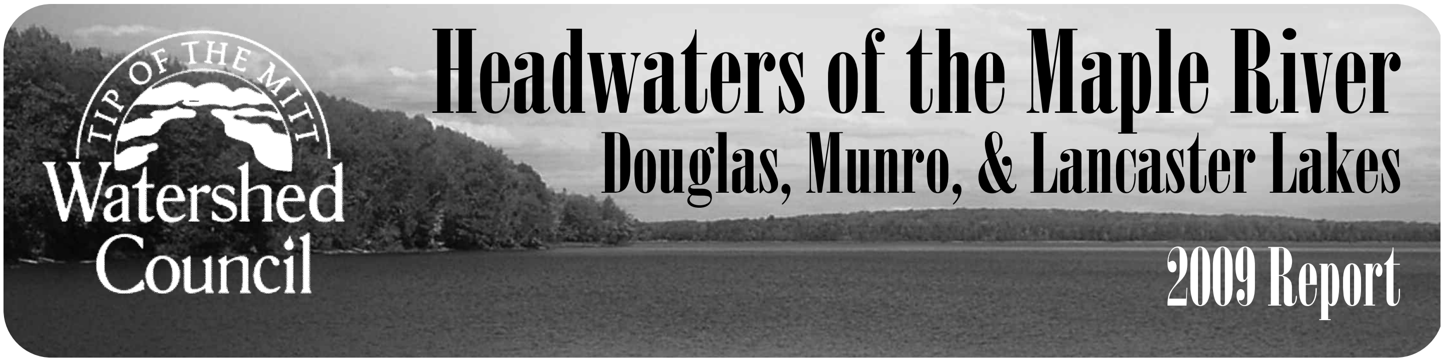


Headwaters of the Maple River

Douglas, Munro, & Lancaster Lakes

2009 Report

What attracts people to Northern Michigan? In general, people come north to enjoy the natural beauty of the area's pristine ecosystems, but if asked for one specific landscape feature, most would undoubtedly say our "lakes". Lakes define the landscape of Northern Michigan and sustain local economies, providing stunning views, abundant fisheries, and tremendous recreational opportunities.

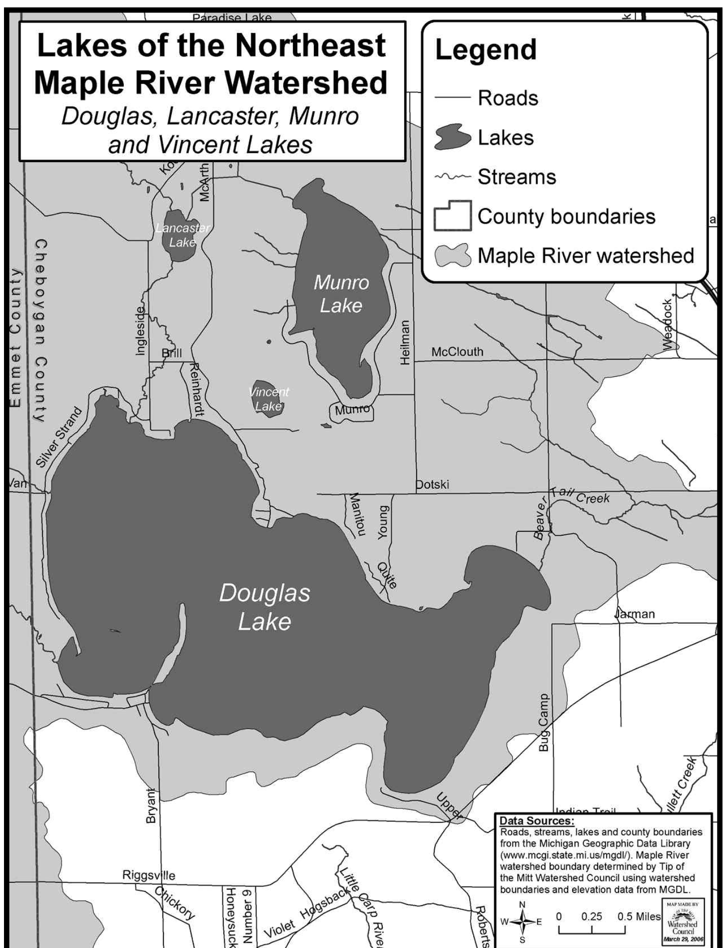
In the Tip of the Mitt Watershed Council service area there are nearly 60 lakes greater than 100 acres in size, and 14 of these are among the State's largest with over 1,000 acres of lake-surface area. The region also boasts some of the State's deepest lakes with five lakes having maximum depths of 100 feet or more. Douglas Lake, in northwest Cheboygan County, stands among these lake "giants" with 3,727 acres of surface area and over 80 feet of depth. Just north of Douglas, is the broad, shallow Munro Lake with 515 acres of surface area and a maximum depth of 15 feet as well as the small, secluded, but relatively deep Lancaster Lake with 51 acres and 57 feet of depth.

Douglas, Munro, and Lancaster, all wonderful lakes in their own right, play an essential part in the Maple River's designation as a high-quality Blue Ribbon trout stream. These three interconnected lakes, as well as the streams flowing into them, essentially form the headwaters of the Maple River. The East Branch of the Maple River begins at the outflow in the southwest corner of Douglas Lake, supplied with abundant and clean water from the area's lakes and streams. Over the last few decades, the Watershed Council has worked hard to protect Douglas, Munro and Lancaster Lakes to ensure that the lakes, and the Maple River, remain high quality resources for the enjoyment of future generations.

Water quality of the region's lakes, both large and small, has been monitored by staff and volunteers alike, providing valuable data on the overall health of our waters. Our cornerstone water quality monitoring programs include Comprehensive Water Quality Monitoring and Volunteer Lake Monitoring. The Comprehensive Water Quality Monitoring program is run by Watershed Council staff who have monitored water quality of Northern Michigan's lakes and streams for over 20 years. The Volunteer Lake Monitoring program was started in 1984 and has relied on hundreds of dedicated volunteers who monitor water clarity, algae abundance, phosphorus levels and more.

In addition to monitoring, the Watershed Council has worked with lake shoreline owners and lake organizations on a variety of projects to protect the lakes scattered throughout Northern Michigan. Projects carried out on these lakes have ranged from comprehensive aquatic plant surveys to shoreline restoration projects. Details about recent monitoring activities and lake projects in the headwaters of the East Branch of the Maple River are included in this report.

We hope you find this report both informative and helpful. If you have any questions, comments, or concerns, please contact Tip of the Mitt Watershed Council at (231) 347-1181 or visit our website at www.watershedcouncil.org.



DOUGLAS LAKE, located in northwestern Cheboygan County, has over 3,727 acres of surface area and is over 80 feet in depth.

Comprehensive Water Quality Monitoring

Water Quality Trends: 20 years of data

In 2007, Tip of the Mitt Watershed Council completed its 20th year of comprehensive monitoring. Starting on just 10 lakes in 1987, the Watershed Council's Comprehensive Water Quality Monitoring Program has expanded to include over 50 lakes and rivers throughout Northern Michigan. An incredible amount of data has been generated from this program and utilized by the Watershed Council, lake and stream associations, local governments and regulatory agencies in an effort to protect and improve the water resources that are so important to the region.

Every three years, Watershed Council staff head into the field as soon as ice is out to monitor lakes and rivers spread across the tip of the mitt. Over 60% of the region's lakes greater than 100 acres in size, and all major rivers are included in the program. In each of these water bodies, the Watershed Council collects a variety of data, including parameters such as dissolved oxygen, pH, chloride, phosphorus and nitrogen.

Information gathered in the Comprehensive Water Quality Monitoring Program has proven to be very useful. The data are used by the Watershed Council and others to characterize water bodies, identify specific problems and examine trends over time. One obvious trend found by analyzing data from this program is that chloride (a component of salt) levels have increased significantly in many water bodies during the last 22 years. Why? We need not look any farther than ourselves to find the answer as we use salt in everything from de-icing to cooking.

The following pages contain descriptions of the types of data collected in the program as well as select data from Douglas, Lancaster, and Munro Lakes. We have also included charts to provide a graphic display of trends occurring in the lake. For additional information about the Comprehensive Water Quality Monitoring Program please visit our web site at www. watershedcouncil.org/protect.

Parameters and Results

pH

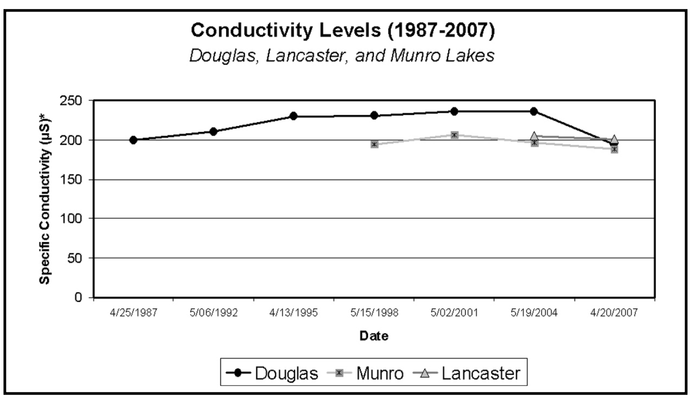
pH values provide a measurement of the acidity or alkalinity of water. Measurements above 7 are alkaline, 7 is considered neutral, and levels below 7 are acidic. When pH is outside the range of 5.5 to 8.5, most aquatic organisms become stressed and populations of some species can become depressed or disappear entirely. State law requires that pH be maintained within a range of 6.5 to 9.0 in all waters of the state. Data collected from Douglas, Lancaster, and Munro Lakes show that pH levels consistently fall within this range, except on one occasion in 1987 when the pH in Douglas Lake was measured at 9.4. Other than the high reading in 1987, which may have been due to equipment or operator error, pH has ranged from a low of 7.08 (Douglas, 1992) to a high of 8.67 (Munro, 2001).

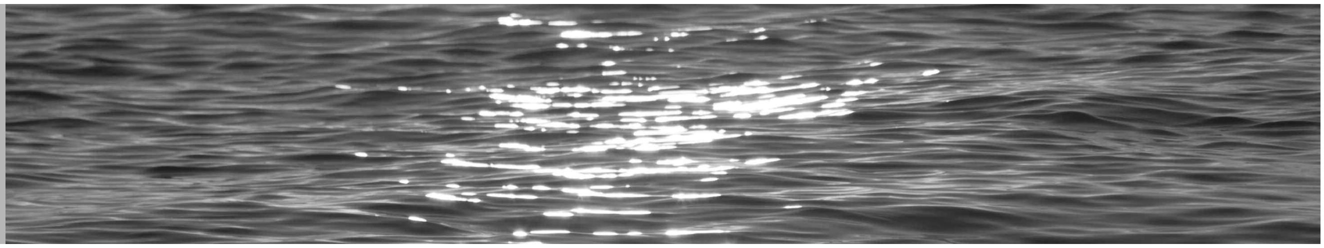
Dissolved Oxygen

Oxygen is required by almost all organisms, including those that live in the water. Oxygen dissolves into the water from the atmosphere (especially when there is turbulence) and through photosynthesis of aquatic plants and algae. State law requires that a minimum of 5 to 7 parts per million (PPM) be maintained depending on the lake type. Dissolved oxygen levels recorded in Douglas, Lancaster, and Munro Lakes typically exceed State minimums. The lowest readings, 0.57 and 0.72 PPM, were both recorded in the bottom of Lancaster Lake. Dissolved oxygen stores at the bottom of lakes like Lancaster often become depleted because of limited mixing between surface and bottom waters due to its depth and small surface area. Otherwise, dissolved oxygen levels on all three lakes have ranged from 5.4 PPM (Lancaster, 2004) to 13.1 PPM (Douglas, 1995).

Conductivity

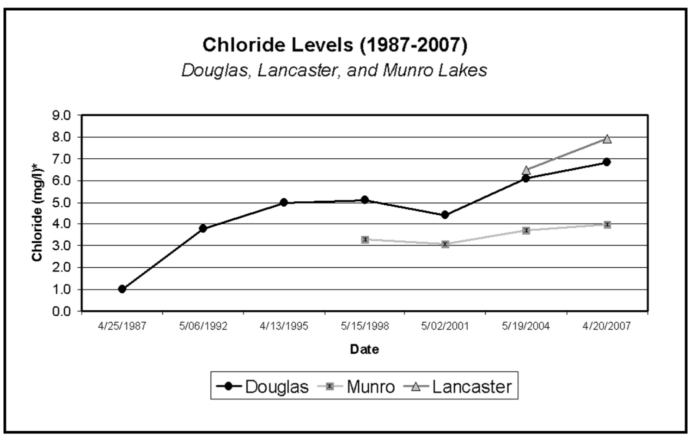
Conductivity is a measure of the ability of water to conduct an electric current, which is dependent upon the concentration of charged particles (ions) dissolved in the water. Readings on lakes monitored by the Watershed Council have ranged from 175 to 656 microSiemens (µS), and in Douglas, Lancaster, and Munro Lakes, ranging from a low of 178 µS (Douglas, 1987) to a high of 378 µS (Lancaster, 2004). Conductivity levels rose gradually in Douglas Lake from 1987 to 2004 and then dropped substantially in 2007. A steady increase in conductivity levels generally occurs due to greater human activity in the watershed and may indicate that water pollution is occurring.





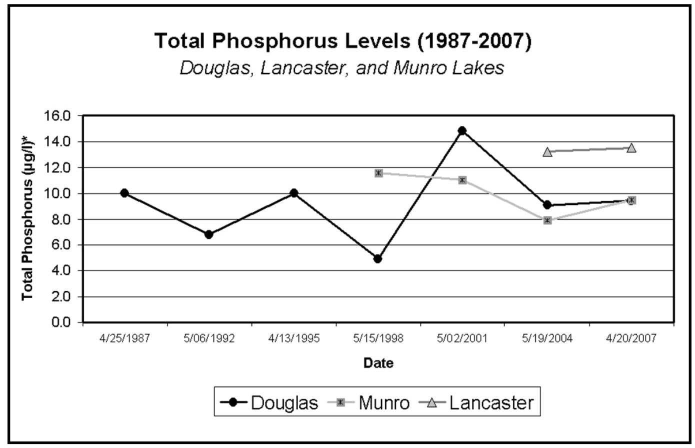
Chloride

Chloride, a component of salt, is present naturally at low levels in Northern Michigan surface waters due to the marine origin of bedrock (typically < 5 PPM). Chloride is a "mobile ion," meaning it is not removed by chemical or biological processes in soil or water. Many products associated with human activities contain chloride (e.g., de-icing salts, water softener salts, and bleach). Although most aquatic organisms are not affected until chloride concentrations exceed 1,000 PPM, increasing chloride concentrations are indicative of other pollutants associated with human activity (such as automotive fluids from roads or nutrients/bacteria from septic systems) reaching our waterways. Chloride concentrations have tripled in Douglas Lakes from a low of 1-2 PPM in 1987 to a high of 6-7 PPM in 2007. Current chloride levels in Lancaster are similar to Douglas, whereas Munro Lake remains low at 4 PPM.



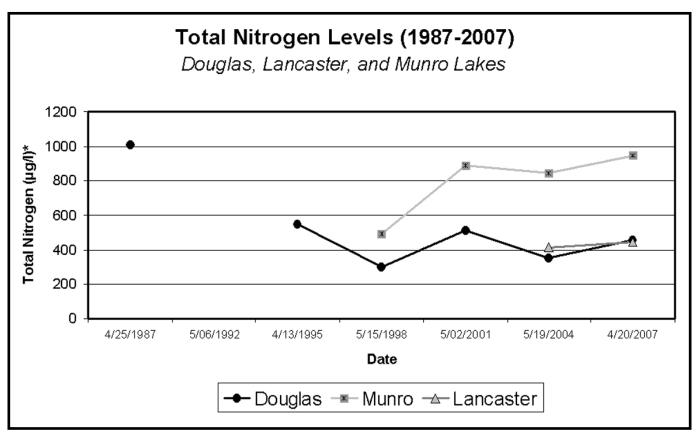
Total Phosphorus

Phosphorus is the most important nutrient for plant productivity in surface waters because it is usually in shortest supply relative to nitrogen and carbon. A water body is considered phosphorus limited if the ratio of nitrogen to phosphorus is greater than 15:1. In fact, most lakes monitored by the Watershed Council are found to be phosphorus limited. Although water quality standards have not been set for lakes, the U.S. EPA recommends that total phosphorus concentrations in streams discharging into lakes not exceed 50 parts per billion (PPB). Phosphorus is normally found at concentrations of less than 10 PPB in high quality surface waters. Although most total phosphorus concentrations in Douglas, Lancaster, and Munro Lakes have been below 20 PPB, levels exceeded 30 PPB two times on Douglas Lake and two times on Lancaster Lake.



Total Nitrogen

Nitrogen is another essential nutrient for plant growth. It is a very abundant element throughout the earth's surface and is a major component of all plant and animal matter. Although nutrients occur naturally, nutrient pollution is usually the result of human activities (e.g. fertilizers, faulty septic systems, and storm water runoff). In general, the lowest nutrient levels are found in Lake Michigan and large deep inland lakes, while the highest nutrient levels were found in small shallow lakes.Total nitrogen levels in Douglas, Lancaster, and Munro Lakes have ranged from 298 PPB (Douglas, 1998) to 1010 PPB (Douglas, 1987). Nitrogen levels have remained fairly stable on Douglas Lake since 1995 and there appears to be a trend toward increasing levels in Munro Lake.



*Unit descriptions: mg/l = parts per million, µg/l = parts per billion, µS = microSiemens per centimeter

Comprehensive Water Quality Monitoring Program 2007 Data

Water Body	Date	Dissolved Oxygen (mg/l)	pH (units)	Specific Conductivity (µS)	Chloride (mg/l)	Nitrate-Nitrogen (µg/l)	Total Nitrogen (µg/l)	Total Phosphorus (µg/l)
Bass Lake	4/19/2007	12.33	8.41	309.6	38.1	17.0	504.0	7.9
Bear River	5/24/2007	8.78	8.26	338.0	12.3	103.5	305.0	8.6
Bellaire Lake	4/19/2007	12.43	8.36	294.9	8.5	428.1	469.0	4.6
Benway Lake	4/16/2007	11.37	8.08	311.7	8.5	419.4	556.0	1.6
Birch Lake	4/19/2007	12.48	8.30	257.0	15.6	42.5	279.0	3.7
Black Lake	5/4/2007	11.74	8.16	262.5	6.0	54.5	269.0	3.5
Black River	4/9/2007	13.14	8.17	260.7	2.9	62.4	250.0	3.1
Boyne River	4/2/2007	10.29	8.32	366.4	6.1	368.2	475.0	3.2
Burt Lake	5/8/2007	11.19	8.29	273.6	10.4	120.3	254.0	3.0
Charlevoix, Main Basin	5/2/2007	13.00	8.19	271.9	10.2	300.0	498.0	2.2
Charlevoix, South Arm	5/2/2007	12.28	8.30	285.3	9.1	570.6	508.0	2.4
Cheboygan River	4/9/2007	14.18	8.34	282.9	6.1	68.4	338.0	4.8
Clam Lake	4/17/2007	12.10	8.24	300.5	8.8	421.4	471.0	2.6
Crooked Lake	4/25/2007	11.62	8.31	275.1	7.8	267.9	404.0	2.8
Crooked River	3/28/2007	11.97	8.36	290.3	8.9	224.8	373.0	4.9
Deer Lake	4/24/2007	11.41	8.32	239.9	6.7	49.1	308.0	2.6
Douglas Lake	4/20/2007	12.24	8.22	194.9	6.8	46.9	455.0	9.4
Elk Lake	4/17/2007	13.24	8.31	249.4	9.3	262.3	338.0	2.9
Elk River	4/2/2007	11.64	8.47	267.1	8.0	245.0	305.0	1.0
Ellsworth Lake	4/16/2007	11.90	8.12	310.3	9.6	349.3	409.0	3.5
Hanley Lake	4/19/2007	11.79	8.26	316.5	9.4	443.7	547.0	3.3
Huffman Lake	4/30/2007	10.43	8.41	277.2	4.7	38.0	179.0	6.9
Huron, Duncan Bay	5/8/2007	12.11	8.27	215.5	8.2	170.5	311.0	3.9
Indian River	5/22/2007	10.13	8.25	284.7	10.4	105.2	316.5	3.9
Intermediate Lake	4/19/2007	12.11	8.33	315.9	11.3	442.6	608.0	3.4
Jordan River	4/2/2007	10.04	8.30	322.0	6.0	981.5	1021.0	5.6
Lancaster Lake	4/20/2007	10.08	8.25	201.1	7.9	53.8	444.0	13.5
Larks Lake	5/3/2007	10.88	8.50	189.6	4.2	66.0	453.0	7.6
Little Sturgeon River	5/21/2007	9.82	8.30	293.3	13.2	57.5	202.0	8.1
Long Lake	5/4/2007	11.40	8.21	191.3	8.9	45.3	346.0	4.4
Maple River	4/9/2007	14.41	8.17	222.3	3.3	270.3	472.0	3.0
Michigan, Bay Harbor	5/30/2007	10.87	8.13	262.2	13.4	279.0	391.0	2.5
Michigan, Grand Traverse Bay	4/17/2007	13.34	8.29	232.6	6.3	257.3	331.0	2.0
Michigan, Little Traverse Bay	5/17/2007	13.40	8.29	228.0	11.6	259.0	397.0	2.5
Mullett Lake	5/8/2007	11.54	8.28	276.2	12.9	73.0	211.0	3.1
Munro Lake	5/8/2007	11.88	8.35	187.8	4.0	79.6	948.0	9.5
Nowland Lake	5/10/2007	10.40	8.49	184.2	6.5	10.2	567.0	8.1
Paradise Lake	4/20/2007	12.58	8.29	180.7	10.9	35.5	569.0	8.3
Pickerel Lake	4/25/2007	11.07	8.31	267.5	6.3	209.1	361.0	2.7
Pigeon River	5/21/2007	9.75	8.37	316.0	6.8	28.0	247.0	7.8
Pine River	4/2/2007	13.54	8.47	277.7	7.7	322.2	418.0	4.6
Rainy River	4/9/2007	13.14	8.09	248.8	4.5	32.7	411.0	8.3
Round Lake (Emmet Cty)	5/1/2007	10.44	8.54	262.9	26.9	16.7	350.0	6.3
Silver Lake (Wolverine)	4/30/2007	11.15	8.30	190.0	4.2	35.2	1203.0	2.8
Six-mile Lake	4/24/2007	11.38	8.21	260.6	6.9	224.9	433.0	4.2
Skegemog Lake	4/17/2007	12.75	8.36	257.7	8.3	300.0	311.0	1.8
Spring Lake	5/1/2007	11.07	8.25	571.5	88.2	857.7	1292.0	7.3
St. Clair Lake	4/16/2007	11.97	8.13	293.6	6.1	283.8	385.0	3.2
Sturgeon River	4/9/2007	14.41	8.26	340.5	12.2	280.5	280.0	2.3
Susan Lake	4/24/2007	10.83	8.28	251.4	9.5	29.1	333.0	3.6
Tannery Creek	3/28/2007	12.22	8.22	428.1	37.1	705.2	902.0	5.7
Thumb Lake	4/30/2007	11.66	8.33	177.8	4.4	37.0	293.0	2.8
Torch Lake	4/17/2007	13.07	8.34	245.9	6.2	364.6	377.0	2.2
Twin Lakes	5/1/2007	11.27	8.40	239.5	2.3	10.3	275.0	7.7
Walloon, Foot	5/7/2007	11.77	8.18	243.6	12.4	91.2	279.0	1.9
Walloon, Mud Basin	5/9/2007	10.92	8.32	277.7	15.2	9.6	424.0	10.2
Walloon, North Arm	5/7/2007	10.91	8.24	267.1	14.2	268.5	458.0	4.1
Walloon, West Arm	5/9/2007	12.27	8.27	238.4	9.3	157.7	385.0	3.0
Walloon, Wildwood Basin	5/7/2007	11.79	8.24	238.8	12.5	82.9	255.0	2.7
Wildwood Lake	4/30/2007	10.13	8.42	247.0	13.2	>1	379.0	6.2
Wilson Lake	4/16/2007	11.75	8.11	317.6	9.7	405.2	595.0	1.9

*Unit descriptions: mg/l = parts per million, µg/l = parts per billion, µS = microSiemens per centimeter

Partnering to Protect Dougals Lake

Gold & Blue Uncover Blue & Green on Douglas Lake

In June of 2008, Tip of the Mitt Watershed Council received a call from University of Michigan Biostation staff concerning a potentially dangerous form of blue-green algae in Douglas Lake. Samples taken during an algae class revealed the presence of microsystis, a blue-green algae species that can produce a toxin harmful to animals, including humans. Although uncertain as to whether the toxin was present at dangerous levels in the lake, Biostation staff notified the Cheboygan County Health Department and the Douglas Lake Improvement Association; advising "bug camp" staff and residents to limit time in the lake until further information was obtained. A sample collected and sent off for analyses showed the microsystin toxin to be at non-detectable levels. This brief scare for the Douglas Lake community during the summer of 2008 increased action on part of the Lake Association, the Biostation, and the Watershed Council to become better informed regarding the biology, ecology, and dangers of blue-green algae and to take steps to monitor Douglas Lake for blue-green algae and, thereby, better protect lake users.

The name "blue-green algae" is a bit of a misnomer as this group of organisms more closely resembles bacteria and in fact, belong to a phylum commonly called *Cyanobacteria.* These bacteria that have the ability to photosynthesize (which has created the confusion in taxonomic classification) have been on the planet for a long time, fossil records going back almost 3 billion years! Present day, over 3,000 species have been described worldwide. Some of these species can produce toxins, including neurotoxins, hepatotoxins, cytotoxins, and endotoxins, which are potentially dangerous to animals and humans. One type of toxin-producing blue-green algae, Microcystis, has been in the spotlight in recent years in Michigan following the discovery of high levels of the associated toxin, microsystin, in lakes near Muskegon. Microcystis is the type that was discovered by the algae class at the Biostation that raised the flag and caused the alert.

Tom Kennedy, board member of both the Douglas Lake Improvement Association and Tip of the Mitt Watershed Council, was particularly interested in blue-green algae in Douglas Lake and has been actively researching the issue and coordinating monitoring efforts. Following an extensive information search, Tom developed a program to monitor microcystin in the lake. Arrangements have been made to collect and analyze samples from Douglas Lake with assistance from Biostation staff. Although microsystin was not detected in samples collected in 2009, monitoring efforts will continue in 2010 and beyond to ensure the safety of those living on, studying, and recreating in Douglas Lake.

The Watershed Council will continue to collaborate with the Lake Association, Biostation, and other partners to monitor microcystin in Douglas Lake and to spread the knowledge and lessons learned to other lake organizations throughout Northern Michigan. We thank Tom for all his efforts and the Biostation for their vigilance and support.

Although microsystin was not detected in samples collected in 2009, monitoring efforts will continue in 2010 and beyond to ensure the safety of those living on and utilizing Douglas Lake.

Volunteer Lake Monitoring

Local Volunteers Monitor & Protect Our Lakes

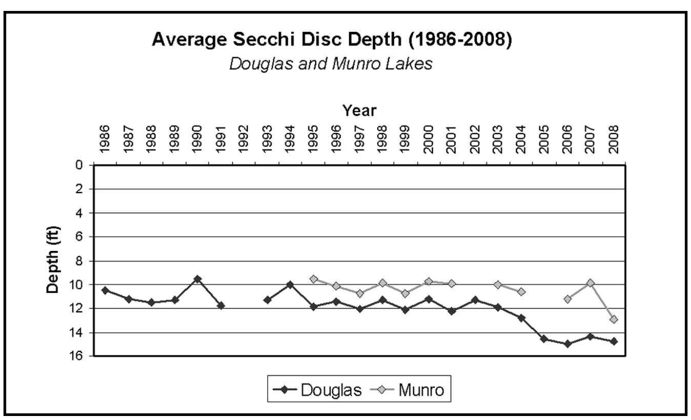
Since 1984, Tip of the Mitt Watershed Council has coordinated the Volunteer Lake Monitoring program (VLM), relying upon hundreds of volunteers to monitor the water quality of dozens of lakes in the northern Lower Peninsula of Michigan. During the summer of 2008, 40 volunteers monitored water quality at 33 stations on 25 lakes.

A tremendous amount of data has been generated by the VLM program and is available to the public via our web site (www.watershedcouncil.org/protect). This data is essential for discerning short-term changes and long-term trends in the lakes of Northern Michigan. Ultimately, the dedicated effort of volunteers and staff will help improve lake management and protect and enhance the quality of Northern Michigan's waters.

Volunteers measure water clarity on a weekly basis using a Secchi disc. Every other week volunteers collect water samples to be analyzed for chlorophyll-a. Staff at the Watershed Council process the data and determine Trophic Status Index (TSI) scores to classify the lakes and make comparisons. On Douglas and Munro Lakes, volunteers have monitored water quality since 1986 and 1995 respectively. The following section summarizes the results.

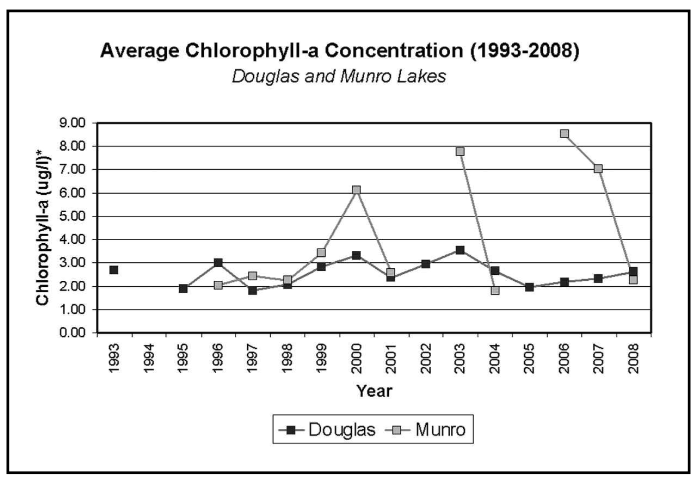
Secchi Disc

The Secchi disc is a weighted disc (eight inches in diameter, painted black and white in alternating quarters) that is used to measure water clarity. The disc is dropped down through the water column and the depth at which it disappears is noted. Using Secchi disc measurements, we are able to determine the relative clarity of water, which is principally determined by the concentration of algae and/or sediment in the water. The clarity of water is a simple and valuable way to assess water quality. Lakes and rivers that are very clear usually contain lower levels of nutrients and sediments and, in most cases, boast high quality waters. Throughout the summer, different algae bloom at different times, causing clarity to vary greatly. Secchi disc depths have ranged from just a few feet in small inland lakes to 40-50+ feet in large inland lakes and Great Lakes' bays.



Chlorophyll-a

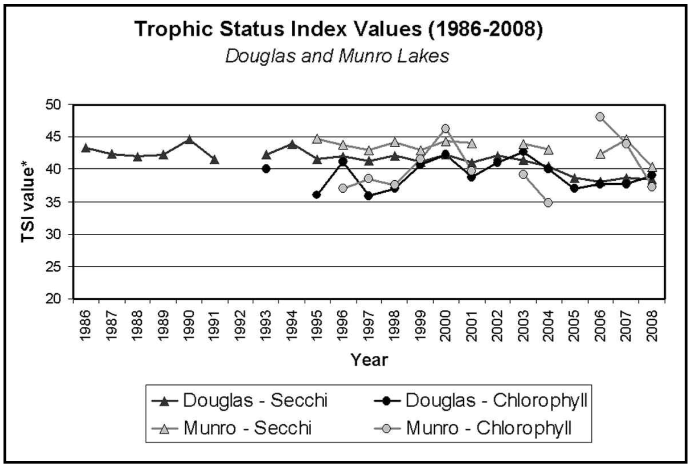
Chlorophyll-a is a pigment found in all green plants, including algae. Water samples collected by volunteers are analyzed for chlorophyll-a to determine the amount of phytoplankton (minute free-floating algae) in the water column. There is a strong relationship between chlorophyll-a concentrations and Secchi disc depth. Greater amounts of chlorophyll-a indicate greater phytoplankton densities, which reduce water clarity and, thus, the Secchi disc depth as well. So why collect chlorophyll-a data? The chlorophyll-a data provides support for Secchi disc depth data used to determine the productivity of the lake, but it can also help differentiate between turbidity caused by algal blooms versus turbidity caused by other factors such as sedimentation or calcite.



Trophic Status Index

Trophic Status Index (TSI) is a tool developed by Bob Carlson, Ph.D. from Kent State University, to determine the biological productivity of a lake. Formulas developed to calculate the TSI value utilize Secchi disc depth and chlorophyll-a

*Unit descriptions: mg/l = parts per million, µg/l = parts per billion, µS = microSiemens per centimeter



measurements collected by our volunteers. TSI values range from 0 to 100. Lower values (0-38) indicate an oligotrophic or low productive system, medium values (39-49) indicate a mesotrophic or moderately productive system, and higher values (50+) indicate a eutrophic or highly productive system. Lakes with greater water clarity and smaller phytoplankton populations would score on the low end of the scale, while lakes with greater turbidity and more phytoplankton would be on the high end.

TSI values do not measure water quality, but simply place the lake on a scale of biological productivity. Oligotrophic lakes are characteristically deep, clear, nutrient poor, and with abundant oxygen. On the other end of the spectrum, eutrophic lakes are shallow, nutrient rich and full of productivity, which when excessive can lead to oxygen depletion. Mesotropic lakes lie somewhere in between and are moderately productive. Lakes may be placed in the eutrophic category as a result of algal blooms, which are often a public concern and can be indicative of water pollution problems. On the other hand, low productivity of oligotrophic lakes may result in a lackluster fishery when compared to highly productive eutrophic lakes.

(2008 TSI Values for all lakes on back page.)

Results from Douglas and Munro Lakes

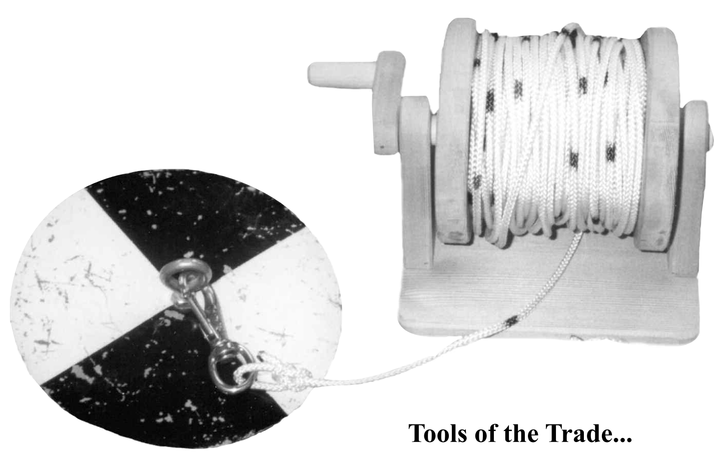
Volunteer monitors have collected water quality on Douglas Lake for over 20 years, near its deepest point to the east of Pells Island. Data from Munro Lake is growing as it has been monitored for over a decade. Lancaster Lake, however, was monitored only one year (2007) and is therefore, not included in trend analyses. The long-term Secchi disc and chlorophyll-a data from these lakes allow Watershed Council staff to assess water quality and examine changes over time.

Data from Douglas Lake show an increase in average Secchi disc depths, particularly since 2002, whereas water clarity has largely remained stable in Munro Lake. Average chlorophyll-a concentrations have gone up and down in both lakes and show no clear trends. The increased water clarity in Douglas Lake is probably linked to zebra mussels, which were first documented in the lake in 2001. Zebra muscles are voracious filter-feeders that feed upon algae and essentially clear the water column. Unfortunately, zebra mussels are not cleaning the water, but rather removing the algae that are the base of the food chain and ultimately, causing ecosystem disruptions. Their feeding habits make them a very likely culprit for the recent increases in transparency observed in Douglas. To date, zebra mussels have not been found in Munro Lake and hopefully, the 2008 increase in water clarity is an anomaly rather than a sign of exotic mussel invasion.

Douglas Lake appears to be wavering between mesotrophy (moderately productive) and oligotrophy (low productivity) while Munro Lake steadily scores in the mesotrophic category. Trophic status index scores in Douglas Lake, based on Secchi disc depths, were consistently above 40 until 2005 when they dipped into the upper 30s. In Munro Lake, trophic status index scores based on Secchi disc depths have consistently been 40 or above. Both lakes have seen a lot of variation in trophic status index scores calculated from the chlorophyll-a data. Although not completely supported by the chlorophyll-a data, it appears that the introduction of zebra mussels may be moving Douglas Lake into the oligotrophic category; clearer with fewer nutrients in the open water, but maintaining high dissolved oxygen levels.

Overall, volunteer data show that the water quality of Douglas and Munro Lakes remains high. Without dedicated volunteers, we would have less data, so we would like to send out a big "thank you" to all those that have helped with the program. We would also like to encourage others to become involved with our volunteer program to help us monitor and protect the aquatic treasures of Northern Michigan.

If you would like to get involved, please contact the program coordinator, Kevin Cronk, at (231) 347-1181 ext. 109 or by e-mailing kevin@watershedcouncil.org.



Tools of the Trade...
Volunteer Lake Monitors use a Secchi disc to measure water clarity.

* TSI values range from 0 to 100. Lower values (0-38) indicate an oligotrophic or low productive system, medium values (39-49) indicate a mesotrophic or moderately productive system, and higher values (50+) indicate a eutrophic or highly productive system.

Trophic Status Index (TSI) Values for Lakes Monitored in 2008

Lake	TSI	Lake	TSI	Lake	TSI
Bass Lake	44	Lake Charlevoix, South Arm	32	Pickerel Lake	38
Black Lake	28	Huffman Lake	31	Six Mile Lake	44
Burt Lake, Central Basin	34	Lake Marion	23	Thayer Lake	43
Burt Lake, North	34	Lake Michigan, Bay Harbor	14	Thumb Lake	32
Burt Lake, South	36	Lake Michigan, Little Traverse Bay	27	Twin Lake	38
Crooked Lake	38	Long Lake, Cheboygan County	31	Walloon Lake, Foot Basin	34
Douglas Lake - Cheboygan City	39	Mullett Lake, Center	25	Walloon Lake, North	37
Douglas Lake - Otsego City	42	Mullett Lake, Pigeon Bay	32	Walloon Lake, West Arm	33
Elk Lake	38	Munro Lake	39	Walloon Lake, Wildwood	33
Lake Charlevoix, Main	24	Paradise Lake	45		

* TSI values range from 0 to 100. Lower values (0-38) indicate an oligotrophic or low productive system, medium values (39-49) indicate a mesotrophic or moderately productive system, and higher values (50+) indicate a eutrophic or highly productive system.

Special Thanks to Our Douglas & Munro Lake Volunteers
We couldn't do it without you.