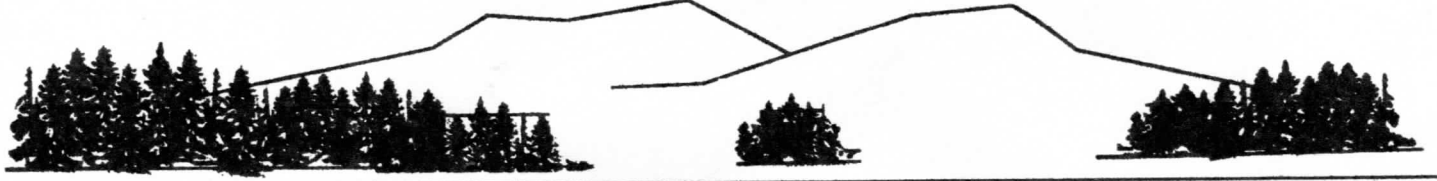


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Cyanobacteria in Mirror Lake

An interview with Dusty Davies, president MLPA

Q. When was the Mirror Lake Protective Association (MLPA) formed, by whom and what is its purpose?

A. The Mirror Lake Protective Association was formed in 1991 by a group of lakefront property owners concerned with the maintenance and preservation of the environmental quality of Mirror Lake and its environs. Its mission is to protect and preserve the lake's wildlife and habitat and to promote knowledge and history about the lake.

Q. Where is Mirror Lake located and who are the members of the MLPA?

A. Mirror Lake is 37-acre lake located within the towns of Wolfeboro and Tuftonboro. It has approximately 90 lakefront residences and approximately 200 residences are located in the Mirror Lake watershed. It is bordered on the north side by State Route 109, where there is a public boat launch, and on the east side by Lang Pond Road, on which a public beach is located. Since Mirror Lake is a shallow, warm water lake, it is also a popular spot for fishermen. MLPA's membership is comprised of approximately 125 residents and businesses located in the watershed.

Q. When were the first signs of cyanobacteria detected in Mirror Lake and by whom?

A. Cyanobacteria was first identified in August 2007 by a senior at UNH, majoring in environmental studies, whose family has a camp on the lake. Mirror Lake was then placed on the list of impaired waters, the "NHDES 303(d) list", when cyanobacteria blooms were verified by the New Hampshire Department of Environmental Services (NHDES) in 2007 and 2008.

Q. Since cyanobacteria is found in almost every natural habitat, from oceans to bare rock and soil, why is it a problem for Mirror Lake?

A. You're correct. According the NHDES web site, cyanobacteria are photosynthetic, single-celled organisms which commonly occur in nearly all of New Hampshire's waterways. When present in low numbers, they do not cause recreational or aesthetic problems; however, when conditions are optimal, they

form blooms which can be toxic.

Q. What causes the "blooms", what do they look like and why are they harmful?

A. Factors contributing to blooms include nutrients, sunlight and temperature. Cyanobacteria blooms (also known as blue-green algae) may have the appearance of spilled paint on the water's surface, car antifreeze, or bluish green chunks floating throughout the water column. A bloom may cover an entire water body or be confined to a cove area and often congregate along the windward shoreline from wind and wave action. There are four cyanobacteria common to New Hampshire's lakes that produce toxins that are stored within the cells and released upon cell death. The

NHDES has confirmed that the cyanobacteria blooms in Mirror Lake produce such toxins. These toxins can cause both acute and chronic health effects ranging in severity from skin and mucous membrane irritations, nausea, vomiting, and diarrhea to permanent liver and central nervous system damage.

Q. Cyanobacteria feeds on excess nutrients. What are these nutrients and where do they come from?

A. Research indicates that the numbers of cyanobacteria increase as the nutrients in the water increase, causing toxic blooms. Nutrients in the water

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come from phosphates, nitrates and other elements and these can come from many sources within a watershed, including septic systems, cesspools, lawn and garden fertilizer, residential developments, logging operation and runoff from roads.

Q. What impact does cyanobacteria have on individuals who swim in the lake or drink the water?

A. The current status of impairment of Mirror Lake has caused serious problems for the Lake's residents and the communities of Tuftonboro and Wolfeboro who use the lake for household and drinking water, boating and fishing recreation. At the first onset of algae bloom, in 2007, residents and lake users were unknowingly exposed and one became seriously ill; news releases about the infection caused a home buyer, under contract, to back out of the purchase of the lakefront property, specifically because of the water quality issues. In addition to the health risk, the existence of cyanobacteria represents to the community a loss of recreation and, to lake residences, a concern for their own financial investments in Mirror Lake properties. In addition, many residents have historically used lake water for household use and drinking water. The DES has advised that both boiling and filtering the water increases the toxicity and has recommended that the water not be used for household purposes. So, many homeowners are facing the expense of drilling wells.

Q. What steps are being taken to control or eliminate the bacteria from the lake?

A. In July, 2008, the MLPA sought guidance from experts to determine appropriate remediation efforts. It held a joint meeting at UNH with representatives from UNH, NHDES and the UNH Center for Freshwater Biology. Among those in attendance were Drs. Jeffrey Schloss and Robert Craycraft, UNH Cooperative Extension - Water Resources and Dr. James Haney, professor of Marine and Fresh Water Biology at UNH, and a noted expert on cyanobacteria, and Sonya Carlson, Beach Program Coordinator, NHDES. The experts recommended that, before any lake-wide treatment or remediation efforts commence, further testing of the lake be done to determine (a) all of the sources contributing to the excess of nutrients in the lake and (b) the scope of the cyanobacteria present in the lake

Q. If the MLPA has had these two testing programs in place, why the need for more testing?

A. As described above, to date, the MLPA had been testing only one tributary as a possible source of excess nutrients in the lake, and only one spot in the lake for the location of phosphorus which would cause the cyanobacteria blooms. The experts pointed out that, although the entire lake might appear to be

covered with cyanobacteria blooms, the question is, are the blooms occurring around the lake due to cyanobacteria in the lake's sediment and cyanobacteria in the water column where the blooms are appearing, or has the bloom been blown to that area of the lake by winds and wave action? If the sources of excess nutrients are not eliminated or reduced, and the scope of the presence of cyanobacteria is not accurately determined, any chance of an effective, long-term, remediation effort is diminished. The experts cited examples of lake treatment programs which were initiated without first determining the sources of the excess nutrients and scope of the cyanobacteria. In such programs, blooms reoccurred within a year or two of treatment.

Q. What type of further testing was suggested by the experts and how much will it cost?

A. The experts strongly recommended, that MLPA fund a nutrient water sources study of Mirror Lake to identify nonpoint-sources (indirect) of pollution, from which they can study an ongoing water quality monitoring and control program that could be developed to reduce the sources and scope of cyanobacteria in the lake. The long-term goal would be to reduce nutrient loading in the lake and reduce total phosphorus levels in the lake to below that which supports the formation of cyanobacteria bloom (10 ppb). They stated that in order for such a study to be scientifically reliable, it should be undertaken over an 18-month period. The estimated cost of such a study would be, approximately, \$30,000.

Q. Does the MLPA have that kind of funds?

A. With only 125 members, the answer is no. However the consultants suggested that perhaps this could be funded through the Environmental Protection Agency (EPA) by applying for a Watershed Restoration Grant for Impaired Waters. This grant is awarded and administered by the NHDES. In late August, the MLPA filed a "Pre-Proposal Information and Application" with the NHDES. If the MLPA is awarded this grant, testing under this program would begin in the summer of 2009. However, the experts recommended that the MLPA not wait until next summer to determine whether it is awarded the EPA grant and that it immediately commence a more limited, but very valuable, testing program of the lake in order to begin collection of base-line data. In mid August, 2008, a much more modest interim testing program began and we have applied for a grant from the Meredith Village Savings Bank to fund the cost of the laboratory analysis.

Q. Will this testing be carried out by outside consultants?

A. No. The consultants advise us as to the type, frequency and location of the sites from which to collect water samples. Initially, we are collecting

water samples from sites in the lake and the one tributary referred to above, but, if we get the funding, eventually we will collect water samples, soil samples and monitor inflows and outflows of inlets and tributaries from locations in and around the entire Mirror Lake watershed. This will be the most effective way to identify all of the sources of excess nutrients in the lake. I might add that all of the time spent collecting, preparing and delivering the samples to the laboratory at UNH is being performed by MLPA volunteers, and this is no mean task. For example, the DES program requires cutting through the ice in the winter at five sites along the tributary. The consultants advise us as to what we need, where to go, and what to gather, and analyze and interpret the data.

Q. How long will this process take?

A. Well, first, using the results of the test data, we need to find the sources causing the excess nutrients in the lake and eliminate or reduce them. At the same time we will analyze the best method for removing the excess nutrients and cyanobacteria already in the lake. We anticipate that we will be looking for assistance from local, state and federal resources in what will be a substantial effort.

Q. You have mentioned the help that you are receiving from state and federal agencies. Are you also receiving help from the towns of Tuftonboro and Wolfeboro?

A. Yes. In the fall of 2007, at the request of the MLPA, the Town of Wolfeboro commenced treating the effluent from its waste water treatment facility for the removal of phosphorus and nitrates prior to spraying the treated effluent, although such treatment was not required by the town's permit for the system issued by the NHDES. In addition, the Town of Wolfeboro has advised the MLPA that it is employing "Best Management Practices" to reduce runoff from spray field 5, which is the spray field that most directly impacts the flow into Mirror Lake. The town has also appropriated more than \$8 million to address the NHDES Administrative Order by retiring the existing effluent spray system and replacing it with a new treated effluent system called Rapid Infiltration Basins (RIB). This system is expected to be completed in the winter of 2008 and will replace the spray fields currently used by the existing system.

The Town of Tuftonboro has been very supportive and concerned about the pollution issues in Mirror Lake. Members of the Board of Selectmen have participated in MLPA's annual meetings. For a number of years the town paid for the UHNLMP testing program for Mirror Lake. In June, 2007, Tuftonboro and the MLPA, co-sponsored a public meeting at which faculty members and students from UNH presented their analysis of lake conditions and members of UNH

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and DES answered questions. The meeting was held at the Tuftonboro Town building and over 100 people were in attendance.

Q. You mentioned the MLPA volunteer efforts, but what about individual homeowners and their contribution to excess nutrients?

A. The MLPA has been proactive in distributing information on how individual homeowners can reduce their impact on the lake. At the 2008 MLPA annual meeting, a representative of NHDES discussed lake-friendly household products, plant life to protect the shoreline and prevention of run-off. Residences have reported using lake-friendly products and protective plantings are being planted lakeside. Thirty percent of lake residences have state sewer approvals. In addition, 40 residents voluntarily tested their sewer septic systems for leakage. MLPA's goal is to have 100 percent of the sewer septic systems on Mirror Lake tested.

Q. Are there any other lakes in the area with this same problem?

A. Yes. The DES reported this year that more than 130 lakes in New Hampshire are impaired, more than 30 of which have been placed on its list for cyanobacteria. It is the goal of the MLPA that Mirror Lake be the case study for lake recovery. New Hampshire can ill afford the loss of revenue from residents and tourism that will result if its lakes, one of its most precious natural resources, are polluted.

Rosalie Triolo