

Water Quality

Water quality can be measured in a number of different ways. Chemical or biological characteristics of the water itself can be directly measured or more indirect indicators can be used. Plants, fish, or other aquatic organisms such as phytoplankton (words printed like this are defined at the end of the section) or zooplankton can be monitored and changes in their population or distribution used as an indicator of changing water quality.

When monitoring occurs, the results give a snapshot of the conditions present at that particular time, in that particular location. On most Wisconsin lakes, monitoring usually occurs at one location, typically at the deepest portion. Due to their large size, the lakes in the Winnebago Pool need to be monitored at several locations to more accurately assess the conditions of the whole lake. Multiple sampling locations make data analysis and trend identification more challenging.

To get an idea of whether conditions are improving or deteriorating, monitoring over a long period of time is needed. The frequency of sample collection will depend on what characteristics are sampled. Collection frequencies range from daily, weekly, monthly, seasonally, to even yearly. Many parameters fluctuate on a daily, seasonally, or yearly basis and it is important to take that natural variation into account when examining data collected. For example, the water temperature of a lake varies little on a day-to-day basis but does vary significantly on a seasonal scale. Dissolved oxygen, on the other hand, will often vary over the course of a day. During the day aquatic plants release oxygen to the water as they undergo photosynthesis. This means dissolved oxygen levels in the water are usually highest late in the afternoon. As the sun sets and aquatic plants begin the respiration process, oxygen is consumed and levels in the water drop to their lowest points in the morning before sunrise.

The DNR often relies on monitoring of chemical and biological characteristics in order to assess the condition of lakes and to determine whether water quality is improving or not. This type of information is relatively easy and inexpensive to collect and standardized methods are followed to insure that the data is easy to compare even if different people collect the data. The information collected allows the department to evaluate water quality and ultimately helps guide management efforts.

Routine chemical and biological monitoring has been done on Lake Winnebago and, to a smaller extent, on the other Pool lakes for about the last 15 years. This sampling has occurred, on average, several times per year and has been done for the purpose of monitoring the Pool for changes in water quality.

Other, more sporadic monitoring has occurred, often times as a part of a larger, more specific project. For example, water quality monitoring data has been collected in association with the Terrell's Island breakwall project on Lake Butte des Morts. The monitoring is done to provide details on how the project is affecting the area inside versus outside the breakwall.

A typical water quality monitoring plan for a lake will sample many different characteristics. Individually, these characteristics may not reveal much information about a lake's water quality but when examined together a much clearer picture of a lake's health is seen. Continued monitoring over a long time period gives an indication of how a lake behaves throughout a year. Because weather is so variable in any given year and is so important to many lake processes, monitoring over the course of several years will minimize the affects the weather of any single year will have on the data collected. Monitoring is especially useful for examining the impact of conservation practices that may have been implemented in the watershed to reduce non-point sources of pollution.

Collection of monitoring data in the Winnebago Pool occurs year-round but typically occurs more frequently during the summer months. In addition, most sampling events occur in the middle of the day in relatively calm weather. Sampling under these conditions can introduce bias in the sample results but it is difficult to avoid these issues given the resources available.

Definitions

ZOOPLANKTON—Small, usually microscopic animals found in water, possessing little or no means of propulsion. Consequently, animals belonging to this class drift along with the currents.



PHYTOPLANKTON—Microscopic floating plants, mainly algae, that live suspended in bodies of water and that drift about because they cannot move by themselves or because they are too small or too weak to swim effectively against a current.



PHOTOSYNTHESIS—The process in green plants and certain other organisms by which carbohydrates are synthesized from carbon dioxide and water using light as an energy source. Most forms of photosynthesis release oxygen as a byproduct. Chlorophyll typically acts as the catalyst in this process.

RESPIRATION—The process occurring within living cells by which the chemical energy of organic molecules (i.e., substances containing carbon, hydrogen, and oxygen) is released in a series of metabolic steps involving the consumption of oxygen (O₂) and the liberation of carbon dioxide (CO₂) and water (H₂O).

Definitions courtesy of the North American Lake Management Society (NALMS). www.nalms.org/glossary/glossary.htm

Characteristic Sampled	Sampling Location	Reason for Sampling
<i>Water Temperature</i>	From surface to bottom at every ½ meter of depth	Many lake activities are temperature influenced (fish spawning, algae blooms, etc.). Monitoring helps predict these events.
<i>Dissolved Oxygen</i>	From surface to bottom at every ½ meter of depth	Dissolved oxygen is crucial for supporting life in the lake. Low levels may indicate some sort of pollution
<i>Water Clarity by a Secchi Disk</i>		Measuring water clarity gives an indication as to how much particulate matter, such as algae or sediment, is suspended in the water.
<i>Nitrogen</i>	Water sample collected from ½-1 meter from surface and ½-1 meter above the bottom	Nitrogen can be a nutrient that limits algae growth. Depending on the ratio of nitrogen and phosphorus present the type of algae likely to bloom can be predicted.
<i>Phosphorus</i>	Water sample collected from ½-1 meter from surface and ½-1 meter above the bottom	Phosphorus is most often the nutrient that limits algae growth. The more phosphorus, the more likely there will be algae blooms.
<i>Chlorophyll</i>	Water sample collected from ½-1 meter from surface and ½-1 meter above the bottom	The measurement of chlorophyll, which algae use in photosynthesis, gives an idea of how much algae is present in the water.
<i>pH</i>	Water sample collected from ½-1 meter from surface and ½-1 meter above the bottom	The pH of the lake is a general indicator of any changes that may be occurring. Typically the pH changes little throughout the year.

For more information on water quality and its measurement, you can visit one of the following web pages.

The U.S. EPA's Office of Wetlands, Oceans, and Watersheds at
<http://www.epa.gov/owow/monitoring/>

The National Water Quality Monitoring Council at
<http://water.usgs.gov/wicp/acwi/monitoring/>

DNR's Bureau of Watershed Management at
<http://www.dnr.state.wi.us/org/water/wm/>