 2000, quagga mussel densities in Lake Michigan at depths greater than 100 feet averaged 57 mussels per square meter and increased to 7,547 mussels per square meter five years later (Nalepa et al., 2014).

The distribution of mussel sizes in a lake are sometimes used to gain insights into the stage of mussel infestation. Although the length of the mussels from Torch Lake were measured, that information was later deemed insufficient to determine if populations in Torch Lake are expanding or have leveled off.

The results of last summer's mussel sampling may not have been sufficient to establish a reliable figure for the overall mussel density in Torch Lake but it provided TLA with enough information to say there are a lot of quagga mussels in the lake at depths people were previously unaware of. It is also very likely the number of mussels will increase over time and that they are, or will at some point in the future, have a substantive impact on nutrient cycling in the lake. Studies involving lake nutrients should consider their influence.







MDNR Releases Wake Boat Report

By Lois MacLean
Executive Director

Wake boats are powerboats specially designed to increase wave height for watersports which have gained popularity in our local waterways. The hull is shaped to achieve significantly increased wake height and energy and many have a hydrofoil device that lowers the stern when the boat is under power. Most wake boats also have built-in ballast tanks that can be filled with hundreds of gallons of lake water to increase stern weight and create even larger waves. The resulting wake can be used by a rope towed skier to perform jumps and tricks while skilled riders on a short surfboard are able to follow the slow-moving boat closely without using a tow rope.

This new watersport may be exhilarating but it can create problems for other lake users if operators are not mindful. While all boat wakes make an impact, wakes from boats in wake boarding or surfing mode have exponentially greater energy, upsetting passing boats to a greater degree and requiring substantially longer distances to dissipate. Engineering studies show these waves require distances up to 900 feet to dissipate to the wave heights observed only 100 feet from the same boat in cruising mode. Prop turbulence from wake boating resuspends bottom sediments, even in deeper water. Super-sized wakes and turbulence create risks to aquatic natural resources, increase shoreline erosion, may damage docks and hoists and can create safety issues for other boaters and wildlife. The recommendations shown below in italics are from the Executive Summary of the Michigan Department of Natural Resources, Fisheries Division Report No. 37, July 2023: "A Literature Review of Wake Boat Effects on Aquatic Habitat."

"The Division recognizes the recreational value and popularity of wake boats, and recommends the following voluntary best operating practices in support of the continued use of wake boats while minimizing the effects on natural resources:

It is recommended that awareness and voluntary adoption of these best operating practices be encouraged through outreach actions and materials to educate wake boat operators.

1. Boats operating in wake-surfing mode or wake-boarding mode, during which boat speed, wave shapers, and/or ballast are used to increase wave height, are recommended to operate at least 500 feet from docks or the shoreline, regardless of water depth.

2. Boats operating in wake-surfing or wake-boarding modes are recommended to operate in water at least 15 feet deep.

3. Ballast tanks should be completely drained prior to transporting the watercraft over land."

Limiting the damage to shorelines and fishery habitats, eliminating the scouring of the bottomlands, and reducing the spread of invasive species are critically important to the preservation of our lakes and streams for future generations. Following the recommended distance from shore and minimum depth for operation during wake sports is crucial to the protection of our precious waterways and shorelines. We encourage boaters, lake residents, and boat renters to become educated on this vital topic and to share what they learn.

The full report can be read here: mymlsa.org.

Looking back .....

Editor's Note The following article from the archives of TLA is from a series which appeared in these pages between March 2005 and April 2007. They showcase TLA's development of a predictive water quality model and the efforts of three individuals who made a huge impact furthering the TLA mission to protect water quality; Tim Hannert (Executive Director from 2002 through 2007), Norton Bretz (Treasurer, Executive Director from 2008 through 2011) and Dean Branson (President from 2009 through 2012) plus the many volunteers and partners that supported this effort.

TLA Quarterly
March 2005

Water Quality Model Report

In 2004, Three Lakes Association was awarded a $62,000 grant from the Michigan Department of Environmental Quality (MDEQ) to build a predictive water quality model for Torch Lake. In 2005, MDEQ awarded TLA a phase 2 grant of $80,000 to extend the model to Lake Bellaire and Clam Lake. These grants plus $124,000 in matching and in-kind funds that included thousands of volunteer hours, will result in a decision-making tool to help local township officials protect water quality while they encourage economic growth. "We are very excited and proud to have been selected to receive this grant award," said TLA President (2002 through 2005) Dick Garcia. "We are working with a unique network of partners to accomplish our goal of clean water and a healthy local economy. Our partners include the eight townships surrounding Torch Lake, Clam Lake, and Lake Bellaire; the Great Lakes Environmental Center of Traverse City, the Grand Traverse Bay Watershed Council, Northwest Michigan College-Water Studies Institute, the Antrim Conservation District, Central Michigan University and Torch Lake Protection Alliance, and students from Central Lake, Bellaire, Elk Rapids High Schools, and the University of Notre Dame who will be participating in the Three Lakes Summer Internship Program."

"A water quality model is a computer simulation program that combines actual field measurements with the capability to answer what-if questions" said Bob Kollin, Modeling program co-manager. "For example, as the Village of Bellaire continues to grow, this model will be expected to answer questions about potential impact on water quality due to changes in phosphorus released from the wastewater treatment facility due to more pressure on the sewage lagoons." By answering such questions, the model can help manage the economic growth of Bellaire while ensuring protection of the environment. When asked what is involved in building a predictive water quality model, Corey Arsnoe, Antrim Conservation District technician and program co-manager replied, "For the next 18 months, our team of volunteers will measure river and stream flows and gather water quality data on a monthly basis. They will collect hundreds of water samples from Torch Lake, Lake Bellaire, Clam Lake, their major tributaries, and the groundwater entering the lakes."

"This project represents a wonderful collaborative effort to establish a predictive water quality model for the Elk River Chain of Lakes watershed," commented State Representative, Kevin Elsenheimer, 105th District, and Bellaire resident. "The Chain-of-Lakes is one of northern Michigan's greatest jewels and it is wonderful to see the efforts of the community rewarded."

Torch Lake Gives Up More Secrets

On a blustery winter's day, a team of TLA researchers carefully walked a half of a mile out to the middle of Torch Lake to measure and record oxygen levels from the top to the bottom, 260 feet down. No one has had the capability to do this until TLA invested in an oxygen meter with a 300-foot cable. "It is critical to know the amount of oxygen at the bottom of the lake during the winter" said Dean Branson, Water Quality Model Project Leader, when asked why take such risks and endure such bitter cold. "If the oxygen gets too low at the bottom of a lake nutrients like phosphorus come out of the sediment into the water. This fertilizes the lake and causes problems with water quality." The oxygen meter indicated 80% oxygen saturation at the bottom of the lake. While this is slightly lower than the 100% summer levels it was far from the critical lower limit of 16%. This information is required for the construction of the Torch Lake Predictive Water Quality Model. We are also beginning to understand the groundwater input and its phosphorus contribution to the lake. So far, we have driven 15 shallow wells at 12 different sites around Torch. Many TLA members have given us permission to use the ground just beyond their beaches for this project. We hammer down a miniature well point and screen between 2 and 10 feet below the lake bottom in about 2 feet of water. These points are connected to the surface by a small plastic tube from which we extract our samples and measurements.

Doyle Brusen of MDEQ explains to Tim Hannert and Ray Ludwa how to operate a stream level and sampling gauge

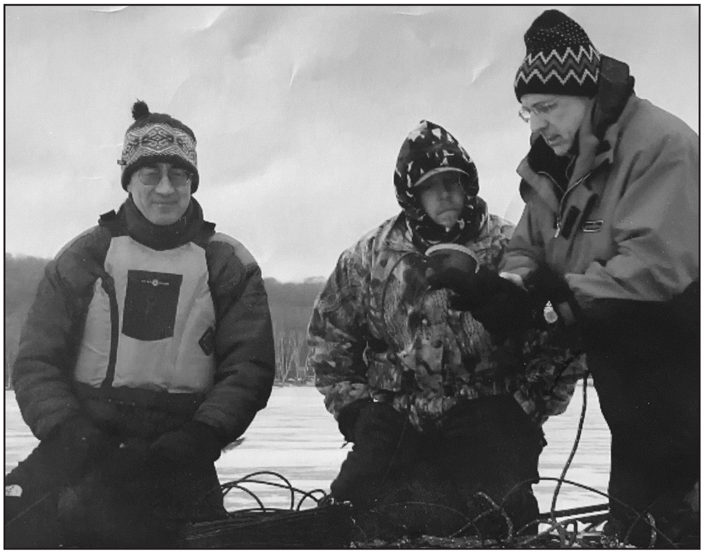
Water Quality Model Report Completed

In May 2006 TLA's water quality modeling experts met at Northwest Michigan College's Water Studies Institute in Traverse City for a peer review of the final report to MDEQ, "Developing a predictive water quality model for Torch Lake." We were fortunate enough to have three world class scientists review our work: Prof. Steve Chapra of Tufts University in Boston, Prof. Ray Canale, retired from University of Michigan, and Prof. Jan Stevenson of Michigan State University. Prof. Chapra is the author of several books and many papers on limnology, the study of lakes and streams. More importantly for us, he wrote the computer modeling code that we used to predict the future health of Torch Lake in response to several hypothetical changes in our watershed.

Doug Endicott, the environmental engineer

Contiued on page 6

Looking Back continued from page 5



Norton Bretz, Corey Arseno and Dean Branson measure Torch Lake's deep basin oxygen profile during mid-winter.

from Great Lakes Environmental Center in Traverse City who used Dr. Chapra's modeling code to build the water quality model for Torch Lake, also actively participated in this peer review, as did Tim Hannert, Norton Bretz, and Dean Branson. Fifteen invited individuals from other lake associations, including Elk-Skegemog Lakes Association, Intermediate Lake Association, and Walloon Lake Association were observers of the peer review process.

One of the important things learned from the review was the significance of Torch Lake's unique water chemistry that controls its water clarity. According to Professor Chapra, the predictable seasonal pattern of Secchi Disk data along with the low levels of chlorophyll and phosphorus can be explained by the formation of insoluble calcium carbonate during the warm summer months. The precipitation is driven by a single parameter, temperature. Biological processes in Torch are so weak that they contribute very little. He felt that with a little more information he could change his software program to include a model for calcium carbonate precipitation. And in a further stroke of good fortune for us, he had a PhD candidate working on this very problem who was willing to work with us this season to tune and calibrate the code. This resulted in the Torch Lake Calcite project that we have been working on in parallel with our Bellaire/Clam work this summer. We go out every two weeks to the north basin of Torch and carry out a set of measurements to follow the summer calcite cycle that reduces the clarity of Torch Lake. We are taking samples in the warm waters above the thermocline and in the colder waters below it, filtering the calcite out of these samples and sending both the filters and the samples off to be characterized for alkalinity, dissolved calcium, and inorganic carbon. In addition, we have been making careful observations of the water clarity with the Secchi disk and the new LiCor optical transparency instrument purchased by Elk-Skegemog Lake Association and with a turbidometer on loan from Tufts University. We have also installed another sediment trap that has been in the north basin since mid-June. With both results from the water chemical and clarity analyses, we expect to improve the computer model.

TLA Presents Model Results

In March 2007, TLA began making presentations to each of the following townships: Milton, Forest Home, Clearwater, Custer, Torch Lake, Helena, Kearney, and Central Lake. Our township partners supported TLA's grant applications to MDEQ for our predictive water quality project by providing letters of support and pledged a total of $14,000 to symbolize their support of this work. As part of the transition of this scientific work into new public policies that upgrade water quality protection measures in this watershed, TLA is providing copies of the reports from this work to each Township Board asking each to continue their commitment to water quality protection initiatives in collaboration with TLA. The following were among some of the findings presented to the township boards:

- The single most important nutrient to Torch Lake is phosphorus and its level, 2.6 ppb (parts per billion), has not changed significantly in the last 30 years. The phosphorus concentrations in Torch Lake are the same near the shore, north and south, and shallow and deep with no measurable differences anywhere in the lake.
- The water clarity in Torch Lake is determined by a combination of two naturally occurring processes: phytoplankton growth and calcium carbonate precipitation. Seasonal variations in the water clarity can be explained by these two factors. Phytoplankton respond to sunlight, temperature, and phosphorus and calcium carbonate precipitation is regulated by pH (through phytoplankton growth) and temperature.
- Phosphorus comes into Torch in approximately equal amounts from rainwater, shallow ground water, and Clam River, the main tributary entering Torch Lake.
- Phosphorus leaves Torch Lake by two routes: primarily (90%) by settling to the bottom as a coprecipitate of calcite where it becomes entrapped in sediment and, secondarily (10%) by flowing out Torch River.
- Tests show that the phosphorus in the sediment at the bottom of Torch Lake will remain entrapped and not re-enter the lake water as long as the bottom waters stay well oxygenated (greater than 2 ppm) and cold. These same tests also show that even if the bottom water became anoxic, the rate of phosphorus release from the sediment in Torch Lake would be very slow compared to other lakes.
- Phosphorus concentrations in Torch Lake have a calculated half-life for settling to sediment of about two years whereas the flushing time for the lake through Torch River is about 7 years. Therefore, consequences of decisions about land use that could increase the phosphorus loading into Torch Lake may not be detectable for many years.
- The phosphorus level in Torch Lake is linked to the phosphorus levels in the upper chain watershed though Clam River and this part of the system, including the land use within the full watershed, must be incorporated into the model to understand the system and pinpoint phosphorus control measures. We are continuing our water quality modeling efforts with the phase 2 project to model Lake Bellaire, Clam Lake, and as importantly, the immediate watersheds of these lakes. Torch Lake is big, but has a modestly sized watershed. Lake Bellaire and Clam Lake are smaller but have huge watersheds connected to them.

"A predictive water quality model is a tool for county and township officials that takes some of the guesswork out of issues surrounding economic development by combining the critical elements of environmental protection with economic growth," said Tim Hannert. "It gives us the rare opportunity to be ahead of water pollution issues before they result in a decline in water quality, while at the same time, it can be used to strengthen Antrim County's economic base."

Your Membership Donation Makes It All Happen!

It's easier than ever to renew and donate online at member.3lakes.com

❑ **DONOR** *$100* ❑ **LEADER** *$250* ❑ **STEWARD** *$500* ❑ **BENEFACTOR** *$1,000* ❑ **LIFE** *$2,000* ❑ **BASIC** *$60*

❑ *Michigan Riparian Magazine Subscription add $17*

TOTAL AMOUNT ENCLOSED: $________________

NAME: ______________________________

EMAIL (REQUIRED): ______________________________

WINTER POSTAL ADDRESS: (Street, P.O. Box) ______________________________

____

CITY: ____________ *STATE:* ________ *ZIP:* ________

WINTER PHONE: ______________________________

SUMMER POSTAL ADDRESS: (STREET, P.O. BOX) ______________________________

____

TOWNSHIP: ____________ *TOWN:* ____________ *ZIP:* ________

SUMMER PHONE: ______________________________

May we include your name in our newsletter donor list? *Yes* ❑ *No* ❑

Are you interested in volunteering in any of the following areas?

- ❑ *Water Quality*
- ❑ *HS Intern Program*
- ❑ *Water Safety*
- ❑ *Education*
- ❑ *Invasive Species*
- ❑ *Membership*
- ❑ *Finance*
- ❑ *Publicity*
- ❑ *Office/Data Entry*
- ❑ *Other*

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

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

Submit your

Great Catch Fish Photo!

Show us your 2024 fishing victories on Clam Lake Torch Lake or Lake Bellaire. Share photos of you or your family landing lunkers panfish and everything in between. Ice fishing, too!

Rules: Only submit one photo per fish caught and the name of the lake and date it was caught. You may enter multiple fish per angler for the current season. If you want to, provide details about your catch like the age of the angler (if appropriate), species of fish, type of bait used, live release, or anything else you care to share.

Enter your best shots here:

https://www.3lakes.com/great-catch-fish-photo-contest-2024/

Contest ends Labor Day, September 2, 2024

Good luck!

QUARTERLY

THREE LAKES ASSOCIATION | *SERVING LAKE BELLAIRE, CLAM LAKE AND TORCH LAKE IN NORTHWEST MICHIGAN* | WINTER 2024

Three Lakes Association
P.O. Box 689
Bellaire, MI 49615
3lakes.com

NON PROFIT ORG
US POSTAGE PAID
BELLAIRE, MICH
PERMIT NO.5

Find us on Facebook

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.