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Onondaga County Department of Water Environment Protection

Onondaga Lake Fact Sheet

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On the Road to Recovery

Special points of interest:

- **Ammonia concentrations in Onondaga Lake have decreased dramatically in recent years in response to improved wastewater treatment.**
- **Phosphorus levels are declining in the lake.**
- **Since the late 1990s, dissolved oxygen levels during fall mixing have been adequate to protect the fish community.**
- **Nearshore bacteria levels in the lake's southern basin limit the potential for water contact recreation.**
- **Water clarity is improving.**

Improvements to the County's wastewater collection and treatment infrastructure are bringing about welcome changes in the quality of Onondaga Lake.

The Ambient Monitoring Program (AMP) is one of three major elements of Onondaga County's court-ordered projects designed to bring the quality of the aquatic environment into compliance with state and federal requirements. The three elements are:

(1) Changes to the sewer collection system to reduce Combined Sewer Overflows (CSOs).

(2) Improvements to the Metropolitan Syracuse Wastewater Treatment Plant (Metro) to remove more contaminants from wastewater prior to discharge.

(3) Monitoring Onondaga Lake, the lake tributaries, and the Seneca River to track their response to the pollution abatement actions.

This fact sheet presents recent water quality data collected by Onondaga County's Department of Water Environment Protection, designated as the primary monitoring entity. The Department is responsible for collecting data and information needed to assess the effectiveness of the improvements to Metro and the CSOs through its AMP. The County has convened an expert panel of scientists and engineers to guide their monitoring program and help interpret the findings. New York State Department of Environmental Conservation (NYSDEC) oversees the County's AMP. Results are reviewed with members of the Onondaga Lake Partnership and other interested parties at an annual lake advisors meeting. An annual report is available from the Department of Water Environment Protection.

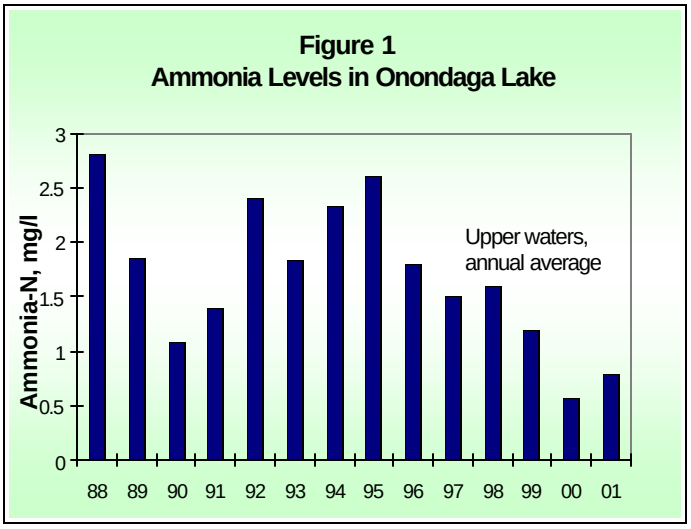
What Water Quality Factors Are Monitored To Assess Progress?

The AMP tests for a comprehensive list of water quality parameters. These data are used to determine the importance of various sources of pollution, establish trends in water quality, and determine whether water quality conditions meet state and federal standards. In addition, many aspects of the lake biology (including a comprehensive program on the fish community) are assessed as part of the AMP.

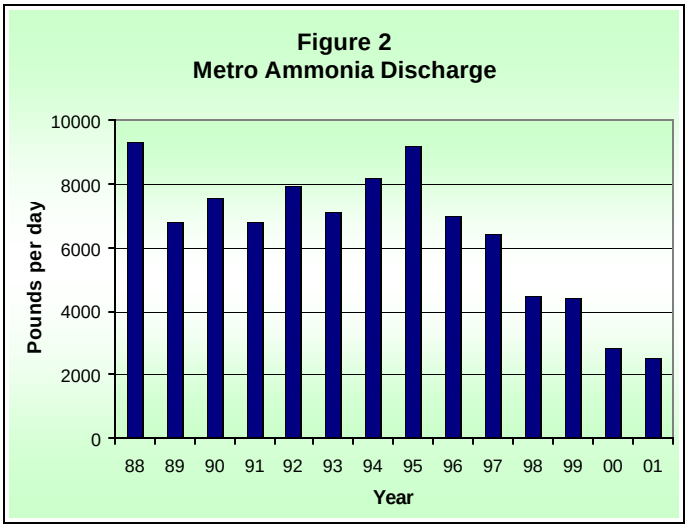
The improvements to the wastewater collection and treatment system are designed to reduce the influx of wastewater-related contaminants to Onondaga Lake. Currently, concentrations of ammonia, phosphorus, and bacteria limit the use of the lake as a recreational resource and a habitat for aquatic plants and animals. The AMP measures the amount of these materials entering the lake as well as their concentrations in the lake water. Other issues such as edibility of the fish are related to industrial wastes. This element of the lake restoration effort is the focus of a separate project.

A restored Onondaga Lake will have water quality conditions suitable for recreational use and for supporting a balanced ecological community of plants and animals. The AMP monitors water quality and biological components of Onondaga Lake, the lake tributaries, and the Seneca River.

Ammonia

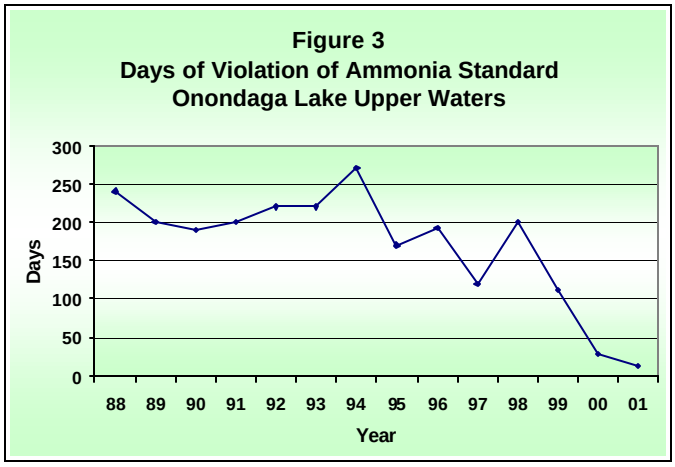


The columns of Figure 1 display the average ammonia nitrogen (NH3-N) concentrations in Onondaga Lake's upper waters measured in recent years. Throughout the 1990s, concentrations of ammonia in the lake water exceeded the state's water quality standard designed to protect sensitive aquatic life. Because Metro contributes more than 90% of the ammonia influx, reductions in ammonia in the wastewater effluent are quickly evident in the lake. The dramatic reduction in ammonia levels in recent years is the direct result of engineering improvements at Metro. Reductions in ammonia loading from Metro are displayed in Figure 2.



Metro effluent quality also depends on the quality of wastewater entering the treatment plant. Onondaga County is working with local industries, particularly Bristol Myers Squibb, to reduce ammonia in wastewater before it reaches the treatment plant. Some of the reductions that have been achieved are a result of the controls on the industrial sources.

As shown in Figure 3, ammonia concentrations in the lake's upper waters are improving with respect to compliance with standards designed to protect sensitive aquatic life. However, slight exceedences of safe levels remain, particularly early in the spring, a critical period for fish spawning activity. This pattern is a result of the challenges associated with achieving consistent nitrification (conversion of ammonia to the nontoxic form nitrate nitrogen) when wastewater temperatures are cool in winter. The biological process is extremely sensitive to temperature.



Greater reductions in ammonia levels are anticipated with completion of the ammonia phosphorus project now under construction at Metro. Year-round nitrification will be achieved and full compliance with standards is projected. New York State Department of Environmental Conservation has established strict limits on ammonia levels in Metro effluent. Phased effluent limits are in place, with compliance milestones in 2004 and 2012. The County is projected to meet the 2012 required ammonia limits by 2004, eight years ahead of schedule.

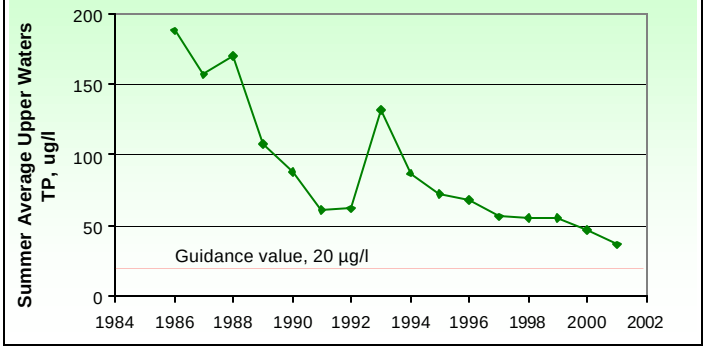
Phosphorus and Dissolved Oxygen

Phosphorus is naturally present in all waters and is an essential nutrient for life. In most Northeastern lakes, including Onondaga Lake, phosphorus is the limiting nutrient for algal growth. Because it is the limiting nutrient, the concentration of phosphorus in lake water is correlated with abundance of algae. Excessive algae will make a lake appear turbid or green and diminish its attractiveness for recreational use.

Algal cells eventually sink into deep water and are decomposed. Dissolved oxygen, a basic requirement for fish and other aquatic life, is depleted as these algal cells decay. The deep waters of Onondaga Lake become anoxic (no oxygen present) by mid summer as a result of the large masses of decaying algae. When the lake waters cool and mix in the fall, this deep layer of anoxic water mixes through the lake and depresses lakewide oxygen levels. Fish may seek refuge in areas with higher dissolved oxygen or swim into the Seneca River to find suitable water quality conditions.

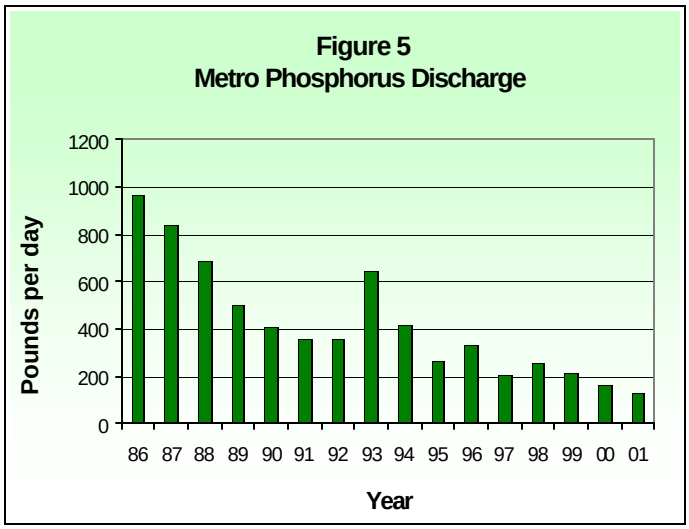
Because of these factors, phosphorus is an important factor in restoring the lake's recreational use and aquatic habitat. New York State has adopted a statewide guidance value for phosphorus of 20 micrograms per liter (a unit of measure equivalent to parts per billion). As shown in Figure 4, phosphorus levels are declining in the lake but remain above the guidance value.

Figure 4
Summer Phosphorus Levels in Onondaga Lake



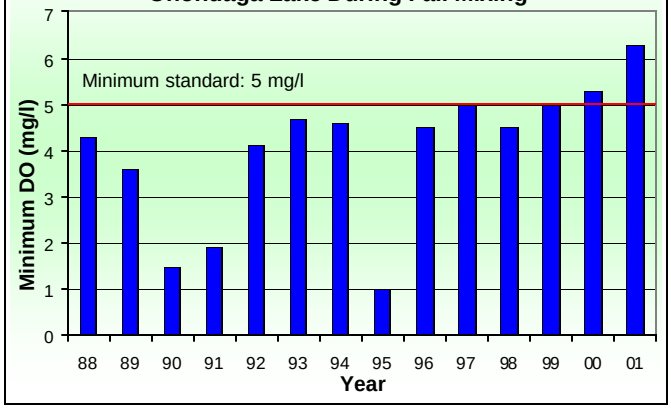
Slightly more than half of the phosphorus entering the lake comes from Metro; the other half is contributed by runoff from urban and agricultural areas. Since the late 1980s, the County has made many operational changes at Metro to reduce phosphorus levels in the treated wastewater. Figure 5 charts the reduction in phosphorus output from Metro. The high value in 1993 was due to construction at the treatment plant and spring floods. Additional reductions will be achieved with completion of the ammonia phosphorus project now under construction at Metro.

Figure 5
Metro Phosphorus Discharge



Dissolved oxygen levels in Onondaga Lake are improving as well (Figure 6). In the past several years, oxygen levels in the fall have been adequate to protect the fish community. This change represents real progress towards attaining water quality conditions that will support a balanced ecological community.

Figure 6
Minimum Dissolved Oxygen Concentrations Onondaga Lake During Fall Mixing

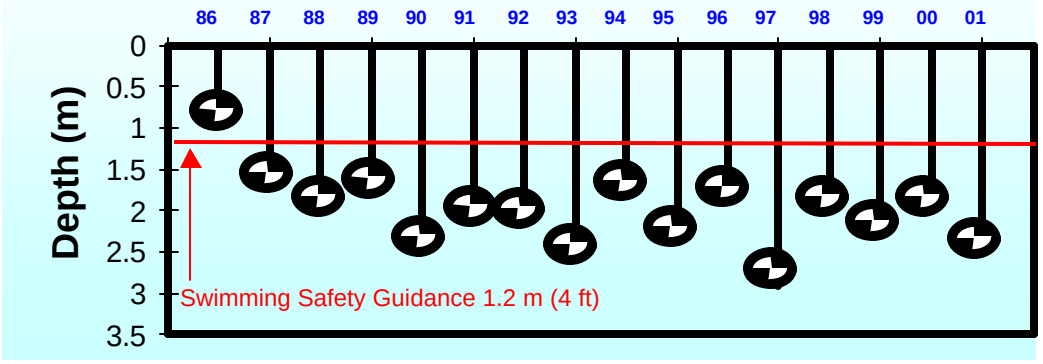


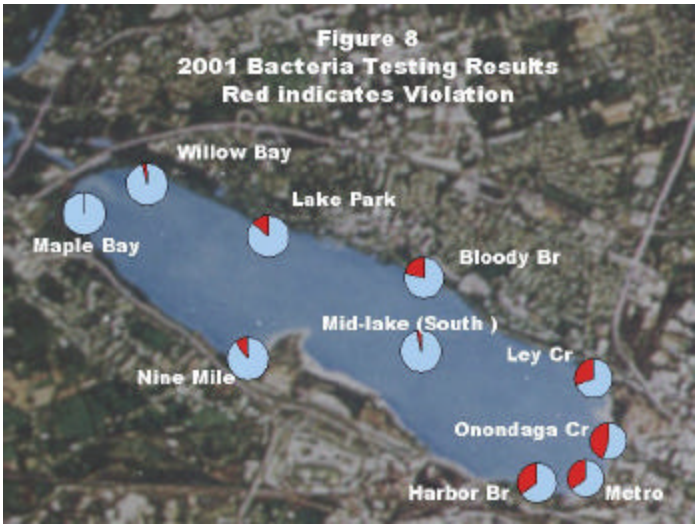
Water Clarity and Bacteria

For Onondaga Lake to be attractive and safe for water contact recreation, the water must be clear and free of disease-causing microorganisms. As described earlier, water clarity is related to algae and phosphorus levels. Microbiological quality is primarily related to the combined sewer overflows and urban stormwater runoff.

Water clarity in the lake has improved in recent years in response to reductions in phosphorus and the shifts in the food web related to the successful invasion of the zebra mussel (Figure 7). However, algal blooms persist and limit the lake's attractiveness for recreational use.

Figure 7
Onondaga Lake Average Summer Water Clarity





Microbiological quality is assessed by monitoring for the abundance of "indicator organisms", bacteria that are associated with recent fecal contamination. Results of the 2001 nearshore bacteria monitoring effort are displayed in Figure 8. The southern end of Onondaga Lake has unacceptably high levels of indicator bacteria following storms and does not support water contact recreation. This finding highlights the need for continued progress with the CSO projects.

However, bacteria levels decrease greatly as one proceeds away from the southern tributaries. Water quality in Willow Bay, Maple Bay, and Onondaga Lake Park shows very few violations of bacteria standards for safe swimming. The County will continue to monitor nearshore areas around the lake shoreline to assess progress towards meeting the goal for safe swimming.

Summary and a Look Ahead

Real progress has been made in Onondaga Lake towards the goal of attaining water quality conditions that support recreational use and aquatic life. The Ambient Monitoring Program will continue to track key indicators as the improvements to Metro and the CSOs are completed.

Visit our Web site:
www.ongov.net

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