**Tip of the Mitt Volunteer Lake Monitoring Program**

Since 1986, the Tip of the Mitt Watershed Council has coordinated the Tip of the Mitt Volunteer Lake Monitoring Program to monitor and assess lakes in the Northern Lower Peninsula of Michigan. Volunteers in the program monitor locations on the Great Lakes (Lake Michigan and Lake Huron), as well as inland lakes pertaining to the following watersheds: Carp River, Cheboygan River, Elk River Chain of Lakes, Lake Charlevoix, and Little Traverse Bay. The goals of the program include:

1. Assess lake water quality, identify water quality or lake ecosystem problems, and determine water quality trends.
2. Characterize lakes in terms of trophic status (i.e. biological productivity).
3. Provide accurate and reliable water quality data to agencies, organizations, and the public to assist with lake management efforts.
4. Inform and educate the public in terms of water quality, lake ecology, lake ecosystem degradation associated with human activity, and approaches for reducing impacts to the lake ecosystem (e.g., low-impact development).
5. Protect Northern Michigan lakes through monitoring and observations by volunteers (i.e., more eyes on the water).

**Lake Aging**

All lakes undergo a natural “aging” process called eutrophication. In their early years, glacially formed lakes are often deep, cold, and nutrient-poor, which results in low biological productivity and potentially lackluster fisheries. As a lake ages, it gradually becomes more shallow as it fills in with sediments and organic material, nutrient levels rise, and biological productivity increases. This process leads to changes in the lake ecosystem including physical (e.g. increased water temperatures), chemical (e.g. increased nutrient concentrations), and biological changes (e.g. increased algal and aquatic plant growth). In a natural setting this process occurs very slowly, with little or no change apparent over the course of a person’s lifetime. However, human influence can lead to “cultural eutrophication” or premature aging of a lake.

Cultural eutrophication is the result of human activities in a watershed that accelerate the natural lake aging process, primarily through excessive sediment and nutrient inputs. High sediment inputs contribute to cultural eutrophication in that they reduce lake depth and increase nutrient levels, but sediments affect the lake ecosystem in many other ways, such as reducing habitat and elevating water temperatures. Excessive nutrient inputs, aka “nutrient pollution”, increase biological productivity, resulting in nuisance and potentially harmful algae blooms and aquatic plant growth. Heavy algae and aquatic plant growth in a lake can have recreational impacts, making swimming, boating, and angling less desirable, as well as water quality impacts, such as reduced dissolves oxygen levels from night-time respiration and the decomposition of plant material by aerobic bacteria. In addition, excessive algal growth poses a public health threat due to toxins found in blue-green algae (cyanobacteria).

Volunteer monitoring provides the necessary data to evaluate the biological productivity of a lake and determine whether changes are occurring as a result of nutrient pollution or sedimentation. Monitoring water quality does not ensure clean water, but it does provide valuable information that helps us combat pollution and cultural eutrophication of Northern Michigan lakes.

**What do volunteer lake monitors do?**

The Watershed Council’s volunteer lake monitors are among the first to get out on the water in the spring. Every week throughout the months of June, July, and August, volunteers anchor their boats in the deepest part of the lake, measure surface water temperature with a thermometer, note general weather conditions, and check water clarity with a Secchi disc. The Secchi disc , a weighted, eight-inch diameter disc painted black and white in alternating quarters, is one of the oldest water quality monitoring tools and the most widely used today due to the growth of volunteer monitoring programs across the nation. Volunteers lower the disc through the water and note the depth at which it disappears. The deeper the Secchi disc depth, the clearer the water and, in general, the better the water quality.

Every other week, the volunteers collect water samples to assess minute free-floating algae in the water column (this algae type is called phytoplankton). The sample is used to measure chlorophyll-a concentration, a pigment found in all green plants including phytoplankton, which provides a measure of algae abundance in the water. Collecting the water sample is the most difficult task for volunteers. After checking water clarity, volunteers collect a water sample from the lake’s surface to twice the Secchi disc reading. Research has shown that, because of light attenuation, most algal growth occurs in this zone (2 x Secchi disc depth), which is called the photic zone.

The challenge for volunteers is to collect a representative water sample from throughout the photic zone. This is accomplished with the “composite sampler”, which is simply a plastic bottle inside a weighted can that is attached to a rope and lowered through the water. A hole drilled in the cap controls the rate of flow into the bottle. The trick is to lower and raise the sampler at a steady rate, such that the bottle is roughly ¾ full when it reaches the surface. Although seemingly difficult, the volunteers seem to master this sampling procedure very quickly.

Once the water sample has been successfully collected, the volunteer returns home to filter a specific volume of the water sample. A syringe and filter holder are used to force sample water through the filter. The filter is then carefully transferred into a test tube, which is labeled with lake name and date, covered with aluminum foil to prevent sun exposure, and stored in the freezer. At the end of the sampling season, volunteers deliver all tubes with filters and datasheets to the Watershed Council office, which are then transported to the University of Michigan Biological Station for analysis. Low chlorophyll-a levels indicate relatively small amounts of algae in the lake and generally good water quality. High chlorophyll-a levels indicate heavier algal growth, which could be an indication of water quality impairment. Steady increases or decreases over time in chlorophyll-a concentrations or water clarity indicate that fundamental changes are occurring in the lake ecosystem.

**Putting the Data to Work**

Volunteer lake monitors have generated a remarkable amount of data over the last few decades for more than 25 lakes (data available via our web site: [www.watershedcouncil.org/protect](http://www.watershedcouncil.org/protect)). These data do not simply sit in a database, but have already been put to work to improve lake management and protect the water quality and ecosystem integrity of Northern Michigan’s lakes. The Watershed Council uses volunteer data to characterize lakes, assess water quality, and discern both short-term changes and long-term trends in the lakes of Northern Michigan.

Lake characterization is accomplished by calculating the Trophic Status Index (TSI), 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. Oligotrophic lakes are characteristically deep, clear, nutrient poor, and with abundant oxygen. On the other end of the spectrum, eutrophic lakes are generally shallow and nutrient rich. A highly productive eutrophic lake could have problems with oxygen depletion whereas the low-productivity oligotrophic lake may have a lackluster fishery. Mesotrophic lakes lie somewhere in between and are moderately productive.

The most accurate TSI values are based on seasonal averages for Secchi disc depths, and chlorophyll-a concentrations. Total phosphorus concentrations can also be used to calculate TSI values, but most volunteers do not monitor phosphorus because it is already monitored in their lakes as part of the Watershed Council’s Comprehensive Water Quality Monitoring Program. Because environmental factors such as weather greatly influence TSI values, volunteer monitoring data are most useful for evaluating multi-year trends. Averaged TSI values for individual lakes and trends over time can be viewed in the Lake Profile reports available on the Watershed Council’s web site: [www.watershedcouncil.org/protect](http://www.watershedcouncil.org/protect).