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! While many of the results again this year indicate that the Manchester ponds are degraded, we hope that this project will continue to encourage the citizens of the city to participate in water quality sampling. Through sampling, education, and various water quality improvement projects initiated by the City of Manchester, we ultimately expect that the degraded conditions of the ponds will be improved!

After reviewing data collected from **CRYSTAL LAKE, MANCHESTER,** 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 are microscopic plants that contain chlorophyll-a and are naturally found in lake ecosystems, the concentration of chlorophyll-a found in the water gives an estimation of the concentration of algae.

  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 chlorophyll-a concentration *decreased* from June to October during the 2001 sampling season. On the June sampling event, the chlorophyll-a

concentration was *slightly less than* the state mean, while on the October sampling event the concentration was *well below* the state mean.

The dominant phytoplankton species observed in the plankton sample this year were as follows: *Microcystis* (a blue-green alga), *Ceratium* (a dinoflagellate), and *Anabaena* (a blue-green alga) in June; *Ceratium, Dinobryon* (a golden-brown alga), and *Microcystis* in September; and *Fragilaria* (a diatom), *Oscillatoria* (a blue-green alga), and *Mallamonas* (a golden-brown alga) in October. Diatoms and golden-brown alga are typical in New Hampshire's less productive lakes and ponds, while blue-green alga may indicate that there is 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 mean is *greater than* the 2000 mean but still slightly *less than* the state mean.

Overall, the historical data (the bottom graph) show a *slightly decreasing* in-lake chlorophyll-a trend, meaning that the concentration has *slightly improved* since monitoring began in 1993. We hope to see this trend continue.

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 *increased steadily* from June to October, with the October transparency being greater than the state mean! The *gradual increase* in transparency as the season progressed coincided with a *gradual decrease* in chlorophyll-a concentration. Generally we expect this inverse relationship between chlorophyll-a concentration and transparency in lakes.

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

Overall, the historical data (the bottom graph) show a relatively stable, but *slightly decreasing (slightly worsening),* trend since monitoring began.

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 pond. Too much phosphorus in a lake can lead to increases in plant and algal growth over time.

  The current year data (the inset graphs) for the upper layer and lower layer show that the total phosphorus concentration *decreased slightly* from June to September. The total phosphorus concentration in the lower layer was *slightly greater* than in the upper layer for the June and September sampling events.

  The historical data for the upper layer show that the 2001 total phosphorus mean is *slightly greater than* the 2000 mean and *approximately equal to* the state median. Overall, the historical data for the upper layer show a *stable* total phosphorus trend *approximately equal to* the state median.

The historical data for the lower layer show that the 2001 total phosphorus mean is *less than* the elevated 2000 mean and *slightly greater than* the state median. Overall, the historical data for the lower layer show a *slightly increasing* total phosphorus trend, which means that the concentration has *slightly worsened* in the lower layer since monitoring began.

One of the most important approaches to reducing phosphorus loading to a waterbody is to educate the public. Phosphorus sources within a lake's watershed typically include septic systems, animal waste, lawn fertilizer, road and construction erosion, and natural wetlands. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- Sediment core sampling was conducted at **CRYSTAL LAKE** in June of 2001. Sediment cores were analyzed for pesticides, PCB's and metals. 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 will be analyzed for pesticides, PCB's and metals content.

- Conductivity has ***increased*** in the lake and tributaries since your association joined the program (Table 6). Specifically, the conductivity at the deep spot ranged from 421 – 481 uMhos/cm, with the hypolimnion having the greatest conductivity. Typically, sources of increased 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 road runoff (which typically contains road salt during the spring snow melt). In addition, natural sources, such as iron deposits in bedrock, can influence conductivity.

- The bottom dissolved oxygen was depleted to less than 1 mg/L in the bottom meter of the deep spot on the June and September sampling events (Table 9). The loss of oxygen in the lower layer (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, the phosphorus that is normally bound up in the sediment may be re-released into the water column. This process is referred to as *internal loading.*

- The *E. coli* concentration at the ***City Beach*** was slightly elevated in ***September*** (Table 12). However, the concentration of 28 counts per 100 mL ***was not above*** the state standard of 88 counts per 100 mL designated for public bathing places. If you are concerned about *E. coli* levels at this beach, you may want to repeat this test on a weekend when beach use is heavy or after a rain event. Since bacteria die quickly in cool pond waters, testing is most accurate and most representative of the health risk to bathers when the source (humans, animals, or waterfowl) is present. Please be aware that *E. coli* samples must be analyzed within 30 hours of collection.

- The *E. coli* concentration at the ***Cardins*** sampling location was slightly elevated in ***September*** (Table 12). Specifically, result of 28 counts per 100 mL is well below the state standard of 406 counts per 100 mL for surface waters, and 88 counts per 100 mL for swimming areas. Most lakes typically have 10 or less counts per 100 mL in the open waters. If you are concerned about *E. coli* levels at this location, you may want to repeat this test on a weekend when beach use is heavy or after a rain event. Since bacteria die quickly in cool pond waters, testing is most accurate and most representative of the health risk to bathers when the source (humans, animals, or waterfowl) is present.

- The *E. coli* concentration at the ***Storm Treatment Unit*** was elevated in ***June*** (Table 12). The concentration of 200 counts per 100 mL was not above the state standard of 406 counts per 100 mL for surface waters, or 88 counts per 100 mL for swimming areas. In September the *E. coli* concentration at this location was 37 counts per 100 mL.

NOTES

- Monitor's Note (6/19/01): Bathers, boaters, and water skiers observed

- Monitor's Note (9/16/01): Blue-green algae observed; 20" diameter snapping turtle observed

- Monitor's Note (10/11/01): Isothermic.

- Biologist's Note (10/11/01): No phosphorus or E. coli samples due to account/billing problems.

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

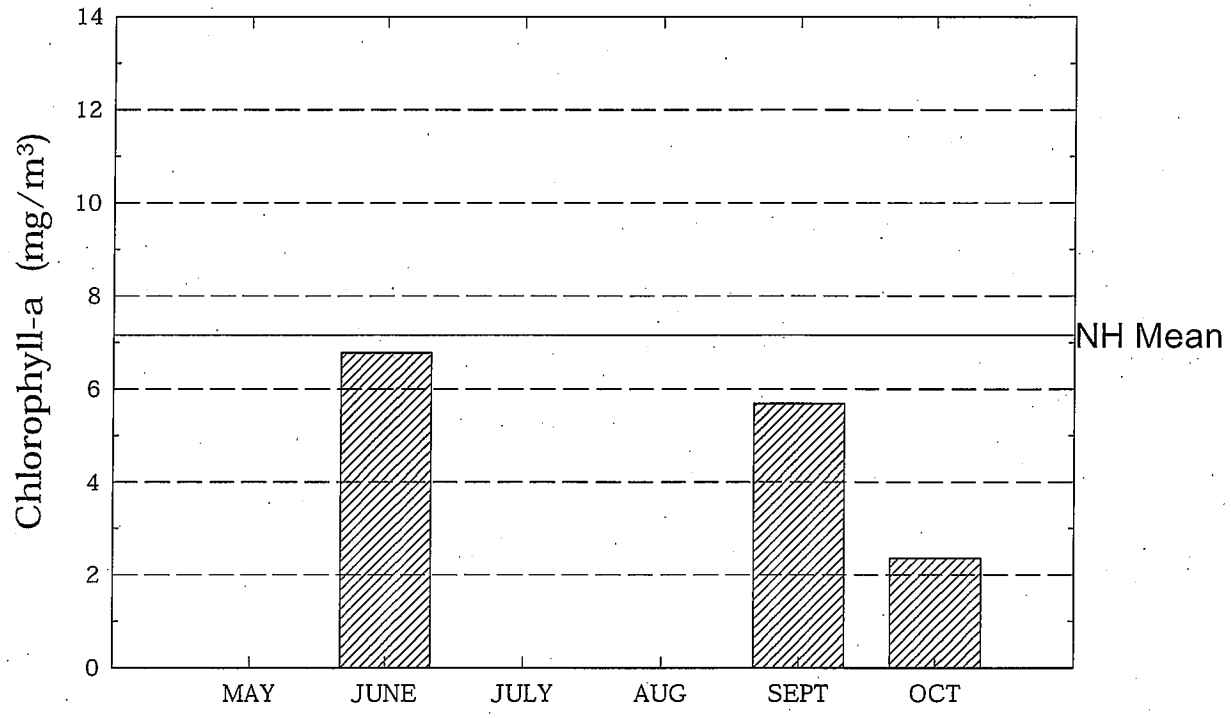
Road Salt and Water Quality, WD-WMB-4, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/wmb/wmb-4.htm

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

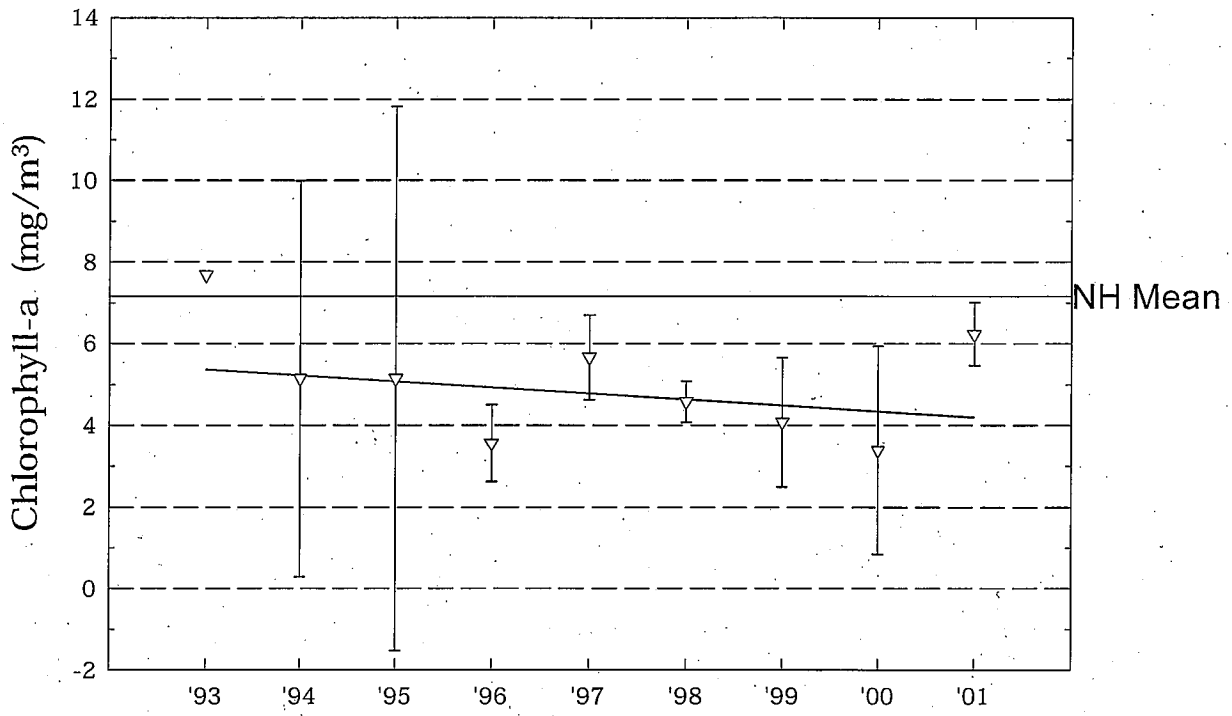
Management of Canada Geese in Suburban Areas: A Guide to the Basics, Draft Report, NJ Department of Environmental Protection Division of Watershed Management, March 2001, www.state.nj.us/dep/watershedmgt/DOCS/BMP_DOCS/Goosedraft.pdf

Crystal Lake, Manchester

Figure 1. Monthly and Historical Chlorophyll-a Results



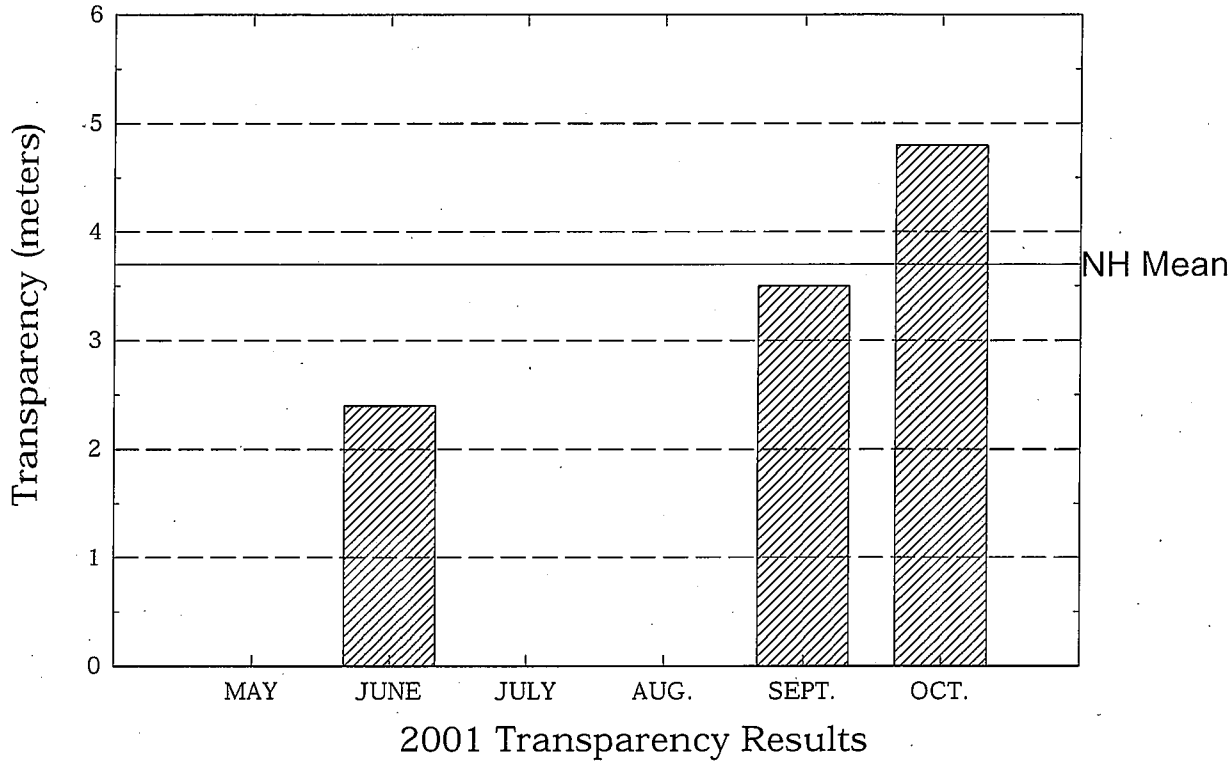
2001 Chlorophyll-a Results

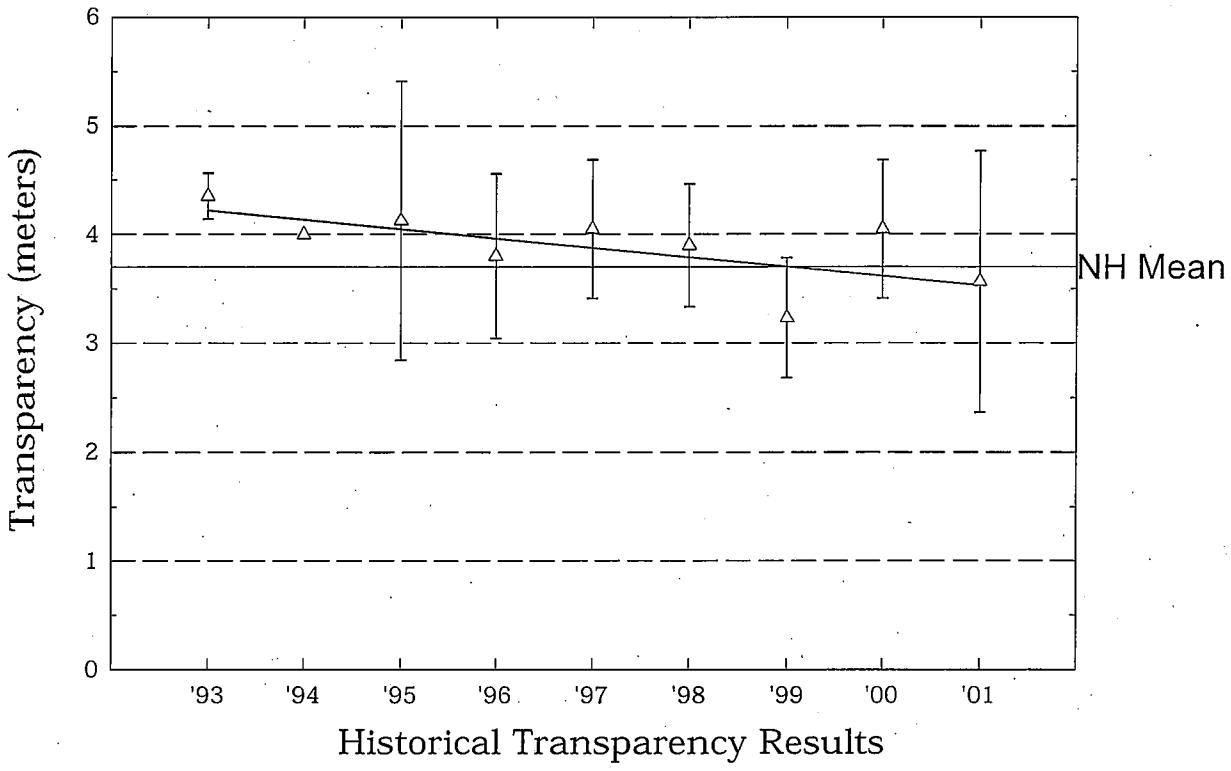


Historical Chlorophyll-a Results

Crystal Lake, Manchester

Figure 2. Monthly and Historical Transparency Results





Crystal Lake, Manchester

Figure 3. Monthly and Historical Total Phosphorus Data.