Silver Lake Nutrient Budget Project Update

Fall 2013

Silver Lake Improvement Board
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USGS and GVSU Project Proceeding on Schedule

A comprehensive diagnostic evaluation of Silver Lake is underway to evaluate current water quality conditions and to identify primary sources of nutrients (phosphorus and nitrogen) to the lake. The project is being conducted by scientists from the U.S. Geological Survey (USGS) and Grand Valley State University (GVSU). The project includes two years of intensive field sampling, followed by one year of data interpretation and a final report of findings. The project is scheduled for completion in 2015.

The comprehensive diagnostic evaluation is being financed through a combination of state and federal grants, special assessment of lake residents, and with contributions from Golden Township, Oceana County, area businesses and the Friends of Silver Lake Association. Once USGS and GVSU complete the project, the Silver Lake Improvement Board will be armed with data that will help identify corrective actions to improve lake water quality, i.e., eliminate algae blooms. The results of the comprehensive diagnostic evaluation will guide future decision-making regarding the health of Silver Lake.

Background

During the summers of 2010 and 2011, water quality in Silver Lake showed a marked decline. The lake was plagued with unsightly algae growth and poor water clarity. Then, in August of 2011, thousands of carp in the lake died from a viral infection. Lake residents wanted action. In order to decide on the best course of action, the Lake Board commissioned the comprehensive diagnostic evaluation to find the causes of the water quality problems in Silver Lake.

Study Progress

Field work on the project began in the fall of 2012 and the project is proceeding according to schedule. Samples have been collected from within the lake and also from tributary streams, groundwater wells, and lake sediments to help determine the source of the lake's high nutrient levels. To date, one year of sampling has been completed and a full year of sampling remains to be done.

Note that until all the data has been collected and analyzed, no definitive conclusions or interpretations can be made regarding nutrient sources (specifically phosphorus and nitrogen) that cause algae blooms, weed growth and poor water quality. For example, if a stream has a high concentration of nutrients but carries just a trickle of water, the stream may not have a significant impact on the lake. Until all of the chemical data has been collected and integrated with flow measurements, it is not possible to calculate nutrient inputs or "loadings." We will have to wait until the project is completed to find out which sources are the most significant and how the lake will respond to increases or decreases in nutrient loadings. However, sampling conducted to date is sufficient to characterize the general condition or "trophic state" of Silver Lake.

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Lakes can be classified based on their ability to support plant and animal life. When classifying lakes, scientists use the broad categories "oligotrophic," "mesotrophic," or "eutrophic."

Oligotrophic lakes are low in nutrients and are generally deep and clear with little aquatic plant growth. These lakes maintain sufficient dissolved oxygen in the cool, deep bottom waters during late summer to support cold-water fish such as trout and whitefish.

Eutrophic lakes are high in nutrients, have poor clarity and support abundant aquatic plant growth. In deep eutrophic lakes, the cool bottom waters usually contain little or no dissolved oxygen. Therefore, these lakes can only support warm-water fish such as bass and pike.

Lakes that fall between the two extremes of oligotrophic and eutrophic are called mesotrophic lakes.

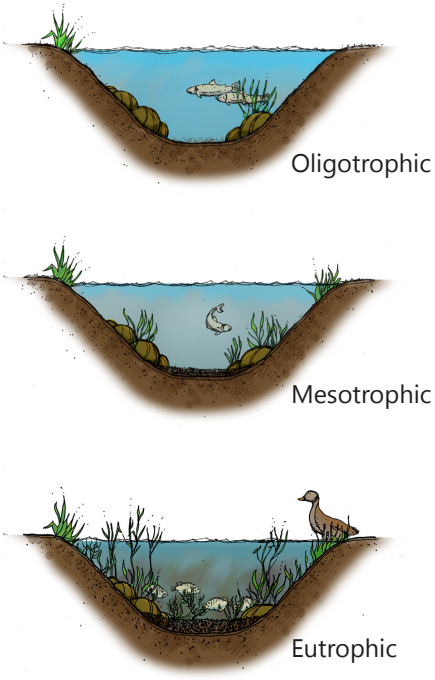
There are many ways to measure lake water quality, but there are a few important physical, chemical, and biological parameters that indicate the overall condition of a lake. These measurements include total phosphorus, chlorophyll-*a*, and Secchi transparency.

Phosphorus

The quantity of phosphorus present in the water column is especially important since phosphorus is the nutrient that most often controls aquatic plant growth and the rate at which a lake ages and becomes more eutrophic. By reducing the amount of phosphorus in a lake, it may be possible to control the amount of aquatic plant growth. In general, lakes with a phosphorus concentration greater than 20 parts per billion are able to support abundant plant growth and are classified as nutrient-enriched or eutrophic.

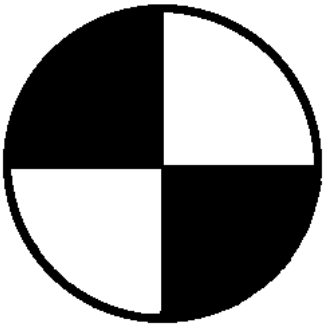
Chlorophyll-*a*

Chlorophyll-*a* is a pigment that imparts the green color to plants and algae. A rough estimate of the quantity of algae present in lake water can be made by measuring the amount of chlorophyll-*a* in the water column. A chlorophyll-*a* concentration greater than 6 parts per billion is considered characteristic of a eutrophic condition.



Study results to date indicate Silver Lake is eutrophic, meaning it is nutrient-enriched.

Secchi Transparency



Secchi disk

A Secchi disk is often used to estimate water clarity. The measurement is made by fastening a round, black and white, 8-inch disk to a calibrated line. The disk is lowered over the deepest point of the lake until it is no longer visible, and the depth is noted. The disk is then raised until it reappears. The average between these two depths is the Secchi transparency. Generally, it has been found that aquatic plants can grow at a depth of approximately twice the Secchi transparency measurement. In eutrophic lakes, water clarity is often reduced by algae growth in the water column, and Secchi disk readings of 7.5 feet or less are common.

Lake Classification Criteria

Ordinarily, as phosphorus inputs to a lake increase, the amount of algae will also increase. Thus, chlorophyll-*a* levels will increase and transparency decreases. A summary of lake classification criteria developed by the Michigan Department of Natural Resources is shown in the table below.

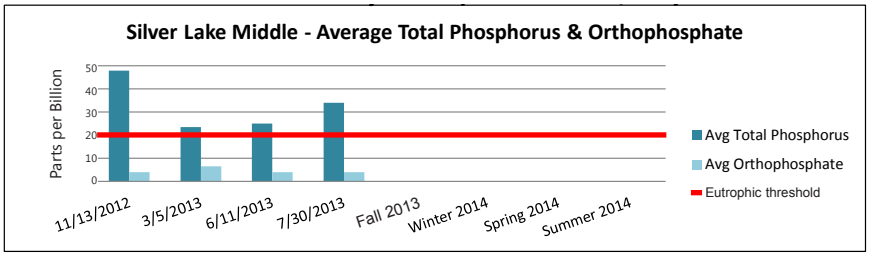
LAKE CLASSIFICATION CRITERIA

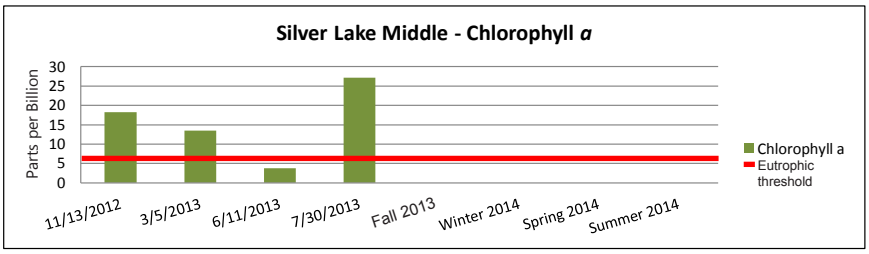
Lake Classification	Total Phosphorus (µg/L)[1]	Chlorophyll-*a* (µg/L)[1]	Secchi Transparency (feet)
Oligotrophic	Less than 10	Less than 2.2	Greater than 15.0
Mesotrophic	10 to 20	2.2 to 6.0	7.5 to 15.0
Eutrophic	Greater than 20	Greater than 6.0	Less than 7.5

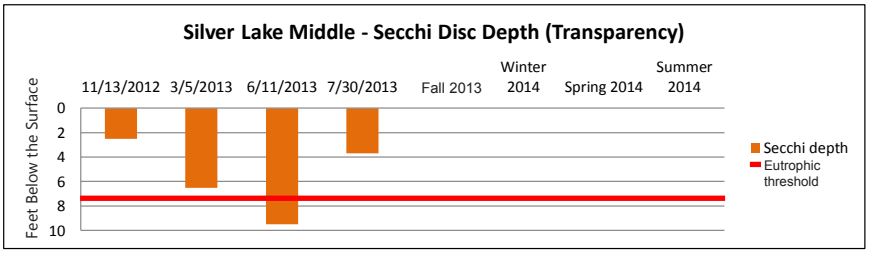
1 µg/L = micrograms per liter = parts per billion.

More information is available from the Silver Lake page on the USGS website:

http://mi.water.usgs.gov/projects/silverlake/







Data are provisional and subject to revision until they have been thoroughly reviewed and received final approval (Data collected by USGS MI-WSC).

For more information, visit nwis.waterdata.usgs.gov/nwis/qw

Map showing USGS sampling locations: In-lake sampling sites = blue pins; tributary sampling sites = red pins; groundwater sampling sites = green pins.

A part of USGS work included collecting samples from five locations in the lake on four different occasions. The data collected to date from each of the five sites within the lake have been very similar. The adjoining bar graphs represent average values from the sampling site in the middle of the lake. These data show that during the first year of sampling, Silver Lake had high total phosphorus and chlorophyll-*a* readings and low Secchi transparency. Sampling to date indicates that Silver Lake is eutrophic.

Based on nearly 20 years of historical data from Silver Lake, the median total phosphorus, chlorophyll-*a* and Secchi transparency readings were 20 parts per billion, 3 parts per billion, and 6.5 feet, respectively. Comparing this data to the more recent data presented in the three bar graphs, it appears as though Silver Lake is undergoing accelerated eutrophication.

The Silver Lake Improvement Board has been and will continue to work closely with the scientists from USGS and GVSU as they work towards the completion of an accurate model based on sound data that will identify the corrective actions that will improve water quality. We appreciate your patience as the work continues.