The Gem Lakes of Northern Michigan

2008 Report

Tip of the Mitt Watershed Council

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 that "lakes" draw them in. Lakes define the landscape of Northern Michigan and sustain local economies, providing stunning views, abundant fisheries, and tremendous recreational opportunities.

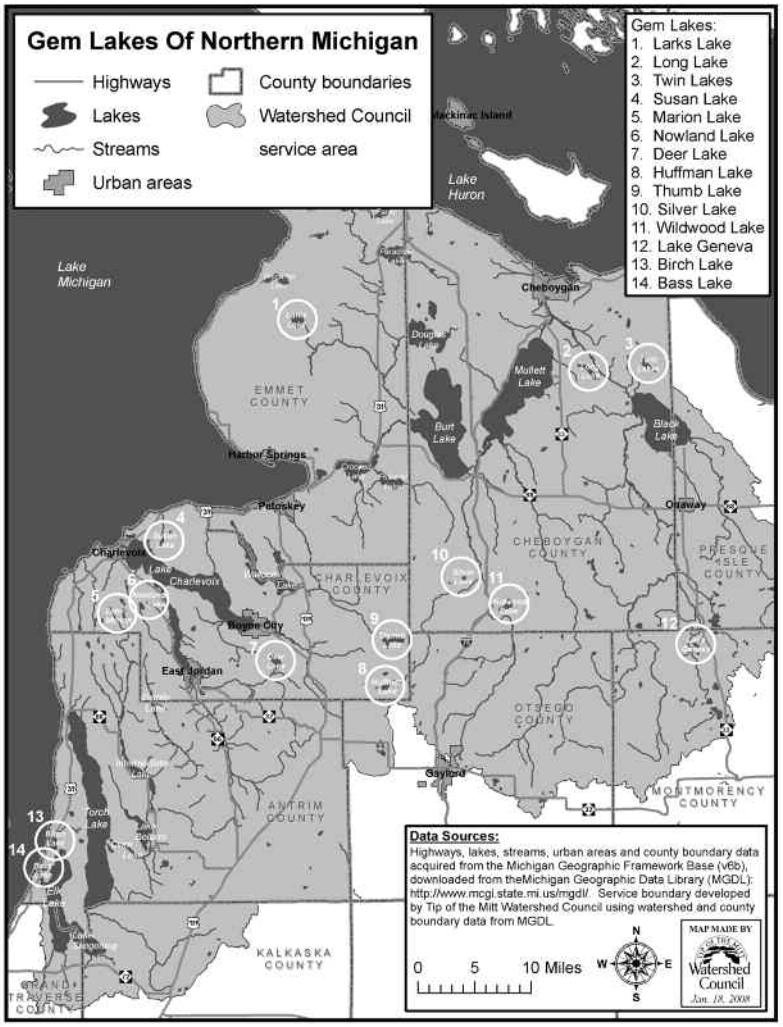
In the Watershed Council service area there are nearly 60 lakes greater than 100 acres in size, and 14 of these are among the State's largest with over 1000 acres of lake-surface area. The region also boasts some of the State's deepest lakes with five lakes having maximum depths of 100 feet or more. These grandiose water bodies, such as Torch Lake or Lake Charlevoix, are quite popular among water enthusiasts. However, there are many smaller, yet equally magnificent lakes that are, for the most part, unknown - the hidden gems of Northern Michigan.

Some of the gem lakes include Larks, Long, Twin, Susan, Marion, Nowland, Deer, Huffman, Thumb, Silver, Wildwood, Geneva, Birch, and Bass. Although often overlooked by the typical recreationalist, these hidden treasures are highly valued by the Watershed Council. Each of the small gem lakes provide an escape where one can go enjoy a relaxing day on the water in relative peace; soaking up sights and sounds of the lake ecosystem. Over the last few decades, the Watershed Council has put forth great effort to preserve these lake gems and ensure they 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 the last 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 gem 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 small gem lakes 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.



Comprehensive Water Quality Monitoring

Water Quality Trends: 20 years of data

In May of 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 20 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 the gem lakes. We have also included charts to provide a graphic display of trends occurring in the lakes. For additional information about the Comprehensive Water Quality Monitoring Program please visit our web site at www.watershedcouncil.org/cwqm.html.

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 the gem lakes has shown that pH levels consistently fall within this range, with a minimum of 7.19 (Silver, 1995) and maximum of 8.68 (Nowland, 2001).

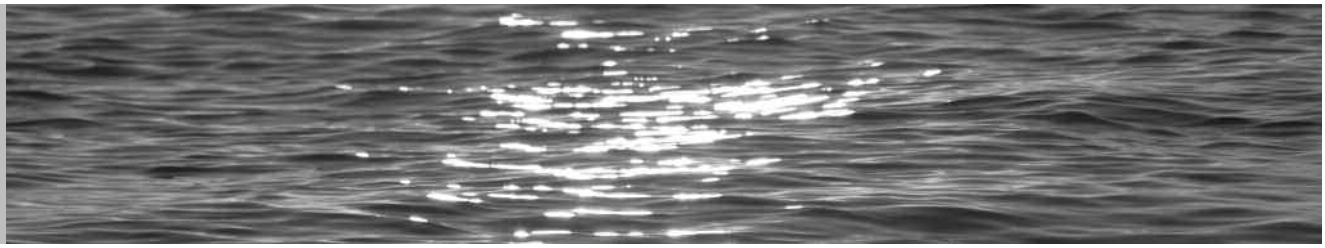
Kevin Cronk, our Monitoring and Research Coordinator, uses the Hydrolab™ to measure water quality.

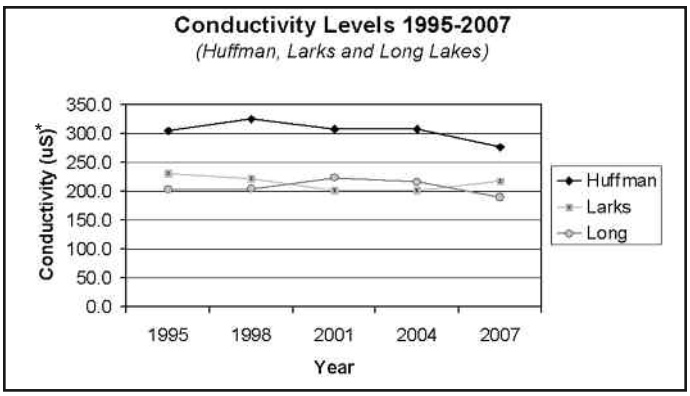
Dissolved Oxygen

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 the gem lakes have ranged from 0.94 PPM (Twin, 2004) to 13.1 PPM (Long, 1995). All levels below 5 PPM were recorded at the bottom, where oxygen depletion is typical for many lakes. However low oxygen levels could be an indicator of water quality impairment.

Conductivity

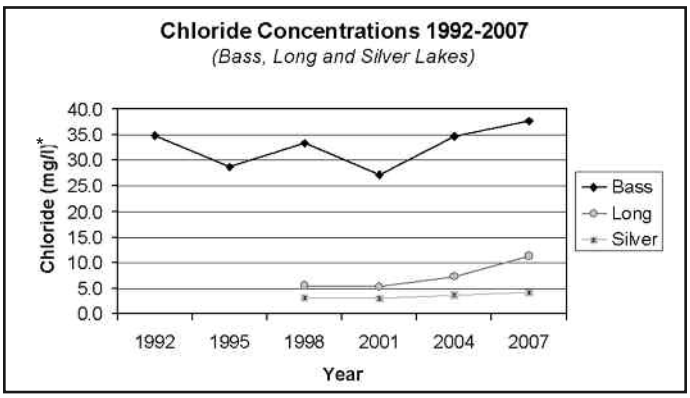
Conductivity is a measure of the ability of water to conduct an electric current, which is dependent upon the concentration of charged particles (ions) dissolved in the water. Readings on lakes monitored by the Watershed Council have ranged from 175 to 656 microSiemens (µS), and in the gem lakes, ranging from a low of 175.1 µS (Thumb, 2007) to a high of 352.6 µS (Bass, 2004). A steady increase in conductivity levels generally occurs due to greater human activity in the watershed and may indicate that water pollution is occurring. Data collected does not show such a trend (ie., increasing conductivity levels) occuring in the gem lakes.





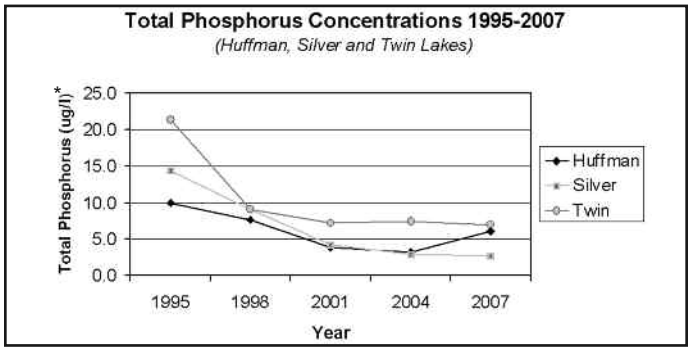
Chloride

Chloride, a component of salt, is present naturally at low levels in Michigan surface waters due to the marine origin of bedrock in Northern Michigan (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 ranged from 1.0 PPM (Larks, 2001) to 38.1 PPM (Bass, 2007). Chloride levels have increased in some of the gem lakes, but generally to a lesser degree than in larger lakes.



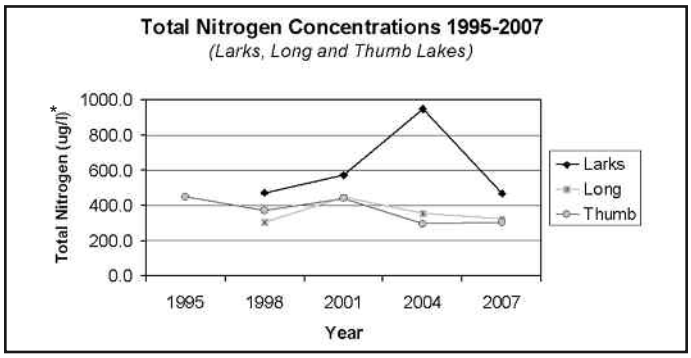
Total Phosphorus

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 less than 10 PPB in high quality surface waters. In the gem lakes, total phosphorus levels have ranged from 1.8 PPB (Long, 2007) to 35.3 PPB (Thumb,1998). In many lakes, large and small, phosphorus levels have been dropping during the last few decades.



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 (from things such as fertilizer, faulty septic systems, and stormwater runoff). In general, the lowest nutrient levels were found in Lake Michigan and large deep inland lakes, while the highest nutrient levels were found in small shallow lakes. Total nitrogen levels in the gem lakes have ranged from 165 PPB (Huffman, 1998) to 1,203 PPB (Silver 2007). There are no clear trends in the nitrogen data.



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

Comprehensive Water Quality Monitoring Program 2007 Data

Water quality data from the surface of all waters bodies monitored in 2007

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

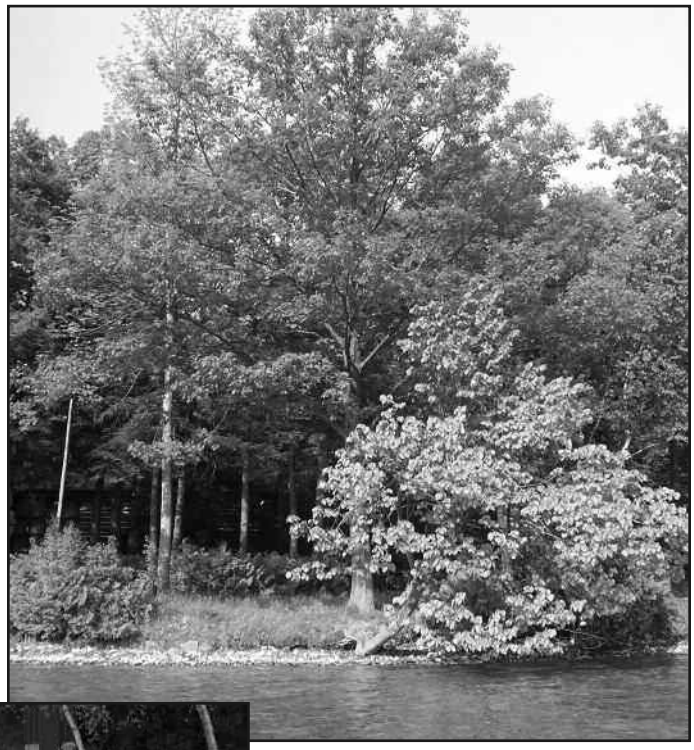
*Unit descriptions: mg/l = parts per million, µg/l = parts per billion, µS = microSiemens per centimeter

Partnering to Protect the Small Gem Lakes

With Great Land Comes Great Responsibility

Property owners living on gem lakes (Bass, Birch, Deer, Geneva, Huffman, Larks, Long, Marion, Nowland, Silver, Susan, Thumb, Twin, and Wildwood Lakes) are blessed with some of the most beautiful lakeshore terrain in Northern Michigan, but this great land comes with great responsibility. Shoreline properties are critical to the lake ecosystem as the interface between land and water. It is within this interface, which is also referred to as the riparian zone, that human activity has the greatest potential for impacting water quality.

A naturally vegetated riparian zone provides tremendous benefits to the lake ecosystem. The vegetation holds soils in place, filters contaminants from surface runoff, provides habitat for aquatic and terrestrial organisms, and shades near-shore areas. Removing too much vegetation from the shoreline and replacing it with seawalls, fertilized turf grasses, and impervious surfaces (e.g., roads and roofs) can cumulatively have negative impacts. Thus, shoreline property owners must manage their land responsibly to safeguard the lake's water quality.



Example of a healthy riparian buffer.

In recent years lake associations from three gem lakes have demonstrated their commitment to wise shoreline management by supporting comprehensive shoreline surveys. Shoreline surveys, performed by Watershed Council staff, document shoreline conditions, such as erosion and greenbelts, but usually with a focus on indicators of nutrient pollution. Nutrient pollution comes from sources such as excess fertilizers, malfunctioning septic systems and stormwater runoff. Nutrients stimulate plant growth, which could have serious consequences for a small lake, particularly if it is shallow and already contains abundant plant growth.

Watershed Council staff conducting a shoreline survey.

The Watershed Council performed shoreline surveys on Larks and Huffman Lakes in 2006 and on Thumb Lake in 2007. These were the first shoreline surveys ever performed on Larks and Huffman Lakes, providing baseline data to determine if and where problems were occurring. In the case of Thumb Lake, it was the third such survey and provided data to both identify problem areas and evaluate changes over time.

Survey results revealed that the majority of shorelines on these lakes were in great shape, though there were a few problem areas in need of attention. To maximize the value of these surveys the Watershed Council intends to work with the lake associations to perform follow-up activities. These activities range from sending questionnaires to property owners to individual site visits. By working directly with property owners to correct problems along the shoreline, the lake associations and Watershed Council will take a big step toward the mutual goal of protecting and improving the water quality of these gem lakes. Of course, all hinges on commitment and action on the part of shoreline residents; taking responsibility for their great piece of land to protect their lake's great water quality for generations to come.

If you or your organization would like more information regarding shore surveys and other technical services provided by the Watershed Council, please visit our website at www.watershedcouncil.org or call Kevin at extension 109.

Volunteer Lake Monitoring

Local Volunteers Monitor & Protect Our Lakes

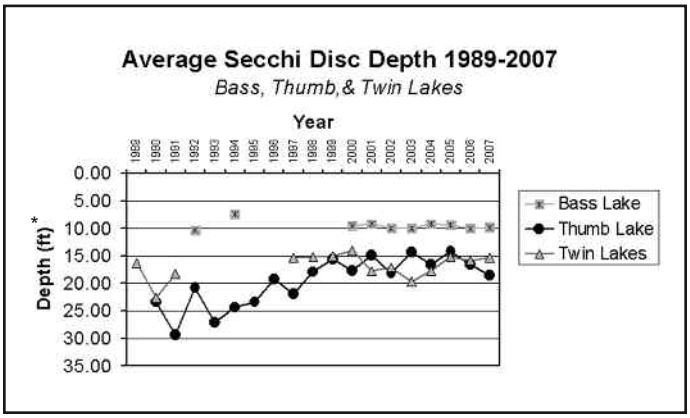
Since 1984, Tip of the Mitt Watershed Council has coordinated the Volunteer Lake Monitoring program (VLM), relying upon dozens of volunteers to monitor the water quality of 35 lakes in the northern Lower Peninsula of Michigan. During the summer of 2007, 40 volunteers monitored water quality at 32 stations on 25 lakes.

A tremendous amount of data has been generated by the VLM program and is available to the public via our website (www.watershedcouncil.org/volunteerlake.html). 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.The following section summarizes the results.

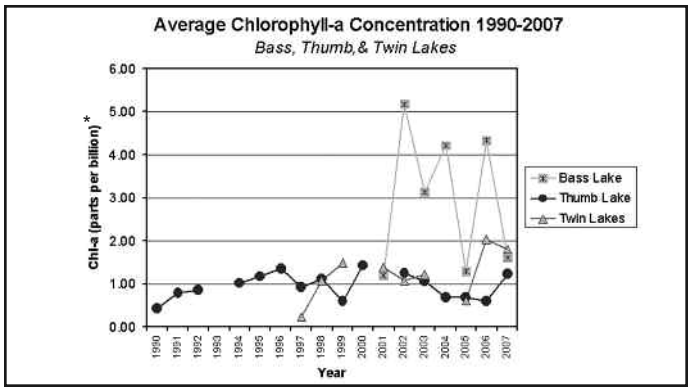
Secchi Disc

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.



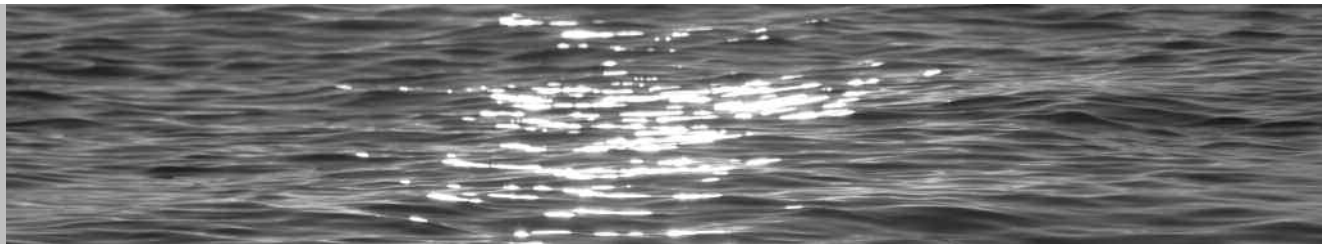
Chlorophyll-a

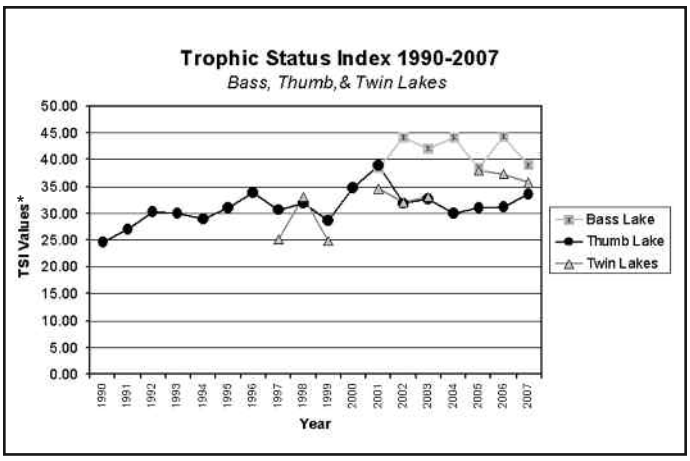
Chlorophyll-a is a pigment found in all green plants, including algae. Water samples collected by volunteers are analyzed for chlorophyll-a to determine the amount of phytoplankton (minute free-floating algae) in the water column. There is a strong relationship between chlorophyll-a concentrations and 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 marl.



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 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.

(2007 TSI Values for all lakes on back page.)

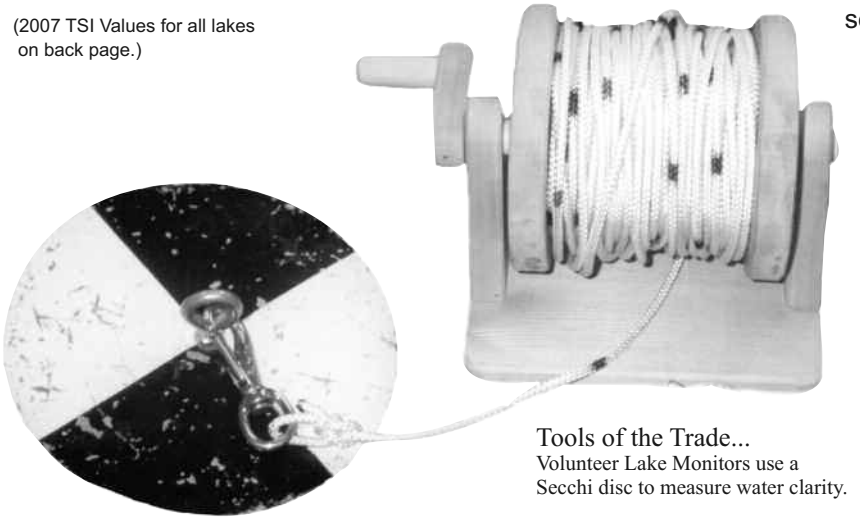
Results from the Gem Lakes

Volunteers have monitored water quality on many of the gem lakes in Northern Michigan, including Bass, Deer, Geneva, Huffman, Larks, Long, Marion, Silver, Susan, Thumb and Twin Lakes. Three of these lakes, Bass, Thumb, and Twin, have been monitored for periods of 10 years or more! These long-term Secchi disc and chlorophyll-a data allow Watershed Council staff to assess the water bodies and examine changes over time.

Secchi disc depth data show that Thumb and Twin Lakes have consistently had clearer waters than Bass Lake, whereas chlorophyll-a concentrations have generally been highest on Bass Lake. As a result, Bass Lake's trophic status index value usually falls in the mesotrophic category (moderate productivity), whereas the other two lakes are considered oligotrophic (low productivity). Why would Bass Lake be more productive? Bass is much smaller than Thumb and Twin Lakes and is located in an urban area. Therefore, Bass Lake probably receives more nutrient pollution in stormwater runoff and has less capacity to absorb impacts from these pollutants due to its size, which ultimately leads to greater productivity.

Another observable trend in the data is the decrease in Secchi disc depth over time in Thumb Lake. Reduced water clarity, which is usually the result of more algae in the water, would make it appear that Thumb Lake is becoming more productive. However, the chlorophyll-a data do not support this and, in fact, show a decrease in algae abundance during recent years. If algae blooms are not responsible for the trend, then another factor, such as turbidity from sediments or marl formation, must be.

Overall, data show that most of the gem lakes have exceptionally high quality waters. 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 hidden treasures of Northern Michigan. If you would like to get involved, please contact the program coordinator, Kevin Cronk, at ext. 109 or at kevin@watershedcouncil.org.



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

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

Trophic Status Index (TSI) Values for Lakes Monitored in 2007

Lake	TSI	Lake	TSI	Lake	TSI
Bass Lake	39	Huffman Lake	34	Six Mile Lake	46
Black Lake	30	Lake Marion	29	Thumb Lake	34
Burt Lake, Central Basin	33	Lake Michigan, Bay Harbor	22	Twin Lake	36
Burt Lake, North	29	Lake Skegemog	37	Walloon Lake, Foot Basin	29
Burt Lake, South	34	Long Lake, Cheboygan County	30	Walloon Lake, North	37
Douglas Lake - Cheboygan	38	Mullett Lake, Center	29	Walloon Lake, West Arm	31
Douglas Lake - Otsego	40	Mullet Lake, Pigeon Bay	33	Walloon Lake, Wildwood	29
Elk Lake	26	Munro Lake	44		
Lake Charlevoix, Main	25	Paradise Lake	40		
Lake Charlevoix, South Arm	30	Pickerel Lake	34		

Special Thanks to Our 2007 "Gem Lake" Volunteers

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