Other Monitoring

Iowa DNR - Ambient Lake Monitoring Program. Along with the volunteer monitoring that occurs through the CLAMP program, the lakes are routinely monitored throughout the summer by the Iowa State University Limnology Laboratory (2000-2006) and the University of Iowa Hygienic Laboratory (2005-2006). Through this program, the lakes are monitored for a number of parameters including nutrients, solids, common field parameters, phytoplankton, zooplankton, and microcystin. Results can be found at http://limnology.eeob.iastate.edu/lakereport/ and http://wqm.igsb.uiowa.edu/iastoret/.

Iowa DNR – Beach Sampling Program. Six state-owned beaches (Emerson Bay, Gull Point, Triboji, Pikes Point, Marble, and Sandy) and one county beach (Orleans) are monitored weekly during the outdoor recreation season for bacteria and microcystin. Results of beach monitoring can be found on the DNR website http://wqm.igsb.uiowa.edu/activities/beach/beach.htm.

Volunteer Opportunities

IOWATER – Iowa's Volunteer Water Monitoring Program. Email: iowater@iowater.net
Website: http://www.iowater.net.

Anyone interested in becoming a CLAMP volunteer should contact Jane Shuttleworth, CLAMP Volunteer Coordinator: 712-337-3669 ext. 7.

References

Carlson, Robert E. (1977) A Trophic State Index for Lakes. Limnology and Oceanography, Vol. 22, No. 2 (Mar., 1977), p. 361-369.

Acknowledgements

CLAMP is coordinated by the Iowa Lakeside Laboratory and supported by Friends of Lakeside Lab, the Dickinson County Water Quality Commission, the Okoboji Protective Association, the Spirit Lake Protective Association, and the East Okoboji Improvement Corporation. Data used in this factsheet were provided by Iowa Lakeside Laboratory, Iowa State University Limnology Laboratory, and the University of Iowa Hygienic Laboratory.

The CLAMP program would not be possible without the hard work of the volunteers. Volunteers on Lake Minnewashta include: Dave and Cindi Dather, Charles Gilbert, Darryl Halling, Carol and Norm Herzog, Jane and Ron Kauzalrich, Bob Lathrop, Christie McCoy, Hank Miguel, Denise and Don Parsons, and Jane Shuttleworth. Thanks also to CLAMP interns: Tasida Barfoot, Ted Klein, Emily Greives, and Laura Guderyahn.

Photo on page 1 from Iowa State University Limnology Laboratory.

Iowa Watershed Monitoring and Assessment Program Web Site – wqm.igsb.uiowa.edu

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IOWA'S WATER
Ambient Monitoring Program

Cooperative Lakes Area Monitoring Project
Lake Minnewashta

Lake Minnewashta in Dickinson County.

The Cooperative Lakes Area Monitoring Project (CLAMP) began in 1999 as a joint partnership between Iowa Lakeside Laboratory and Friends of Lakeside Laboratory to take advantage of a rich tradition of volunteer involvement in the Iowa Great Lakes region. CLAMP combines efforts of multiple organizations into a long-term, unified program for assessing the quality of the lakes in the region. A group of volunteers was organized and trained to monitor water quality on 10 lakes in northwest Iowa. CLAMP focuses on monitoring nutrient levels (nitrogen and phosphorus) as well as chlorophyll *a* (an index of algal abundance) and Secchi depth (an index of water clarity). By monitoring these parameters, CLAMP volunteers provide an integrated measure of each lake's water quality. To address concerns of excessive algae growth, phytoplankton and microcystin were recently added to the program. Phytoplankton are microscopic plants, mainly algae, that live in water. Microcystin is a toxin produced by cyanobacteria, a type of algae.

Since its inception in 1999, over 100 volunteers have participated in CLAMP. These volunteers have taken over 3500 samples on 10 lakes in Dickinson County: Big Spirit, Center, East Okoboji, Little Spirit, Lower Gar, Minnewashta, Silver, Trumbull, Upper Gar, and West Okoboji. By volunteering their time, CLAMP participants are providing a long-term data set that will be useful in protecting these prized resources while learning more about water quality issues and the ecology of the lakes.

CLAMP Data

Secchi depth in Lake Minnewashta ranged from 0.4 meters (m) (8/12/2002) to 3.7 m (6/8/2005) with the deepest Secchi depths occurring in the spring, when algal productivity is lowest, and the shallowest in

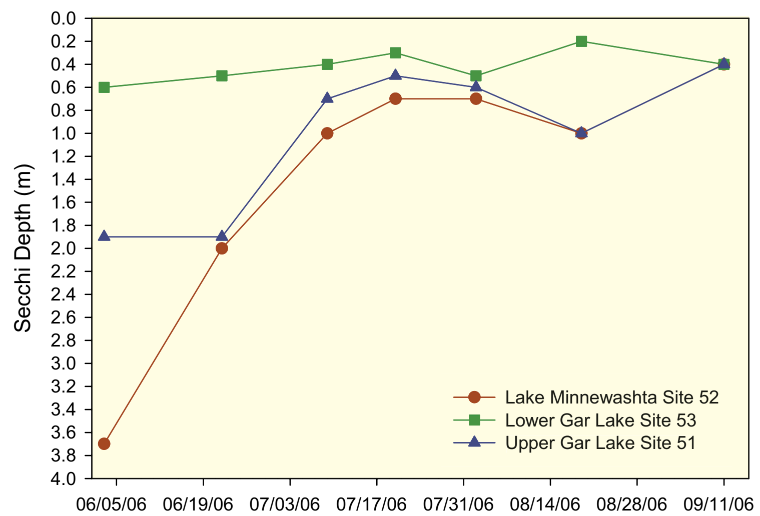
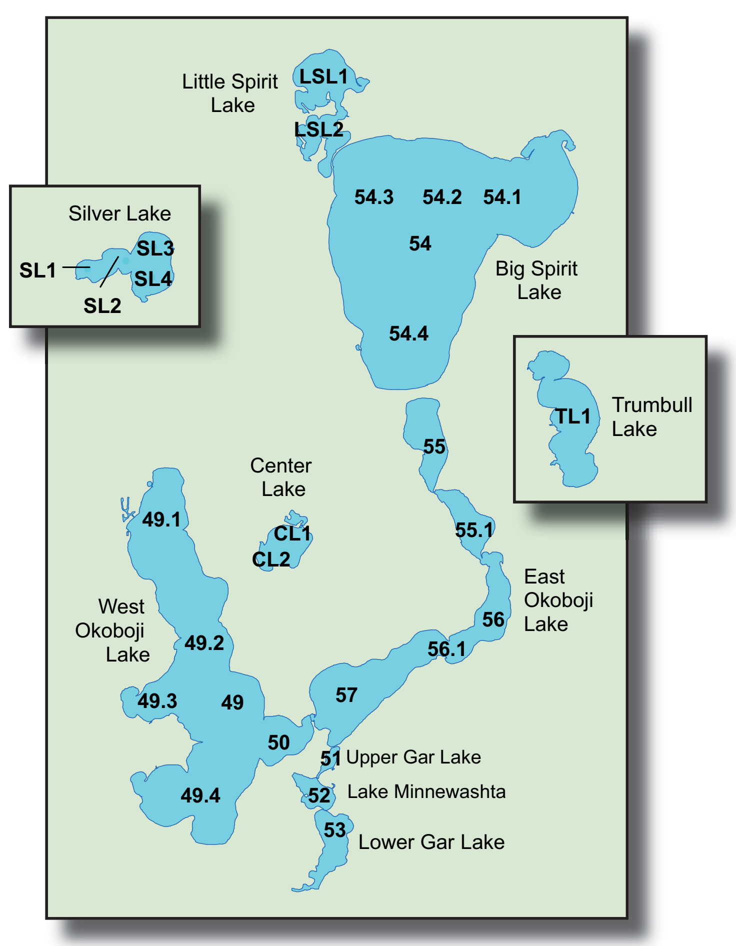


Figure 1. *Seasonal and site variation of Secchi depth in 2006 for Lake Minnewashta, Lower Gar Lake, and Upper Gar Lake.*



CLAMP *sampling locations.* NOTE: *data used for this fact sheet were from the deepest spot in each lake (for comparison).*

late summer, when algal productivity is the greatest. Overall, Secchi depths in Minnewashta were in the middle of the range of CLAMP lakes and deeper then the median for other glacial lakes in Iowa (Insert 1).

Total phosphorus ranged from 0.02 milligrams per liter (mg/L) to 0.23 mg/L with the highest concentrations occurring in the late summer and the lowest occurring in spring. Total phosphorus concentrations in Minnewashta were similar to Upper Gar, Lower Gar and East Okoboji and were slightly higher than the median for other glacial lakes in Iowa (Insert 1). Total nitrogen ranged from 0.8 mg/L to 4.4 mg/L and was similar to Upper Gar and Lower Gar as well as the median for other glacial lakes in Iowa.

Chlorophyll *a* concentrations ranged from 3 micrograms per liter (μg/L) on 5/20/2000 to 467 μg/L on 6/28/2004. The median chlorophyll *a* concentration was in the middle of the range for CLAMP lakes and was slightly higher when compared to other glacial lakes in Iowa.

Microcystin concentrations in Minnewashta ranged from 0.3 nanograms per liter (ng/L) to 5.3 ng/L. Lake Minnewashta's maximum concentration of 5.3 ng/L falls below the 20 ng/L threshold the Iowa DNR uses to post warnings at swimming beaches. Overall, microcystin concentrations were similar to other CLAMP lakes and were slightly lower when compared to other glacial lakes in Iowa.

Figure 1 shows the seasonal and site variation of Secchi depth for Lake Minnewashta, Lower Gar Lake and Upper Gar Lake in 2006. Secchi depths were deepest in early June and shallowest in the summer months. Lake Minnewashta generally had the deepest Secchi depths of the three lakes while Lower Gar Lake had the shallowest.

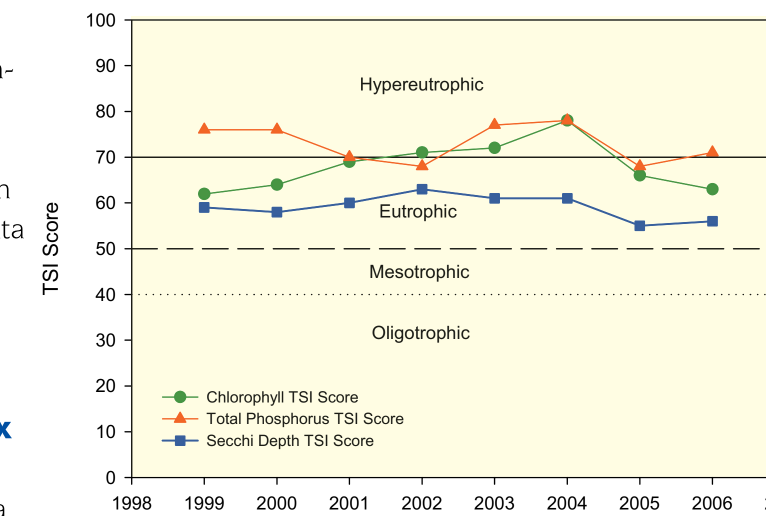


Figure 2. *Average Carlson Trophic State Index (TSI) scores by year for Lake Minnewashta.*

Carlson's Trophic State Index

The large amount of water quality data collected by CLAMP can be confusing and difficult to evaluate. In order to analyze all of the data collected it is helpful to use a trophic state index (TSI). A TSI condenses large amounts of water quality data into a single, numerical index. Different values of the index are assigned to different concentrations or values of water quality parameters.

The most widely used and accepted TSI, called the Carlson TSI, was developed by Bob Carlson (1977). Carlson TSI values range from 0 to 100. Each increase of 10 TSI points (10, 20, 30, etc.) represents a doubling in algal biomass. The Carlson TSI is divided into four main lake productivity categories: *oligotrophic* (least productive), *mesotrophic* (moderately productive), *eutrophic* (very productive), and *hypereutrophic* (extremely productive). The productivity of a lake can therefore be assessed with ease using the TSI score for one or more parameters. Mesotrophic lakes, for example, generally have a good balance between water quality and algae/fish production. Eutrophic lakes have less desirable water quality and an overabundance of algae or fish. Hypereutrophic lakes have poor water quality and experience frequent algal blooms and a lack of oxygen in deep water.

Insert 2 shows the TSI scores for Secchi depth, chlorophyll *a*, and total phosphorus for all CLAMP lakes. The median TSI scores based on Secchi depth and chlorophyll *a* are in the *eutrophic* category while the score based on total phosphorus is in the *hypereutrophic* category. This indicates that phosphorus is not limiting algae growth. Possible other factors that could limit algae include: light limitation due to excessive algal or non-algal turbidity, nitrogen limitation, zooplankton grazing, or toxin production.

Figure 2 shows the mean or average TSI scores for Lake Minnewashta by year. Secchi depth TSI has remained fairly constant over time. Chlorophyll *a* scores increased to the hypereutrophic category in 2002 to 2004 before dropping back into the eutrophic category in 2005. Total phosphorus showed a similar increase in 2003 and 2004 before decreasing in 2005. Possible explanations for this variation include: yearly climatic variability and changes in the watershed.