Tip of the Mitt Watershed Council

Elk-Skegemog Lakes

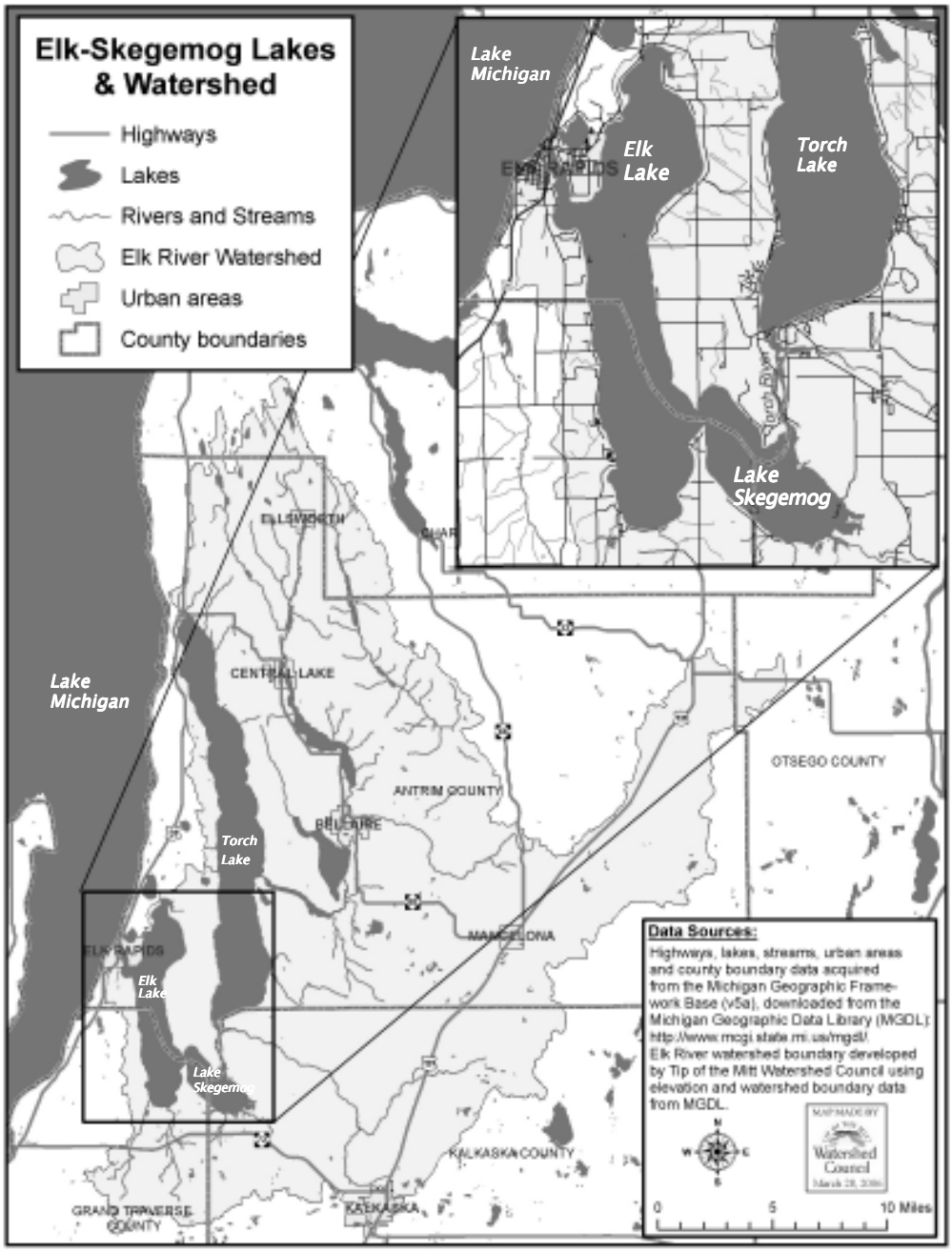
2005 Report

Elk and Skegemog Lakes are the last lakes that make up the interconnected series of 14 lakes and rivers of the Elk River Chain of Lakes Watershed. Elk Lake is Michigan's 14th largest lake with a surface area of 7,730 acres. Lake Skegemog, connected to Elk Lake through the quarter-mile Skegemog Narrows has a surface area of 2,560 acres.

You will find in this report data specific for Elk Lake and Lake Skegemog from two of our cornerstone water quality monitoring programs – 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 17 years. The Volunteer Lake Monitoring program was started in 1984 and relies on dozens of helpful volunteers who collect weekly data on water clarity and algae abundance. These two programs have provided valuable data on the overall health of our waters. Inside are details for the most recent surveys for Elk Lake and Lake Skegemog.

We hope you enjoy reading about two of our projects on Elk Lake and Lake Skegemog. You'll learn about the Watershed Council's work with shoreline property owners to correct erosion as well as partnership efforts with the Elk-Skegemog Lake Association.

We hope you find this report both informative and helpful. If you have any questions, comments, or concerns, please contact the 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: 17 years of data

The Comprehensive Water Quality Monitoring (CWQM) program began in 1987 on 10 lakes in the northern Lower Peninsula and has steadily expanded to the present 54 monitoring sites on 47 lakes and rivers. We now have over 1,300 records in our CWQM database, which are used by Watershed Council staff to characterize lakes and streams, identify specific water quality problems, and view trends or changes in water quality over time. Perhaps the greatest value of the CWQM program is that of an educational and informational tool to generate public interest and promote stewardship of aquatic resources.

By graphing the data collected over the last 17 years, Watershed Council staff have been able to discern a few trends. Total phosphorus concentrations appear to be decreasing on a number of the lakes. Are residents taking more care to prevent phosphorus inputs by reducing or eliminating fertilizers and properly maintaining septic systems? Or could this somehow be linked with the introduction of the invasive zebra mussel to lakes and rivers in our region? Zebra mussels began to appear in the Great Lakes region around 1988, which coincides with the beginning of our monitoring program. While phosphorus levels seem to be decreasing, chloride levels are definitely increasing. Almost all of the lakes monitored for 10+ years show increased chloride concentrations, with a particularly large increase between 2001 and 2004.

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

Parameters and Results

Every three years, the CWQM program waters are sampled and tested in the spring, as soon after "ice-out" as possible. Testing of physical parameters, including temperature, dissolved oxygen, pH, and conductivity, is done on-site with an electronic instrument called a Hydrolab™. Water samples are collected at the surface, mid-depth, and bottom of the water column with a specialized sample collection device called a Kemmerer bottle. The samples are then sent to a consulting laboratory for analysis of nitrates, total nitrogen, total phosphorus, and chlorides. The following section provides brief descriptions and general findings for parameters that we measure.

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 on Elk Lake and Lake Skegemog has shown that pH levels consistently fall within this range, with a minimum of 7.1 and maximum of 8.46.

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 Elk Lake and Lake Skegemog have ranged from 6.22 PPM (Lake Skegemog) to 13 PPM (Elk Lake). Levels below 7 PPM have occurred only two times on Lake Skegemog, which is a natural phenomenon in some stratified lakes and thus, still in compliance with state water quality standards.

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 176 to 656 microSiemens (mS), with an average of 284mS. Conductivity levels in Elk Lake and Lake Skegemog have increased steadily with the lowest reading of 249mS (Elk Lake, 1992) to the highest of 301.5mS (Lake Skegemog, 2004).

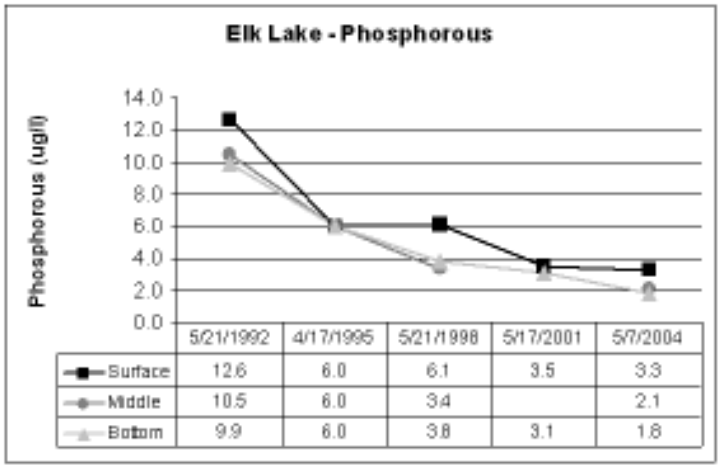
A steady increase in conductivity levels generally occurs due to greater human activity in the watershed and may indicate that water pollution is occurring.

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 fish 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 levels have steadily increased in most lakes monitored by the Watershed Council. Within Elk Lake and Lake Skegemog, chloride levels have ranged from 5.6 PPM (Elk Lake, 1992) to 8.8 PPM (Elk Lake, 2004).

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 and, in fact, all lakes monitored by the Watershed Council were 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 Elk Lake and Lake Skegemog, phosphorus levels have steadily decreased from an average of 11.0 PPB in 1992 to 2.87 PPB in 2004.



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. Nitrogen levels on Elk Lake and Lake Skegemog have ranged from 230 PPB (Elk Lake, 1998) to 550 PPB (Lake Skegemog, 1995).

Comprehensive Water Quality Monitoring **2004** Data Summary

	Depth in Water Column	Dissolved Oxygen (mg/l=PPM)	Specific Conductivity (microSiemens/cm)	pH	Total Nitrogen (micro m/l=PPB)	Total Phosphorus (micro/l=PPB)	Chloride (mg/l=PPM)
Elk Lake	Surface	12.93	293.3	8.26	412	3.3	8.7
	Middle	13.00	292.9	8.26	365	2.1	8.6
	Bottom	12.69	293.2	8.23	418	1.8	8.4
Lake Skegemog	Surface	11.18	301.4	8.37	343	2.8	8.4
	Middle	11.38	301.5	8.38	364	2.9	8.3
	Bottom	11.47	301.1	8.38	361	2.9	8.2

Visit the Watershed Council's website for complete data on all lakes monitored through the CWQM Program **www.watershedcouncil.org**

Partnering to Protect Elk and Skegemog Lakes

A Win-Win Arrangement

Elk-Skegemog Lake Association and the Watershed Council Accomplish Goals Together

According to the Elk-Skegemog Lake Association's (ESLA) web page, "ESLA's focus is in protecting the environment, monitoring development, tracking water quality and following trends in boating, fishing, and other uses of our lakes." ESLA certainly walks the talk. Elk and Skegemog Lakes are both included in the Comprehensive Water Quality Monitoring (CWQM) and Volunteer Lake Monitoring programs, yet ESLA utilizes Watershed Council services to gather even more water quality data.

During the last six years, Watershed Council staff have spent a lot of time on Elk and Skegemog Lakes to help ESLA track water quality. Similar to the data collection techniques in the CWQM program, the additional monitoring is performed in the deepest areas of both lakes, measuring dissolved oxygen, pH, conductivity, temperature, and total phosphorus throughout the water column. The difference is data is collected every year and throughout the season; once in the spring, twice in the summer, and again in the fall (whereas data collection in the CWQM program occurs only every three years in the spring). By collecting data throughout the season, we are able to see a more complete picture.

Dissolved oxygen, a parameter of particular concern, is a good example of viewing the complete picture. During the 2005 field season, Elk Lake experienced the lowest dissolved oxygen levels yet recorded by the Watershed Council, though still above the State of Michigan surface water limit of 7 PPM. The low oxygen levels were recorded near the surface in August, corresponding with some of the warmest water temperatures recorded during these monitoring activities. Warm water holds less dissolved oxygen than cold water and thus, it makes sense that during one of our warmest summers on record, dissolved oxygen levels near the surface were lower than normal.

However, we are more concerned about dissolved oxygen concentration in deep water (near the bottom). Water near the surface is able to replenish dissolved oxygen supplies through atmospheric diffusion, which is augmented by wind and wave action. Deeper waters are not so easily replenished, particularly in summer months when thermal stratification severely limits mixing between surface and bottom waters. If dissolved oxygen is depleted in the deeper waters, phosphorus could be re-suspended from sediments into the water column and lead to nuisance or harmful algae blooms. Furthermore, low dissolved oxygen concentrations at the lake bottom could be harmful or lethal to aquatic organisms inhabiting that niche. Fortunately, the deep waters of Elk Lake have maintained the same high dissolved oxygen concentrations throughout the many years that the Watershed Council has been monitoring the lake's water quality.

The Watershed Council will continue monitoring water quality on Elk and Skegemog Lakes during 2006. In addition, ESLA and the Watershed Council are considering other project possibilities, including: shoreline surveys to document nutrient pollution, shoreline surveys to document greenbelts, tributary water quality monitoring, and shoreline restoration. By working together on these projects, we are both able to accomplish our shared goal of protecting the environment.

Lake Skegemog, 2004

Restoration Remedies

George Rinder is anxious to return to Elk Lake. Not only is he looking forward to spending time at his cottage where he and his family have summered for 80 years, he is curious to see how his property's restored shoreline has weathered its second winter. Based on last year's performance, he's optimistic that the shoreline will not only be intact, but will be further along in its restoration. With each year, the vegetated shoreline, along with the installed coir and riprap, will become stronger and more resilient to the powerful influence of ice and waves. Furthermore, the restored shoreline will provide valuable wildlife habitat and an opportunity for George and his wife Shirley, both amateur botanists, to study the work of nature and marvel at the plant life that has begun to colonize along the lakeshore.

Erosion is a natural process. Accelerated erosion is not. Accelerated erosion occurs most commonly on properties that humans have altered and can have a serious impact on water quality, wildlife habitat, and property value.

If you are concerned about erosion on your shoreline property there are some basic steps to follow to address the problem—1) Assessment of the problem; 2) Prevention of further damage; 3) Restoration, if needed. Through the Watershed Council's Restoration Remedies program we offer a fee service for assessment and project design. If you would like to assess the problem on your own, go to our website to look at "Understanding, Living With, and Controlling Shoreline Erosion," which has detailed information on how to assess your property.

Shorelines are dynamic areas of energy, restoring accelerated erosion is one thing we can do to minimize our impact and enhance our enjoyment of the shoreline.

From phone consultations to comprehensive restoration design, the Watershed Council's Restoration Remedies program works with shoreline property owners to restore their troubled shorelines and streambanks, enhance their aquatic habitat, and guide their property management. Services available through the program include:

Shoreline and Streambank Erosion Control
Greenbelt Design
Habitat Enhancement
Project Installations
Aquatic Invasive Species Management
Permit Applications
Wetland Delineations

If you would like help with your shoreline property, please contact:

Jennifer Gelb, Restoration Ecologist
(231) 347-1181, ext. 112
jen@watershedcouncil.org

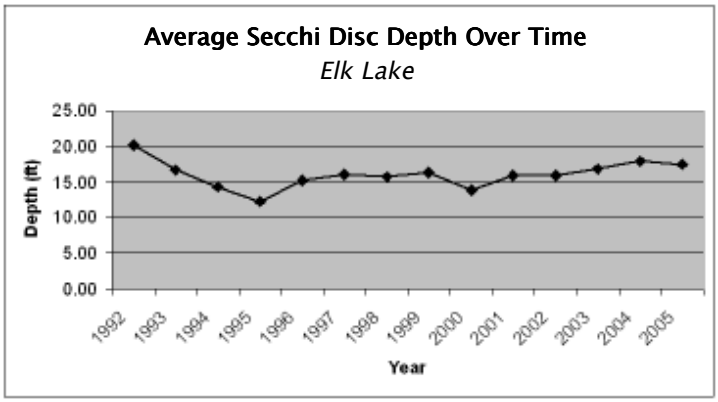
The Rinder's wooded shoreline was experiencing erosion. Restoration of the shoreline involved using plantings, coir bundles with gravel/rock toe protection and backfilling with sand and topsoil.

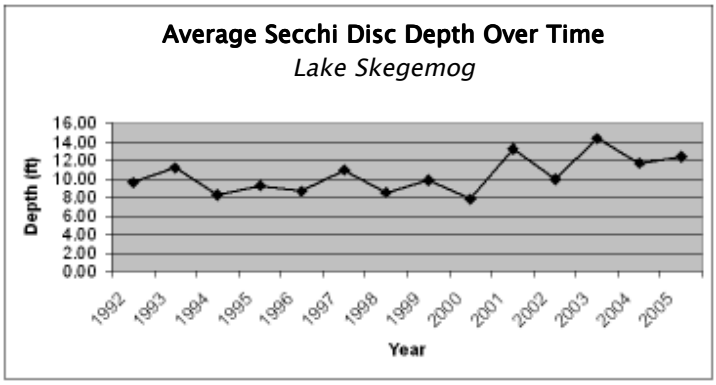
Volunteer Lake Monitoring

Since 1984 the 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 2005, 45 volunteers monitored water quality at 35 stations on 27 lakes.

A tremendous amount of data has been generated by the VLM program and will be available to the public soon via our web site (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.

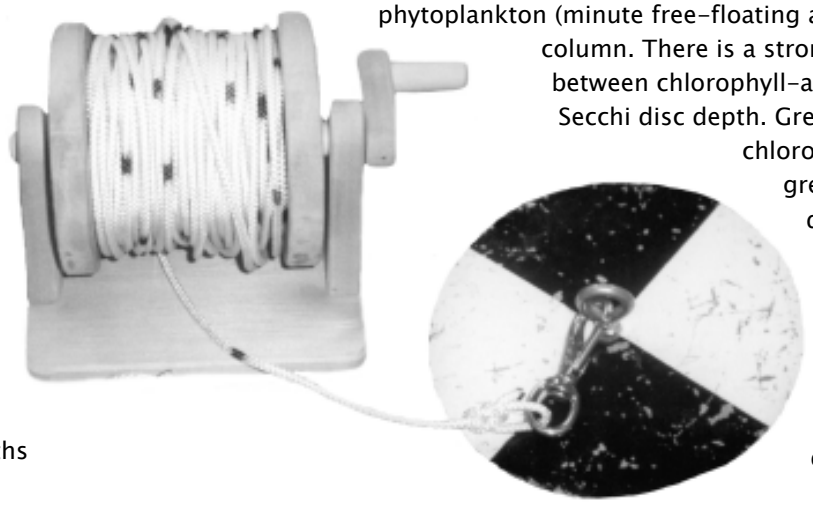
Volunteers have monitored water quality on Elk Lake and Lake Skegemog since 1990. Volunteers measure water clarity on a weekly basis using a Secchi disc. Every other week volunteers collect water samples to be analyzed for chlorophyll-a. Staff at the Watershed Council process the data and determine Trophic Status Index (TSI) scores to classify the lakes and make comparisons. The following section contains detailed explanations and charts showing data from Elk Lake and Lake Skegemog as well as others.





Secchi Disc

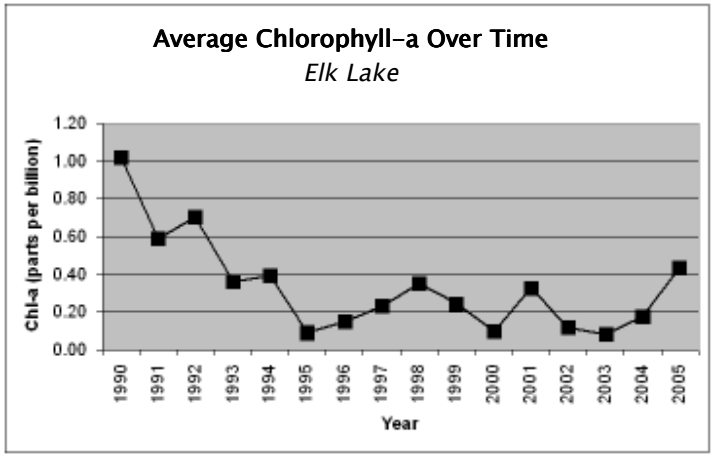
The Secchi disc is a weighted disc (eight inches in diameter, painted black and white in alternating quarters) that is used to measure water clarity. The disc is dropped down through the water column and the depth at which it disappears is noted. Using Secchi disc measurements, we are able to determine 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.

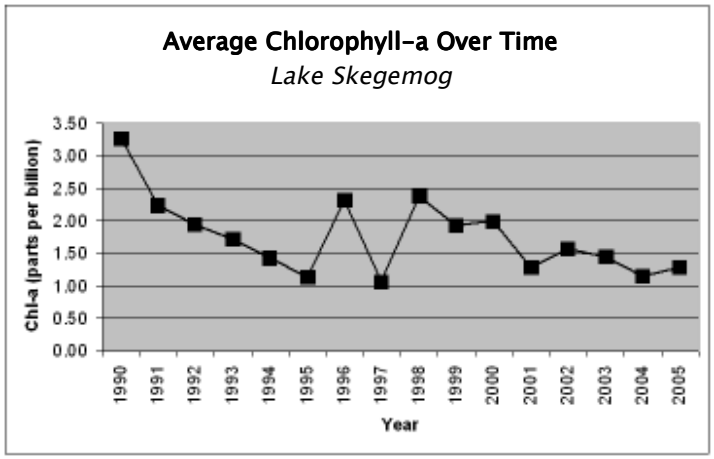


Chlorophyll-a

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 reduces 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.

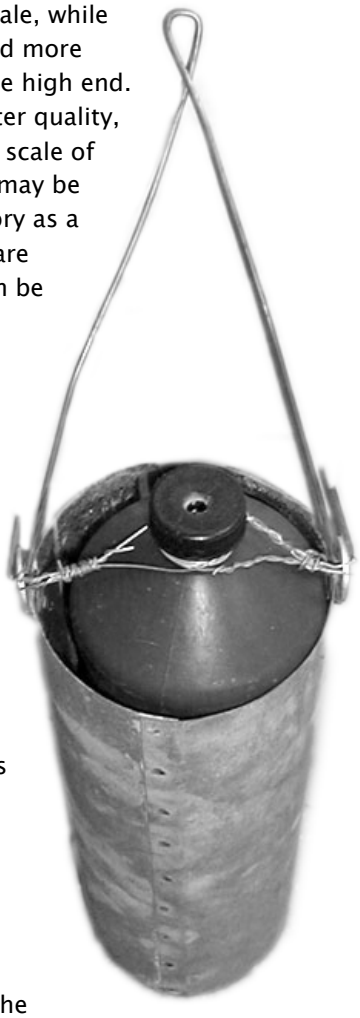




Trophic Status Index

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. 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.

TSI values from 2005 data of 28 on Elk Lake and 35 on Lake Skegemog place these lakes in the oligotrophic category (see chart on the next page). Oligotrophic lakes are characteristically deep, clear, nutrient poor, and with abundant oxygen. Eutrophic lakes are shallow, nutrient rich and full of productivity, which when excessive can lead to oxygen depletion. In the 2005 field season none of the lakes surveyed by volunteer lake monitors were classified as eutrophic.



Tools of the Trade
Volunteer Lake Monitors use a Secchi disc (page 7, bottom) to measure water clarity and an integrated sampling device (above) to collect water to measure chlorophyll-a.

Special thanks to our 2005 Volunteer Monitors

Elk Lake: William R. Letsche
Lake Skegemog: Dale Claudepierre

TSI Values *continued*

Trophic Status Index (TSI) Values for Lakes Monitored in 2005*					
Lake	**TSI**	**Lake**	**TSI**	**Lake**	**TSI**
Bass Lake	38	Lake Charlevoix, South Arm	33	Silver Lake	28
Black Lake	29	Lake Marion	21	Six Mile Lake	43
Burt Lake, Central Basin	33	Lake Michigan, Bay Harbor	12	Thumb Lake	31
Burt Lake, South	31	Lake Michigan, Little Traverse Bay	24	Twin Lakes	38
Clear Lake	23	Lake Skegemog	35	Walloon Lake, Foot Basin	38
Crooked Lake	37	Mullett Lake, Center	28	Walloon Lake, North	40
Douglas Lake-Cheboygan	38	Mullett Lake, Pigeon Bay	31	Walloon Lake, West Arm	33
Douglas Lake-Otsego	38	Paradise Lake	35	Walloon Lake, Wildwood	34
Elk Lake	28	Pickerel Lake	28	Wilson	40
Lake Charlevoix, Main	23	Round Lake	34		

** TSI value not available for all lakes monitored due to lack of data needed to calculate the TSI value.*

This report would not be possible
without the dedicated help of the volunteer lake monitors,
so we would like to sincerely thank all who
have participated in this program.

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