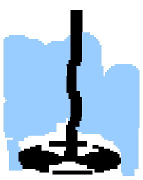
What is the Lake Chemung Riparian Association (LCRA) doing to monitor the water quality and to protect the environmental value of Lake Chemung?

Water Quality Data

Volunteers, who live on the lake, as well as representatives from the DEQ, have collected water samples for phosphorus and Chlorophyll-a and measured water clarity in Lake Chemung since the 1970.s. The voluntary portion of this monitoring has been funded by the LCRA's participation in the Cooperative Lakes Monitoring Program (CLMP)-a joint program sponsored by the DEQ and the Michigan Lake and Stream Associations-and through the voluntary efforts of Lake Chemung's dedicated lake samplers. The data from these tests and measurements is summarized below.

Sampling Dates	Spring Phosphorus	Summer Phosphorus	Mean-Water Clarity-Secchi Disk (ft)	Mean-Chlorophyll-a
3/11/1970	40			
3/14/1973	30			
4/17/1980	21		15.5	1.6
4/10/1985	30		9	9.2
9/12/1985		16	13	6.8
1995	21		12.5	
1996	18		10.9	
1997	15		11.1	
1998	19	15	11.1	
1999	14	12		
4/19/1999	15			7
5/14/1999				4
2000				
2001				
2002	19	11	12.3	
2003	16	12	13.7	2
2004	17	15	12.3	2.5
2005	19	14	(Range) 14-19	3.6
2006	10	15		2.5

Secchi Disk Transparency



Water transparency, or clarity, commonly is measured using a device known as a Secchi disk. This is an eight inch diameter target painted black and white in alternate quadrants. The disk is attached to a marked line, or measuring tape, and lowered from a boat into the lake. The distance into the water column the disk can be seen is the Secchi disk transparency, measured in feet or meters.

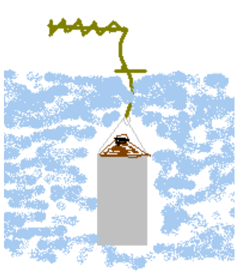
Inside the lake, water transparency is reduced by algae and other microscopic organisms as well as natural or unnatural dissolved materials that color or stain the water and suspended sediments. Factors outside the lake can also affect Secchi disk readings. These include the observer's eyesight and other sources of human error, the angle of the sun, weather, and water surface conditions such as waves, sun glare and surface scum. Despite these interference factors, Secchi disk transparency is used in most volunteer lake monitoring programs as a relative measure of algal abundance in a lake. As an indicator of lake productivity, or trophic state, late summer phosphorus and chlorophyll-a results should be used along with the Secchi disk transparency measurements.

Total Phosphorus

Phosphorus is one of several essential nutrients that algae need to grow and reproduce. For most lakes in Michigan, phosphorus is the limiting factor for algal growth. The total amount of phosphorus in the water is used to predict the level of productivity and eutrophication in a lake. An increase in phosphorus over time is a measure of nutrient enrichment in a lake. Phosphorus is a naturally occurring element that is found in rocks and soil. Humans use and dispose of phosphorus on a daily basis in common items such as fertilizers, foods, and cleaning agents. Lakes with developed watersheds often receive a portion of this human-generated phosphorus through runoff, septic leachate, and other sources.

Phosphorus is found in lakes in several forms that are in a constant state of flux as environmental conditions change and plants and animals live, die, and decompose in the lake. The various forms of phosphorus are constantly changing and are distributed in different locations of the lake with changing seasons. Because the forms of phosphorus are continuously changing and recycling, it is convenient to measure all of the forms of phosphorus together as total phosphorus. The late summer phosphorus results, along with chlorophyll-a and Secchi disk transparency measurements, provide an estimate of the level of productivity, or trophic state, for the lake. Spring overturn, when the lake generally is well mixed from top to bottom, is an opportune time of the year to sample just the surface of the lake to obtain a representative sample for estimating the total amount of phosphorus in the lake. At other times of the year, more extensive water column sampling is needed to determine phosphorus levels in the lake.

Chlorophyll-a

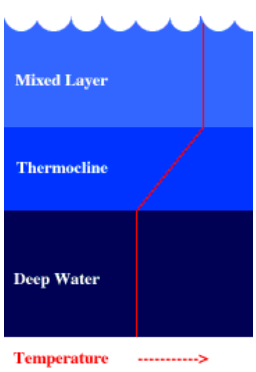


Chlorophyll is the green photosynthetic pigment in the cells of plants. The relative amount of algae in a lake can be estimated by measuring the chlorophyll concentration in the water. The amount of chlorophyll in an algal cell varies among algae species as well as twith changing light conditions at different depths within the lake. Changing seasons also create different light conditions that, in turn, affect chlorophyll production. To account for some of this variability, algal chlorophyll generally is monitored over the entire summer growing season (May-September) using water column composite sampling techniques.

Chlorophyll is actually not a single molecule, but a family of molecules designated chlorophyll-a, b, c, and d. Chlorophyll-d is found only in marine red algae, but chlorophyll-a, b, and c are common in freshwater algae. The relative concentrations within the cell of these chlorophyll molecules vary with the species of algae, but chlorophyll-a is the dominant form in freshwater algae found in lakes. Chlorophyll-a is analyzed in the laboratory from the sample collected by the volunteer monitor using the device pictured above. The summer chlorophyll monitoring results, along with total phosphorus and Secchi disk transparency measurements, provide an estimate of the level of productivity, or trophic state, in the lake.

Dissolved Oxygen and Temperature-the LCRA has begun to monitor these parameters in Lake Chemung. Monitoring for these parameters began in May 2002.

Dissolved Oxygen (DO) and temperature are two fundamental measurements of lake productivity. Lake Chemung volunteers use a meter to measure these parameters. The meter is lowered beginning at 1 foot below the water surface to the bottom of the lake and DO and temperature measurements are recorded at set intervals throughout that depth. The amount of DO in the water is an important indicator of overall lake health. Temperature affects the growth of plants, the release of nutrients, and the mixing of layers of water in the lake. Temperature measurements can determine if mixing occurs, moving nutrients from the lake bottom up into the surface waters promoting algae blooms.



For approximately 2 weeks in the spring and the fall, the temperature in a typical Michigan lake is equally distributed from top to bottom and oxygen in the lake is totally mixed throughout the water column. During the summer months, lakes greater than 30 feet deep generally stratify into three layers-a warm surface layer containing oxygen contributed from the atmosphere and photosynthetic activity that is continually mixed, an intermediate layer (the thermocline) characterized by a rapid decline in temperature with depth, and a cold deep water layer in which oxygen depletion is dependent upon the volume in the deep water zone and the amount of decomposing organic matter falling from the surface. Photosynthesis and the atmosphere add oxygen to the warm surface layer while plant and animal respiration deplete oxygen from that same layer. The amount of DO that the water can hold decreases as the temperature of the water rises. Photosynthesis occurs during daylight hours only. In addition, it is hindered by cloudy weather and cloudy water. Plant and animal respiration and plant decomposition occur continuously 24 hours a day. Lakes with heavy weed growth see highly fluctuating DO levels during a 24 hour period and they generally see an overall decline and eventual depletion in DO with depth because photosynthesis and atmospheric conditions do not generate enough oxygen to make up for the oxygen that is continually depleted through respiration and decomposition. When oxygen is depleted in the cold deep waters, the chemical environment in the bottom sediment changes and phosphorus and other nutrients are released. During major summer storms (particularly in shallow lakes) and/or at fall overturn, the released phosphorus can be mixed in to the surface water and algae blooms may occur. In some lakes, the concentration of phosphorus and other nutrients added to the water from bottom sediments outweighs the amount of these constituents added to the lake by overland flow.

DO is necessary to sustain fish populations. The amount of DO in the lake and the distribution of that oxygen (warm upper layer vs. cold lower layer) determine the fish species that can survive in the lake. In highly productive lakes, levels of DO may occasionally fall below the minimum for fish to survive and fish kills can result.

Lake Classification

A lake's ability to support plant and animal life defines its level of productivity, or trophic state. Lakes are commonly classified bsed on their productivity. The general scheme, classifying lakes as Oligotrophic, Mesotrophic, Eutrophic and Hypereutrophic, is convenient, but somewhat misleading, in that it places all lakes into a few distinct categpreos/

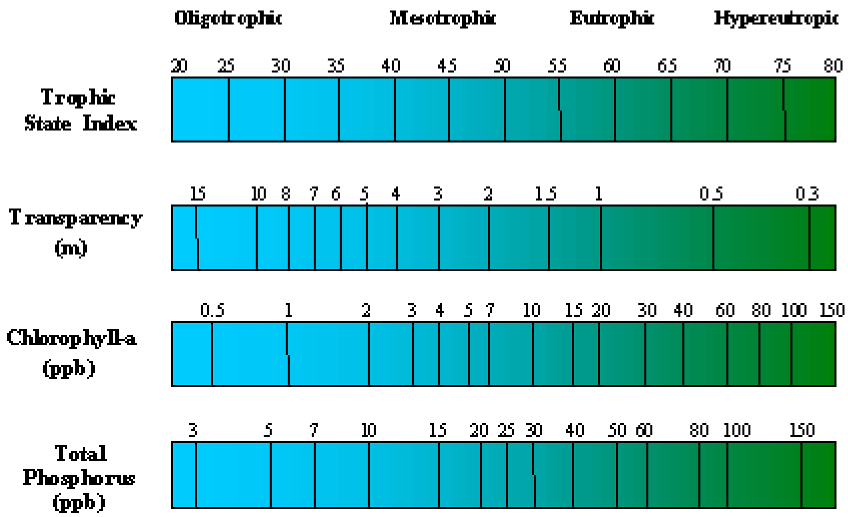
Oligotrophic-nutrient poor and low productivity; high transparency (deep secchi depth), low chlorophyll-a, low phosphorus

Mesotrophic-moderately productive; intermediate clarity, chlorophyll-a and phosphorus concentration.

Eutrophic-very productive and fertile; low clarity/shallow secchi, high chlorophyll-a and phosphorus concentrations.

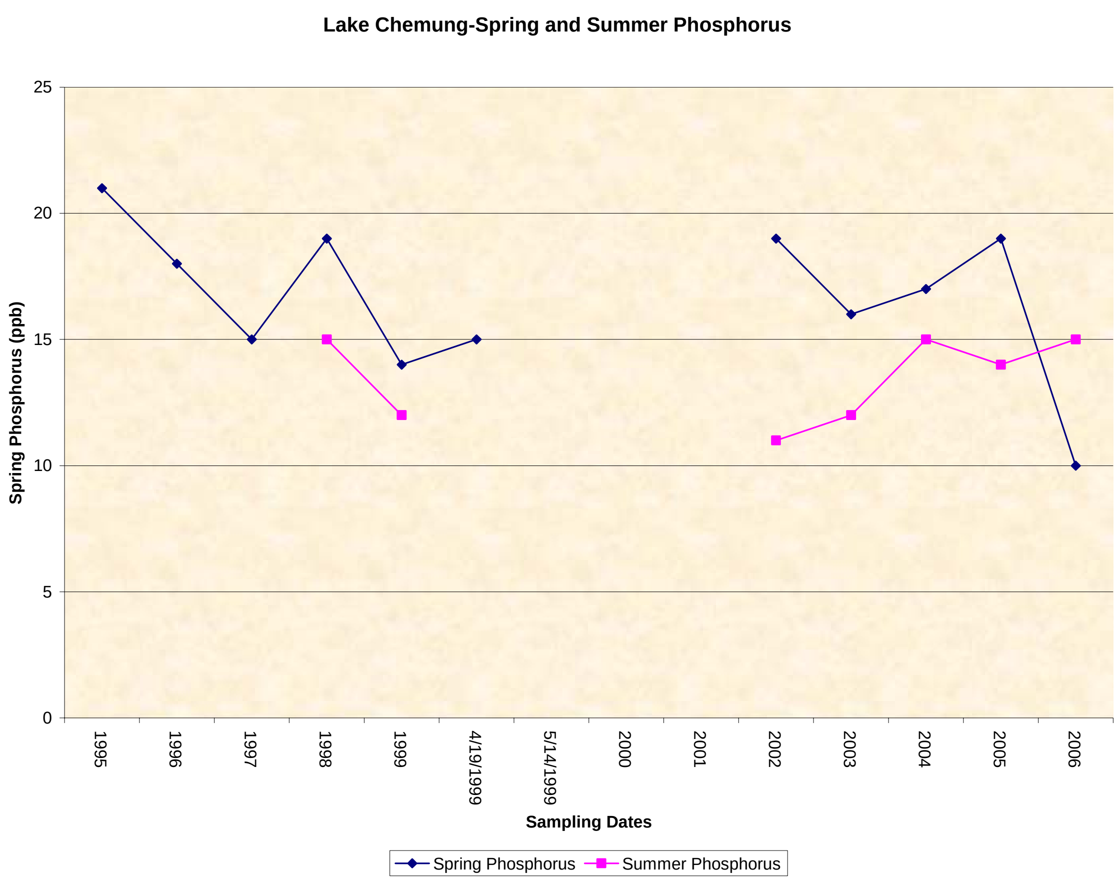
Hypereutrophic- extremely productive, noxious surficial algae scum.

In reality, lake water quality is a continuum, progressing from very good to very poor conditions. A more precise method of describing the productivity of a lake is to use a numerical index that can be calculated directly from water quality data. Carlson's Trophic State Index (TSI Index) is the index that is most commonly used to classify lake water quality more accurately.



Lake Chemung's Spring Phosphorus Trend: ****Note that a number of years of monitoring data are needed to verify the overall trend in water quality in a lake.*

The LCRA has been monitoring for phosphorus and water clarity since the 1970's. In the early 1990's, sewers were put in around the lake and we see what appears to be an overall improvement in the total phosphorus concentration (spring Phosphorus) following their installation. Long-term monitoring (performed each summer and on a continuous yearly basis) is needed to determine if nutrient levels in the lake (following sewer installation) are improving or degrading.

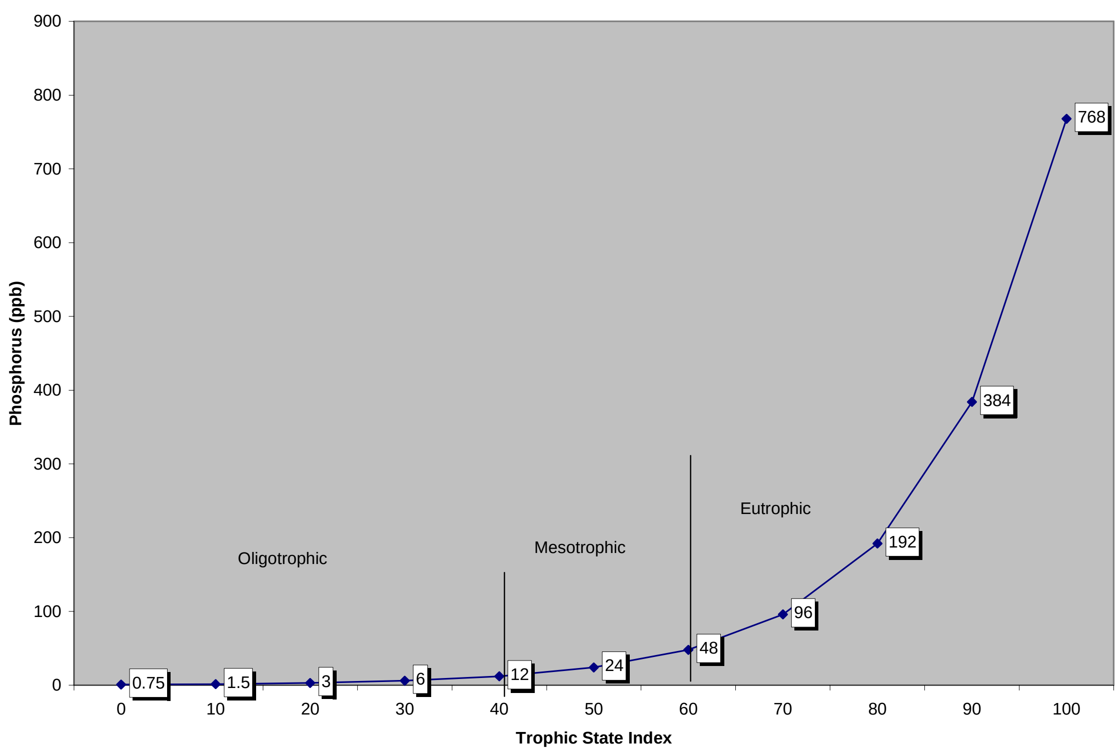


Eutrophication-the gradual increase of lake productivity from oligotrophic to eutrophic is called lake aging, or eutrophication. Lake eutrophication is a natural process resulting from the natural accumulation of nutrients, increased productivity, and a slow filling in of the lake basin. Although lake eutrophication is a natural process that occurs over time, human activities, that add nutrients to the water body, can greatly speed up the rate of lake eutrophication. Lakes should be monitored for key parameters, and increased watershed management efforts should be sought, if the trend in lake productivity appears to be rising.

Key Water Quality Parameters that should be monitored to evaluate Productivity in the Lake:

Nutrients are the leading cause of eutrophication. Nitrogen and phosphorus both stimulate plant growth. Phosphorus is the most important nutrient, and is often used directly as a measure of eutrophication. Plants are the primary users of nutrients. Chlorophyll-a is a component of the cells of most plants and can be used to measure the concentration of small plants in the water, such as algae. Transparency, or water clarity, is an indirect measure of the amount of suspended particles, or algae cells, in water. As such, the measurement provides an indication of nutrient enrichment.

With increased eutrophication, the recreational enjoyment of the lake begins to decline. Although eutrophication of the lake is a natural process, human activities can speed up the timeline at which this process is occurring. Continued lake monitoring is important to understanding the lake and the processes that are occurring in the lake over time. The contribution on lake productivity from human activities can be reduced through the use of good watershed management practices. An important key, nutrient enrichment **MUST** be controlled in the early stages. As shown in the graph below, when the productivity of the lake becomes too high, it takes a tremendous amount of work to bring the nutrient levels in the lake down to a level where you will see improvement in the lake. It may become cost prohibitive to fund a project that will reduce nutrient levels in the waters that are entering the lake to a sufficient level where noticeable lake improvement will be seen.



What We Can Do to Help Our Lake: We can support programs that help us to monitor the water quality in our lake so that our lake is scientifically understood. We can practice activities that help minimize the amount of nutrients running off our property into the lake. We can talk to our neighbors and ask them to do likewise. We can push for programs that teach residents who live in the watershed about the impact that they are having on area lakes and we can seek out assistance to implement watershed management practices that protect our area lakes from increased eutrophication.