2001

OBSERVATIONS & RECOMMENDATIONS

We would like to recognize the Manchester Urban Ponds Restoration Project volunteers for their second year of participation in the New Hampshire Volunteer Lake Assessment Program. Manchester's volunteers collected a large number of samples this summer and we applaud them for their efforts! Although the data collected this past summer continue to reflect poorer water quality, we hope this program continues to encourage citizens to be proactive in sampling efforts and pond cleanup activities. Through sampling, education, and various water quality improvement projects initiated by the City of Manchester, we ultimately expect that the ponds will be improved!

After reviewing data collected from **STEVENS POND,** the program coordinators recommend the following actions.

FIGURE INTERPRETATION

- **Figure 1:** These graphs show the historical and current year concentration of chlorophyll-a in the water column. Chlorophyll-a, a pigment naturally found in plants, is an indicator of the algal abundance. Because algae is a microscopic plant that contains chlorophyll-a and is naturally found in lake ecosystems, the concentration of chlorophyll-a found in the water gives an estimation of the concentration of algae or lake productivity.

  The summer of 2001 was filled with many warm and sunny days and there was a lack of significant rain events during the latter-half of the summer. The combination of these factors resulted in relatively warm surface waters throughout the state. The lack of fresh water to the lakes/ponds reduced the rate of flushing which may have resulted in water stagnation. Due to these conditions, many lakes and ponds experienced increased algae growth, including filamentous green algae (the billowy clouds of green algae typically seen floating near shore) and nuisance blue-green algae (Cyanobacteria) blooms.

  The current year data (the top graph) show that the in-lake chlorophyll-a concentration *decreased* from May to June, *increased* from June to July, increased by a large amount from July to September, and then continued to increase from September to October.

The current year data (the top graph) show that the chlorophyll-a concentration *decreased* from May to June, and then *increased* from June to October. The chlorophyll-a concentration *was less than* the state mean on the May, June, and July sampling events, but was *well above* the state mean in September and October. Specifically, the concentration in September and October was indicative of an algal bloom.

The dominant phytoplankton species observed this season were as follows: *Tabellaria* (a diatom), *Closterium* (a green alga), and *Synedra* (a diatom) in May; *Ceratium* (a dinoflagellate), *Asterionella* (a diatom), and *Dinobryon* (a golden-brown alga) in June; *Synura* (a golden-brown alga), *Dinobryon,* and Ceratium in July; *Ceratium* and *Nitzschia* (a diatom) in September; *and Ceratium and Mallamonas* (a golden-brown alga) in October. Phytoplankton populations undergo a natural succession during the growing season (Please refer to the "Introduction" section of this report for a more detailed explanation regarding seasonal plankton succession). Diatoms and golden-brown algae are typical in New Hampshire's less productive lakes and ponds. An overabundance of blue-green algae indicates that there may be an excessive total phosphorus concentration in the lake, or that the lake ecology is out of balance.

The historical data (the bottom graph) show that the 2001 chlorophyll-a concentration is *slightly less than* the 2000 concentration and the state mean. We hope this *decreasing* (*meaning improving*) trend continues!

As you continue to sample over the years, we will be able to generate long-term trends for chlorophyll-a concentration.

While algae is naturally present in all lakes, an excessive or increasing amount of any type is not welcomed. In freshwater lakes, phosphorus is the nutrient that algae depend upon for growth. Therefore, algal concentrations may increase when there is an increase in nonpoint sources of nutrient loading from the watershed, or in-lake sources of phosphorus loading (such as phosphorus releases from the lake sediments). It is important to continually educate residents about how activities within your lake's watershed can affect phosphorus loading and lake quality.

- **Figure 2:** The graphs on this page show historical and current year data for lake transparency. Volunteer monitors use the Secchi-disk, a 20 cm disk with alternating black and white quadrants, to measure water clarity (how far a person can see into the water). Transparency, a measure of water clarity, can be affected by the amount of algae and sediment from erosion, as well as the natural colors of the water.

  The numerous big snowstorms during the late spring of 2001 contributed a large amount of snowmelt runoff to most of the lakes and ponds throughout the state, which may have increased phosphorus loading and the amount of soil particles washed into the waterbodies. Many lakes and ponds experienced lower than typical transparency readings during late May and June. However, the lower than average rainfall and the warmer temperatures resulted in some lakes reporting their best-ever Secchi-disk readings in July and August, a time when we often observe reduced clarity due to increased algal growth!

  The current year data (the top graph) show that the in-lake transparency *decreased very slightly* from May to June, *increased* from June to July, *decreased* from July to September, and then *continued to decrease* from September to October. The transparency *was less than* the state mean on each sampling event this season.

  The historical data (the bottom graph) show that the 2001 transparency is *slightly greater than* the 2000 mean, but is still *less than* the state mean.

  Again, as you continue to sample over the years, we will be able to generate long-term trends for in-lake transparency.

  Typically, high intensity rainfall causes erosion of sediments into the lake and streams, thus decreasing clarity. Efforts should be made to stabilize stream banks, lake shorelines, and disturbed soils within the watershed and especially dirt roads located immediately adjacent to the edge of the waterbody. Guides to Best Management Practices are available from NHDES upon request.

- **Figure 3:** These graphs show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plant and algae growth in New Hampshire freshwater lakes and ponds. Too much phosphorus in a lake can lead to increases in plant and algal growth over time.

  The current year data for the upper layer (the top inset graph) show that the total phosphorus concentration *increased by a*

large amount **from May to June,** ***decreased by a large amount*** **from June to July,** ***increased*** **from July to October. The total phosphorus concentration was** ***greater than*** **the state median on each sampling event this season except for May, when it was** ***slightly less*** **than the state median.**

The current year data for the lower layer (the bottom inset graph) show that the total phosphorus ***increased*** **as the sampling season progressed. The total phosphorus concentration in June, July, and September was** ***greater than*** **the state median. (Note: A sample was not taken for the lower layer in October.) The algal bloom in September and October could have been the result of elevated total phosphorus in the water column.**

The historical data for the upper layer and lower layer show that the 2001 total phosphorus mean is still ***greater than*** **the state median.**

Typically, high intensity rainfall causes erosion of sediments into the lake and streams, thus decreasing clarity. Efforts should be made to stabilize stream banks, lake shorelines, and disturbed soils within the watershed and especially dirt roads located immediately adjacent to the edge of the waterbody. In addition, catch basins should be cleaned out and street-sweeping measures should be implemented on a regular basis throughout the watershed. Guides to Best Management Practices are available from NHDES upon request.

OTHER COMMENTS

- Sediment depth mapping and sediment core sampling was conducted at **STEVENS POND** during 2001. Sediment depth mapping was done during ice cover and sediment core sample collection was conducted in June. Sediment depth in **STEVENS POND** is 13.2 feet. Sediment cores were analyzed for pesticides, PCB's, PAH's and metals. High levels of copper and zinc were observed in these cores. A fish survey was also conducted with the help of the NH Fish & Game Department. A healthy warm-water fish population was present. Five largemouth bass were collected for tissue analysis. These were analyzed for pesticides, PCB's and metals content. The only detectable substance found during analyses was copper, but levels remained below human health standards.

- The Acid Neutralizing Capacity (ANC) of the surface waters of the pond continue to remain *high*, with the mean being *much greater than* the state mean (Table 5). This indicates that **STEVENS POND** is "*not vulnerable*" to acidic inputs (such as acid precipitation) and has a greater ability than most lakes and ponds in the state to buffer against acidic inputs. While this may seem like a positive condition in the pond, the high ANC is likely due to higher concentrations of ions such as phosphorus, calcium, and metals from roadside runoff into the pond.

- The mean conductivity was even higher than last year at all sampling stations this season (Table 6). The conductivity in the hypolimnion (the lower layer) continued to be the station with the highest conductivity (1633 uMhos/cm!). Typically, sources of elevated conductivity are due to human activity. These activities include septic systems that fail and leak leachate into the groundwater (and eventually into the tributaries and the lake), agricultural runoff, and stormwater runoff from urbanized areas (which typically contains road salt during the spring snow melt). In addition, natural sources, such as iron deposits in bedrock, can influence conductivity. Due to the history and present status of this highly urbanized watershed, and proximity of I-93, the high conductivity levels in the pond are probably inevitable.

- Dissolved oxygen in the hypolimnion (the lower layer) was low again in June, July and September this season (Table 9 and 10). Specifically, the loss of oxygen in the hypolimnion results primarily from the process of biological breakdown of organic matter (i.e.; biological organisms use oxygen to break down organic matter), both in the water column and particularly at the bottom of the lake where the water meets the sediment. When oxygen levels are depleted to less than 1 mg/L in the hypolimnion (as it was this season and last season), the phosphorus that is normally bound up in the sediment may be re-released into the water column, a process known as ***internal total phosphorus loading***. The ***low*** oxygen level in the hypolimnion is a sign of the lake's ***aging*** and ***degraded*** health.

NOTES

- Monitor's Note (5/4/01): Three 2" diameter turtle observed (possibly painted turtles); New lily pad growth observed.

- Monitor's Note (6/19/01): No rain in previous 24 hours; Great Blue Heron observed; Turtle sunning on northeast side observed; Bass sightings observed (Bass appear to be 4" in length); Sunfish observed.

- Monitor's Note (7/25/01): Ducks observed.

- Monitor's Note (10/26/01): Isothermic; low water level.

USEFUL RESOURCES

Combined Sewer Overflows (CSO's), WD-WEB-9, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/wwt/web-9.htm

Impacts of Development Upon Stormwater Runoff, WD-WQE-7, NHDES Fact Sheet, (603) 271-3503, or www.des.state.nh.us/factsheets/wqe/wqe-7.htm

Stormwater Management and Erosion and Sediment Control Handbook. NHDES, Rockingham County Conservation District, USDA Natural Resource Conservation Service, 1992. (603) 679-2790.

Snow Disposal Guidelines, WD-WMB-3, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/wmb/wmb-3.htm

Road Salt and Water Quality, WD-WMB-4, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/wmb/wmb-4.htm

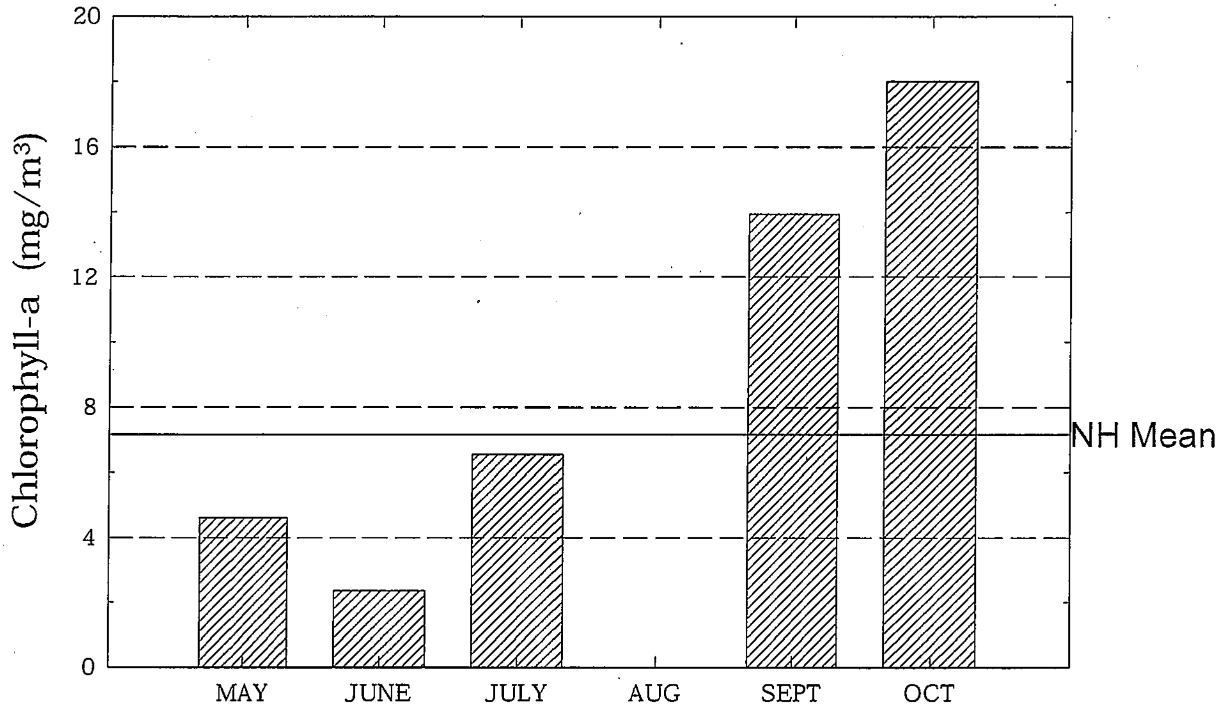
Cleaning Up Winter Storm Damage in Shoreland Areas, WD-BB-39, (603) 271-3503, www.des.state.nh.us/factsheets/bb/bb-39.htm

The Canada Goose: A Beautiful Pest, NHDES VLAP Annual Newsletter The Sampler, Spring 2001, Article written by Alicia Carlson, (603) 271-2658 or www.des.state.nh.us/wmb/vlap/samplr01.pdf

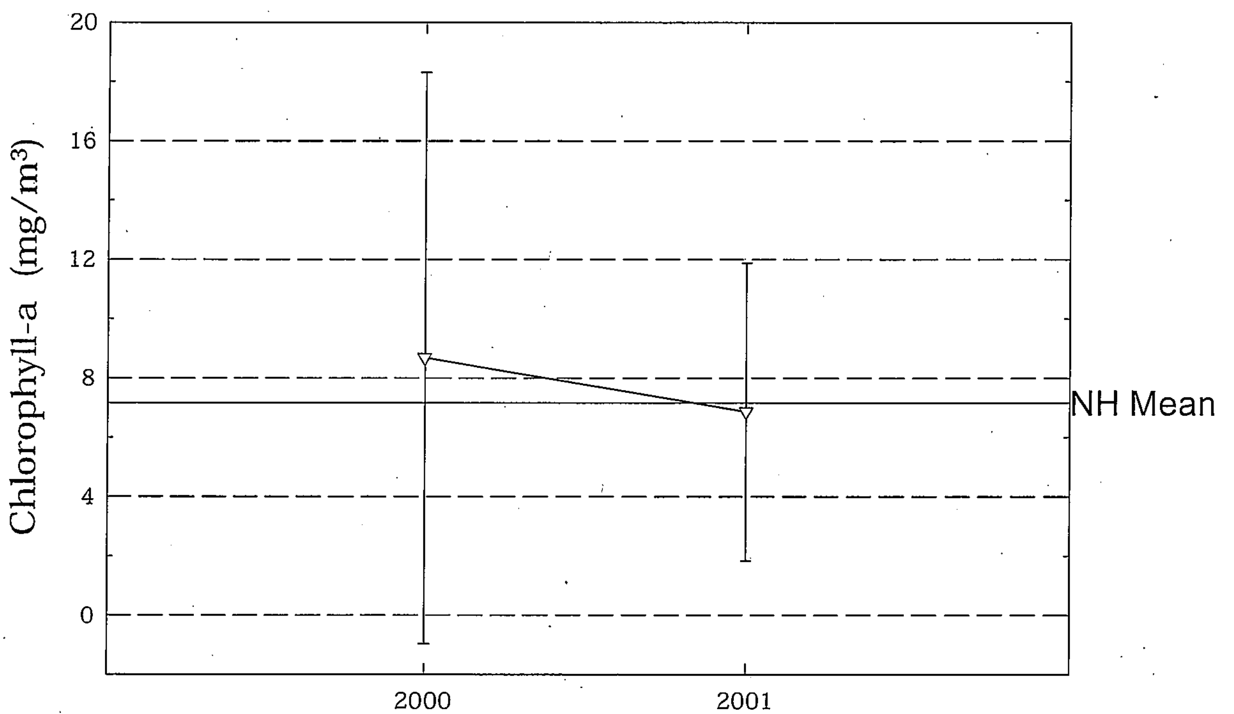
Management of Canada Geese in Suburban Areas: A Guide to the Basics, Draft Report, NJ Department of Environmental Protection Division of Watershed Management, March 2001, www.state.nj.us/dep/watershedmgt/DOCS/BMP_DOCS/Goosedraft.pdf

Stevens Pond

Figure 1. Monthly and Historical Chlorophyll-a Results



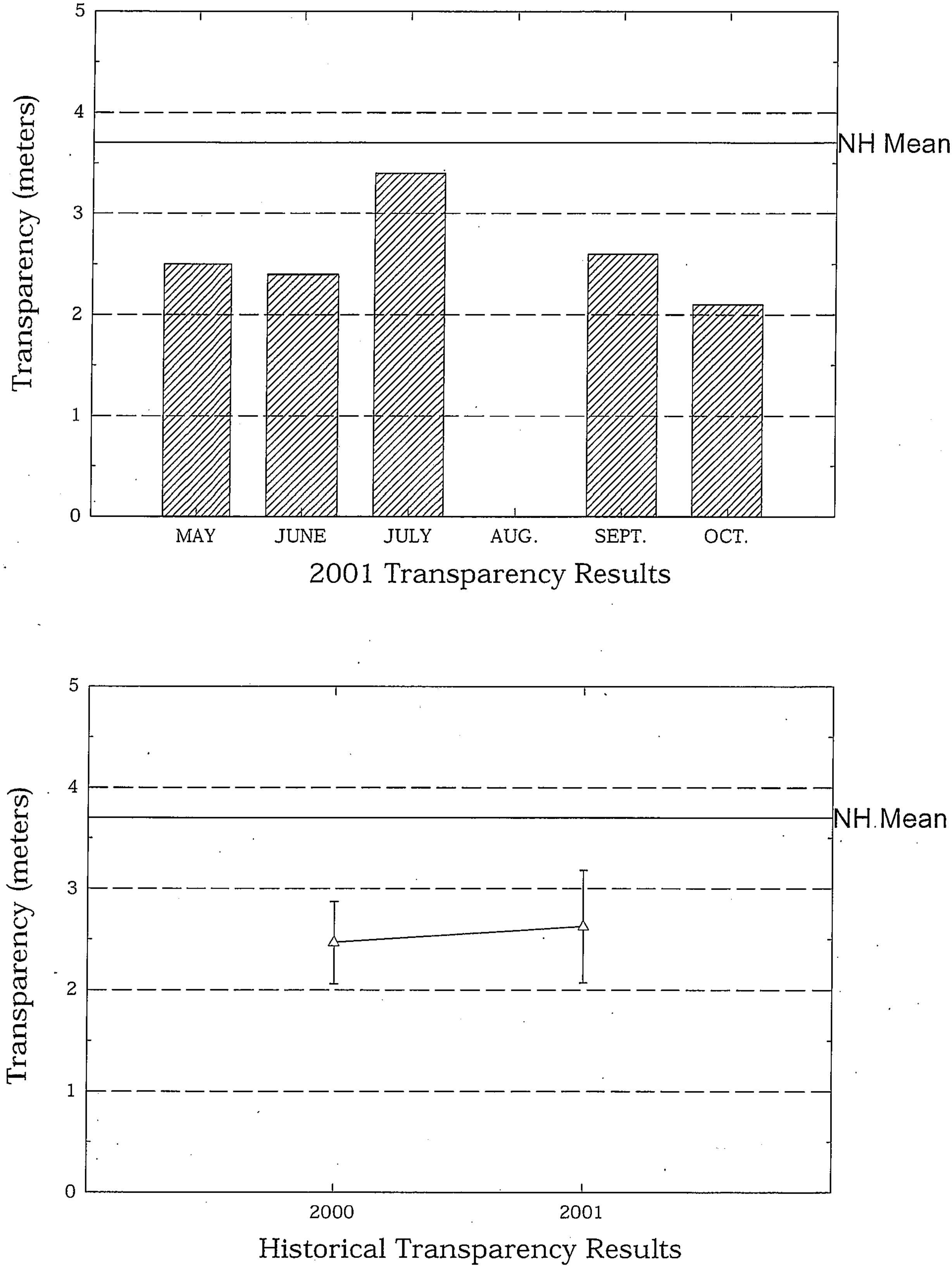
2001 Chlorophyll-a Results



Historical Chlorophyll-a Results

Stevens Pond

Figure 2. Monthly and Historical Transparency Results



Stevens Pond

Figure 3. Monthly and Historical Total Phosphorus Data.