The following report outlines the current state of the bay and highlights improving or declining trends in water quality. There are many factors which influence the amount of aquatic plant and algae growth. Water quality parameters that relate to algal blooms included in this report are: phosphorus, chlorophyll-a, water clarity, and blue-green algal blooms. Since a widespread algal bloom in 2010, water quality and the occurrence of algal blooms have been monitored on Sodus Bay by the State University of New York (SUNY) Brockport, SUNY Environmental Science and Forestry (ESF), Wayne County Soil and Water Conservation District, and the NYS DEC Citizens Statewide Lake Assessment Program (CSLAP). It is intended that this report will be issued on an annual basis.
The Carlson Trophic Index is a commonly used method for categorizing and comparing the productivity level of water bodies. High productivity can hinder aquatic life such as fish. The index is based on the levels of chlorophyll-a, total phosphorus, and clarity of the water. The results assign a trophic state to water bodies:

- **Oligotrophic** is the clearest water state.
- **Mesotrophic** is moderate growth and is the category that currently includes Sodus Bay.
- **Eutrophic** is categorized by high productivity and abundant growth, often limiting recreational activities.
- **Hypereutrophic** is the state with the most prolific growth.

It is important to be mindful of where the bay falls on the trophic scale. Although threatened, Sodus Bay has not progressed past the point of no return. Residents and visitors to the area must be aware that their actions affect the quality of the bay.

**What is productivity?**
Highly productive lakes can support large quantities of aquatic life, including algae. The process of lakes becoming more productive with time is called eutrophication. Human activities speed up this process by increasing the amount of nutrients available for plant growth. The Carlson Trophic Index can be used to gauge lake health.

**Top Chart:** Although the bay appears to be improving with regard to blue-green algal blooms, continued efforts should be focused on reducing nutrients in the bay.

**Graph at Right:** The numeric scale of the Carlson Trophic Index. The red circles represent the 2013 averages for Sodus Bay.

### Water Quality Parameter | Trend 2012-2013
---|---
Phosphorus | Degrading
Chlorophyll-a | None
Water Clarity | Improving
Blue-green Algal Blooms | Improving

Why is it important to monitor algal blooms?
Algal blooms can degrade water quality, limit recreation uses, and alter aesthetics of the bay. In addition, they can spread quickly, limit beneficial plant growth, and some species of algae can produce harmful toxins. When the algae die, decomposition requires oxygen. This means less oxygen is available for fish and other aquatic life in the bay.
Phosphorus is a necessary nutrient for plant growth. However, in excess quantities, it can be a contributing factor to algal blooms. The New York State Department of Environmental Conservation’s guidance value for phosphorus concentration in Sodus Bay is 20 µg phosphorus/L (20 parts per billion). Sodus Bay should strive to have phosphorus concentrations below this level. This value is higher than 10 µg P/L recommended for the off-shore waters of Lake Ontario due to a higher productivity level in the bay.

Since 1988, Sodus Bay has routinely exceeded this guideline value of 20 µg P/L. This has led to excess plant growth and is an important driver for the algal blooms in the bay. The average concentration for May to September 2013 was 32.2 µg P/L. This falls within the eutrophic category of the Carlson Trophic Index (page 2). The seasonal average concentration of phosphorus increased from 2012 to 2013. Therefore, efforts should be made to reduce the amount of phosphorus entering the bay. Individual actions you can take to reduce phosphorus are given on page 8.

Why is phosphorus important?
It is a necessary nutrient for plant growth, just as food is necessary for humans to grow. Addition of this nutrient is one of the main ways in which human activities are increasing eutrophication. Over 500 pounds of algae can grow from just one pound of phosphorus.

Top Image: Drainage pipes can be a major source of nutrients entering the bay.

Graph at Left: Average seasonal phosphorus concentrations in Sodus Bay from 1988 to 2013. The red line represents the New York State guidance value for Sodus Bay of 20 µg P/L.
Chlorophyll is the pigment used by plants for the conversion of light and nutrients into energy used for growth. Chlorophyll-a is a specific type of pigment which is common to all freshwater algae. It is commonly used as an indicator of algal blooms and an indirect estimation of algal abundance or productivity.

The New York State Department of Environmental Conservation’s proposed guidance value for chlorophyll-a is 10 µg/L and the bay should be below this value. The average seasonal concentration from March to October 2013 was 16 µg/L and fell within the eutrophic category of the Carlson Trophic Index. The average concentration was higher during 2010 to 2013, compared to the 2000s, and was consistently above the proposed NYS guidance value. This indicates that the bay has more algae in the water than desirable.

What contributes to a lower chlorophyll level?
Many factors contribute to changes in chlorophyll-a concentrations. The decreased values observed in the early 2000s may be due to the presence of zebra mussels in the bay. Zebra mussels feed on algae, and remove chlorophyll-a from the water.

Top Image: Aquatic vegetation is another sign of abundant plant growth.

Graph at Right: Average seasonal chlorophyll-a concentrations in Sodus Bay from 1988-2013. The red line represents the NYS guidance value of 10 µg/L.
What contributes to a deeper clarity level? Aside from algae in the water, many factors can influence the transparency of the water, such as suspended sediments. The increase in depth during the early 2000s reflects the decrease in algae as shown by the decrease in chlorophyll-a concentrations.

Water Clarity is a measure of the transparency of the water. The Secchi disk is a common method of measuring water clarity. An observer records the distance from the surface to the point where the disk can no longer be seen. Water clarity determines the amount of light that reaches the bottom sediments and is available for plant growth.

The NYS Public Health Law requires Secchi disk values greater than 1.2 meters (4 feet) to ensure safe swimming conditions. The average depth from March to October 2013 was 2.8 meters and fell within the mesotrophic category of the Carlson Trophic Index. Water clarity increased in 2013, and continues to meet the NYS Public Health Law for swimming beaches.

What is the difference between clarity and quality? Public perception of water quality is generally a reflection of the water clarity. However, increased clarity is not always beneficial. Clearer water can allow for more light to reach the bottom and increase submerged plant growth.

Top Image: A Secchi disk is used to measure water clarity. Higher measurements are indicative of clearer waters.

Graph at Left: Average seasonal transparency values in Sodus Bay from 1988-2013. The red line represents the 1.2 meter value required of swimming beaches. Measurements should have a Secchi depth greater than the red line.
Submerged aquatic plants are another measure of the productivity of Sodus Bay. Since the late 1980s, the Wayne County Soil and Water Conservation District has operated the Aquatic Vegetation Control Program to harvest submerged aquatic vegetation.

High concentrations of nutrients such as phosphorus entering the bay and increased water clarity can lead to an increased abundance of submerged aquatic plants. Removing the plants can improve the water quality by removing nutrients. Almost two million tons of aquatic weeds were removed from the bay in 2007. Removal of these weeds was equivalent to preventing 200 pounds of phosphorus from entering the water during decomposition. Preventing the decay of vegetation can account for a 10% decrease in the total annual phosphorus load into the bay.

In addition to removal of phosphorus, harvesting the aquatic vegetation also improves boater access. User enjoyment, water quality, and ecosystem health all benefit from a well managed aquatic vegetation control program.

Data is from the Wayne County Soil and Water Conservation District Aquatic Vegetation Control Program. Data is not available for 2004. Accessible online at: [http://www.waynecountynysoilandwater.org/aquatic-vegetative-control/](http://www.waynecountynysoilandwater.org/aquatic-vegetative-control/)
Since 2010, Save Our Sodus Inc. has initiated a bay-wide monitoring program to track the occurrences of blue-green algal blooms. Blue-green algae can be separated from other algae using a special pigment called phycocyanin. There are no official guideline values for phycocyanin in the water, but values below 20 µg/L are generally considered to be good. The phycocyanin pigment levels in Sodus Bay showed sporadic high values in 2011, and then improved in 2012 and 2013.

Some blue-green algae also produce potent toxins; the most common of which is a liver toxin called microcystins. New York State DEC uses the World Health Organization guidance value of 20 µg microcystins/L as the upper level for recreational contact and 1 µg microcystin/L for drinking water when informing the public about potential risks. Blue-green algae can also contain noxious compounds other than microcystins, so contact with all blue-green algal blooms should be avoided. Microcystin toxicity was high during the bloom in 2010 and has generally decreased over the past three years with a few notable exceptions.

What are box and whisker plots? Box and whisker plots are a common way of displaying scientific data when the seasonal averages are not appropriate. The box includes the middle 50% of the samples with the median (middle) value represented by the line. The whiskers expand out to include 90% of the samples. Outliers are show by individual dots. In cases where the data clusters very close together, the box and whiskers may overlap and show up as a single line.

**Top Graph:** Average seasonal phycocyanin values in Sodus Bay from 2011 to 2013.

**Bottom Graph:** Average seasonal microcystins values in Sodus Bay from 2010 to 2013.
Summary:
Many factors will affect the growth of algae in Sodus Bay. The amount of rainfall, runoff, temperature, wind speed and wind direction all contribute to making conditions optimal for growth. A main contributor, the abundance of nutrients, can be controlled by human activities. The basic water quality parameters (water clarity, chlorophyll-a, phosphorus, submerged aquatic vegetation, and blue-green algal blooms) generally show that the nutrient levels in Sodus Bay are high. Continued efforts need to be made to reduce these nutrients. Small changes over time have a large impact on water quality.

Save Our Sodus, Inc. has been active in the bay community since 1999. Become involved and join their events to learn more about Sodus Bay and what you can do to help our favorite bay.

Decrease the amount of runoff entering the bay by:
- Conserve water, such as limiting use of lawn sprinklers or installing a rain barrel.
- Decrease the amount of impermeable surfaces, such as pavement and concrete paths.

Decrease the amount of nutrients entering the bay by:
- Plant vegetation or install sediment fences to minimize erosion near the waters edge.
- Keep yard waste, such as leaves and grass clippings out of the water. Composting is another alternative.
- Remove aquatic vegetation from around your docks and allow them to decompose away from the waters edge.
- Fertilizer can be a major source of nutrients in the bay. Check the weather before applying to minimize the amount lost to runoff.
- Check for leaky septic systems, another potential contributor of phosphorus to the bay.

Want to Know More? Additional Resources:
- Blue Green Algae. Available online at http://www.saveoursodus.com/bg/
- Save Our Sodus. Available online at http://www.saveoursodus.com/

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