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2012 Duckpuddle Pond Water Quality Report

Overview:

Baseline water quality monitoring of Duckpuddle Pond was conducted on September 4 2012, in accordance with standard procedures for the monitoring of Maine lakes and ponds established by the Maine Department of Environmental Protection and the Maine Volunteer Lake Monitoring Program.

2012 Weather Influences :

Weather conditions prior to, and during the annual lake monitoring period can strongly influence indicators used to assess water quality. Several meteorological phenomena occurred in 2012 that may have had a negative effect on many lakes and ponds throughout Maine:

1. Winter and spring weather was unusually warm, resulting in the earliest ice-out conditions on record (mid- March) for many Maine lakes.
2. Ambient air temperatures in the 80 degree F. range were recorded in March. This resulted in the rapid warming of lake water, and the development of thermal stratification (temperature layers) several weeks earlier than normal.
3. In early June, a severe rain event dropped several inches of rain (8 inches in Auburn) on the area in a period of less than 48 hours, resulting in extremely heavy and erosive stormwater runoff from lake watersheds.
4. This was followed by many days of unusually warm weather. Water surface temperatures of 80 degrees F. were recorded in many lakes and ponds in the region by the end of June.

The combined influence of these unusual conditions resulted in below average water clarity, an extended period of thermal stratification, higher than normal dissolved oxygen loss, and a measureable increase in algae growth for a substantial percentage of Maine

lakes in 2012 ó all of which can be characterized as stressful to lake systems. For more information on the effects of weather on lake water clarity, see the attached statewide perspective on lake water clarity for 2012.

Based on the clarity of the water, the concentrations of phosphorus and algae, and late summer dissolved oxygen concentrations in the deepest area of the lake, the overall water quality of Duckpuddle Pond was “average, to above average” in 2012, when results are compared to historical data for the pond.

Water Clarity (Transparency):

Water clarity (transparency), which is used as an indirect indicator of algal growth in lakes, averaged 2.7 meters (~9 feet) in 2012. The average is based on Secchi transparency readings taken from May through October, all of which were taken by VLMP volunteer lake monitors, with the exception of the September 4 reading, which measured 3.15 meters. The historical transparency average for Duckpuddle Pond is also 2.7 meters. Water clarity data have been gathered for Duckpuddle Pond since 1976. During that period, water clarity has ranged from a very low reading of 0.3 meters in 1994, during a severe algal bloom, to a high reading of 3.9 meters in 2004.

Duckpuddle Pond experienced severe algal blooms from 1989 through 1998, and more recently the pond has dipped to, and below the Maine DEP algal bloom threshold of 2.0 meters in 2005, 2006, 2007 and 2009. The degree of intensity (minimum readings, and duration) has been well documented by the Maine DEP and by certified lake monitors of the Maine Volunteer Lake Monitoring Program. The lowest reading recorded in 2012 was 2.5 meters, which is approaching the high end of historical readings documented for this pond.

The clarity of the water in Duckpuddle Pond last summer appears to have been influenced by the natural color of the water. A color sample taken in September measured 57 Standard Platinum Cobalt units (PCU). When lake water color exceeds approximately 25 PCU, water clarity readings can be depressed by strong coloration of the water. Lake water color is a natural phenomenon caused by organic compounds that leach into the water from vegetation in the watershed. Heavy rain and runoff, resulting in the öflushingö of wetlands in the watershed can cause an increase in lake water color, one of the effects of which is reduced water clarity. The historical color average for Duckpuddle Pond is 62 PCU. Readings as high as the 70ø and 90ø have been documented in past years. In addition to reducing water clarity, color may also be influencing other indicators of lake water quality.

Phosphorus:

A surface (epilimnetic core) total phosphorus sample taken in September measured 14 parts per billion (ppb), compared to the historical average of 18 ppb for Duckpuddle Pond. Phosphorus is the nutrient that most directly influences the growth of algae in lakes and ponds. Phosphorus concentrations in the 12-15 ppb range have been associated with algal blooms in some Maine lakes. Phosphorus samples from Duckpuddle Pond have

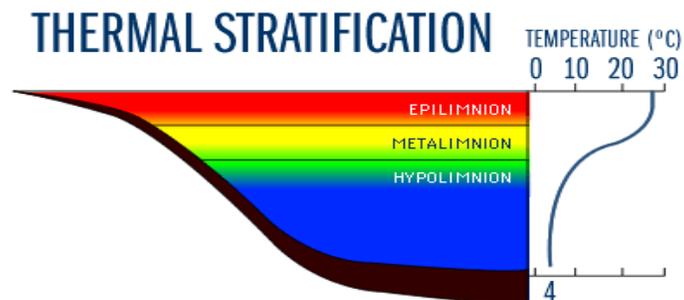
been as high as 25 ppb, but many of the historical samples have been in the 18-20 ppb range.

Chlorophyll *a* (algae):

Chlorophyll-*a* (CHL) is the pigment measured in lake water that is used to determine the concentration of algae in the water. The epilimnetic core CHL level in September measured 6.7 ppb, compared to the historical average for Duckpuddle of 11.9 ppb. Since 1982, the annual average CHL concentration in this lake has ranged from a low of 6.2 ppb in 1977 to a very high reading of 32 ppb in 2005, during a severe algal bloom. Annual CHL averages in Duckpuddle have varied, in part, because for many of the years the average has been based on a single sample, but during the years when the pond was monitored more intensely by DEP staff and others, multiple samples were taken during the monitoring season. The 2012 sample, although relatively low for Duckpuddle, is nonetheless considered moderate, indicating substantial algae growth in the pond.

Dissolved Oxygen:

Temperature and dissolved oxygen profiles were taken at the deep monitoring station on September 4, during which time, Duckpuddle Pond was moderately thermally stratified (distinct temperature layers existed – see adjacent illustration). The dissolved oxygen (DO) profile showed a



depressed (less than 5 ppm) concentration of DO below 3 meters depth, and DO depletion from 5 meters depth to the bottom of the pond at 6.8 meters. The pond was strongly thermally stratified, with a surface temperature of 22.4 degrees C, and at 6.0 meters depth, the temp was 15.0 degrees C.

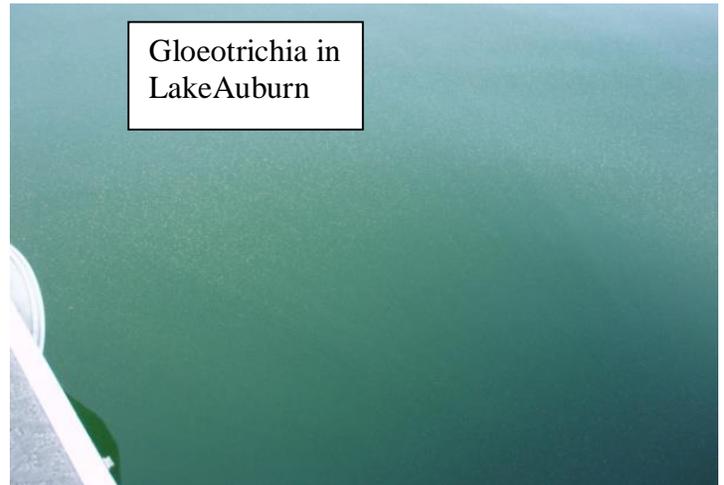
The September, 2012 dissolved oxygen profile was consistent with historical data for Duckpuddle Pond, in which the loss of oxygen occurs from mid to late summer, until the pond de-stratifies in the fall. The potential exists for low dissolved oxygen in the deepest area of Duckpuddle to have a negative impact on water quality, because there is evidence of the release of phosphorus from the bottom sediments during periods of anoxia. The relatively shallow overall depth, and the shape of the Duckpuddle basin is such that phosphorus released from the bottom sediments during periods of low oxygen may be transported closer to the surface through mixing of the water by wind and wave action, resulting in pulses of phosphorus becoming available to algae.

Because the level of dissolved oxygen near the bottom of the pond was virtually depleted on September 4, a discrete phosphorus grab sample was taken to determine whether the nutrient was being released from the bottom sediments. The concentration of that sample measured 25 ppb, compared to the surface concentration of 14 ppb. While not conclusive,

it is likely that the increased concentration near the bottom was associated with oxygen depletion.

Epilimnetic core total alkalinity measured 8.9 mg/l ó very close to the historical average of 8.6 mg/l. pH measured 7.01, compared to the historical average of 6.66.

Gloeotrichia echinulata is a bluegreen algae that is the current focus of research in New England Lakes. The concentration of öGleoö appears to be increasing in some Maine lakes. The implications of this increase are not well understood, however, some findings has suggested that this alga may have the potential to play a role in the decline of lake water quality. We carefully observed for the presence of Gloeo in Duckpuddle Pond on September 4, 2012. No colonies were observed. The adjacent photo was taken at the surface of Lake Auburn last summer during the peak of a öGleoö bloom.



Please note that a Statewide perspective of lake water clarity, based on more than 400 lakes monitored in 2012 is attached as a separate report, in order to help put the findings of this report in perspective. Overall, many Maine lakes experienced a decline in water clarity in 2012, compared to their historical averages.