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# Participatory Water Quality Assessment Through the NH Lakes Lay Monitoring Program

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# Participatory Water Quality Assessment Through the NH Lakes Lay Monitoring Program

## Basic Information

<b>Title:</b>	Participatory Water Quality Assessment Through the NH Lakes Lay Monitoring Program
<b>Project Number:</b>	2012NH174B
<b>Start Date:</b>	3/1/2012
<b>End Date:</b>	2/28/2014
<b>Funding Source:</b>	104B
<b>Congressional District:</b>	001
<b>Research Category:</b>	Water Quality
<b>Focus Category:</b>	Water Quality, Non Point Pollution, Management and Planning
<b>Descriptors:</b>	
<b>Principal Investigators:</b>	Jeffrey Schloss

## Publications

1. Craycraft, Robert and Jeffrey A. Schloss. 2012. Baboosic Lake Annual Lake Report for 2011. New Hampshire Lakes Lay Monitoring Program; UNH Center for Freshwater Biology and UNH Cooperative Extension. Durham, NH. 138 pps.
2. Craycraft, Robert and Jeffrey A.Schloss. 2012. Bow Lake Annual Lake Report for 2011. New Hampshire Lakes Lay Monitoring Program; UNH Center for Freshwater Biology and UNH Cooperative Extension. Durham, NH. 114 pps.
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## 2012NH174B

### **Participatory Water Quality Assessment Through the NH Lakes Lay Monitoring Program**

#### **Problem:**

The fresh waters of New Hampshire represent a valuable resource contributing to the State's economic base through recreation, tourism, real estate revenues and taxes. In addition some lakes and rivers serve as current or potential drinking water reservoirs/supplies. For most residents our generally pristine waters help to insure a high quality of life. However, New Hampshire currently leads all of the New England states in the rate of new development and redevelopment (Society for the Preservation of New Hampshire Forests, Governor's Office of Energy and Planning). The long-term consequences of the resulting pressure and demands on the state's precious water resources remain unknown. Of particular concern is the response of our waters to increasing non-point source pollutant loading due to watershed development and land use activities. Local citizens, lake/watershed associations and local decision-makers remain in dire need of additional information required for the intelligent management of our water resources on the local level. State agencies need to be better informed on water quality changes and trends. Limited financial resources do not allow for adequate monitoring of these waters by state or federal agency personnel, The recent increase of infestations of invasive species such as variable water milfoil as well as the proliferation of blue green bacteria blooms, which can leach dangerous toxins impacting humans and wildlife, has threatened the water quality and has limited or restricted use of NH waters at an increasing rate. There is still no mechanism for successful eradication of milfoil and we are just beginning to understand the conditions that favor blue green bacteria blooms and their ecological impacts through cutting edge research by UNH faculty and students.

#### **Objectives:**

**The funds provided by the WRRC provided continued partial support of our long term citizen science participatory monitoring effort, the NH Lakes Lay Monitoring Program (LLMP).** Additional support for this effort is provided by UNH Cooperative Extension, The UNH College of Life Sciences and Agriculture, USDA National Institute of Food and Agriculture, New Hampshire Department of Environmental Services (NH DES; from US EPA section 319 funding) and from towns, municipalities and lake associations throughout the state.

- 1- The continued collection and analysis of long-term water quality data in selected watersheds.
- 2- The dissemination of the results of the analysis to cooperating agencies, water managers, educators and the public on a local, statewide and regional basis.
- 3- To offer undergraduate and graduate students the opportunity to gain hands-on experience in water quality sampling, laboratory analysis, data management and interpretation.
- 4- To further document the changing water quality in a variety of watersheds throughout the state in the face of land use changes and best management efforts.

## **Methods**

Lake and stream monitoring through the LLMP generally involved a minimum of monthly sampling starting at spring runoff through to lake stratification and weekly to bi-weekly sampling through to fall mixis. Water clarity, chlorophyll a, acid neutralizing capacity, dissolved organic color, dissolved oxygen and nutrients (total N, total P and nitrate) will be the default suite of parameters measured for lakes while nutrients, turbidity, dissolved organic color and flow will be the parameters of choice for the lake tributary work. On occasion, student field teams traveled to join the volunteer monitors to perform quality assurance checks and do more in-depth analysis and lake profiling. All LLMP field sampling and laboratory analysis follows approved Quality Assurance Projects Plans and Site Specific Project Plans reviewed by NH DES and US EPA New England and are on file with both agencies.

As stated above the primary scope of this project was to maintain the long-term data collection effort of the LLMP and support information transfer for informed local decision making regarding water resources.

## **Principal findings and significance**

Focus of this year's efforts was on the Newfound Lake Watershed and Wentworth Lake

These research findings continued to support an innovative approach used by the Newfound Lake Regional Association to have the watershed towns consider changing their current development ordinances to utilize variable buffer width requirements based on slope. To date 2 towns have incorporated this recommendation and additional towns are considering the measure. For this year specifically, volunteer data were used to help calibrate a watershed land use nutrient loading model as well as a lake response model for the resulting phosphorous nutrient loading.

The Town of Wolfeboro and Lake Wentworth Foundation developed a Watershed Management Plan to protect Lake Wentworth and Crescent Lake. Tributary and in-lake water quality data collected through the NH LLMP were used to calibrate a watershed land use nutrient loading model as well as a lake response model for the resulting phosphorous nutrient loading. The resulting information is being used by the Town of Wolfeboro, the Lake Wentworth Association and the Lake Wentworth Foundation to consider regulation and zoning amendments, to target educational/outreach efforts and to prioritize problem areas for remediation.

## **Publications and Presentations**

### Reports:

Craycraft, Robert and Jeffrey A. Schloss. 2012. Baboosic Lake Annual Lake Report for 2011. New Hampshire Lakes Lay Monitoring Program; UNH Center for Freshwater Biology and UNH Cooperative Extension. Durham, NH. 138 pps.

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Presentations:

Craycraft, Robert. 2012. Lake Winnepesaukee Cruise water quality talk: water quality sampling and water quality threats. June 24, 2012 Attendance: Approximately 30.

Craycraft, Robert. 2012. Naturally Newfound Fair: Water quality monitoring in the Newfound Lake watershed. June 30, 2012. Attendance: Approximately 300.

Craycraft, Robert 2012. New Hampshire Coverts Project lecture: Water quality overview and threats to New Hampshire lakes. .October 5, 2012. Attendance: 22.

**Outreach/Information Transfer**

March 23, 2012 –Presented invited opening plenary lecture for Canada Water Day Conference, Dalhousie University, Nova Scotia: “Citizen Science: Participatory Water Resources Monitoring Supports High Tech Analyses”. (Jeff Schloss)

April 6, 2012- Guest lecture-for NREN Introduction to Water Resources on the Lakes lay Monitoring Program and NH Lakes. (Schloss)

May 4, 2012- Panel Discussion –Volunteer Monitoring- for the 2012 National Water Quality Monitoring Conference. Portland Oregon. (Schloss)

May 17, 2012- Newfound Lake Project Update- Water Quality Modeling for the Watershed –(Schloss).

June 8, 2012- Landscaping at the Water’s Edge Workshop. New England Chapter of the North American Lake Management Association. (Schloss)

June 9<sup>th</sup>, 2012- Presentation: “Global Change and Our New England Lakes: What can we expect?” New England Chapter of the North American Lake Management Association. (Schloss).

July 3, 2012. Meeting at NH Dept. Of Environmental Services regarding NH LLMP data sharing and the Winnepesaukee Watershed Gateway web site. (Schloss)

September 13, 2012 Newfound Lake Watershed Forestry Roundtable Discussion (Alexandria NH): Discussed water quality sampling results as part of a Newfound Lake sustainable forestry discussion. (Robert Craycraft)

December 6, 2012- Invited presentation “Lessons Learned from a Long-Term Participatory Water Quality Monitoring Program” Special session on Citizen Science, American Geophysical Union Annual Meeting. San Francisco, CA (Schloss).

### **Students Supported**

While no WRRC support was provided for direct undergraduate student support, the following students were indirect beneficiaries of WRRC support to the NH LLMP:

#### Undergraduate Students

Casey Chalmers	Environmental Conservation	Junior
Michel Henlou	Environmental Conservation	Senior (Spring 2012 Grad)
Hannah Johnson	Environmental Conservation	Senior (Spring 2013 Grad)
Emma Leslie	Zoology	Senior (Spring 2012 Grad)
Ashley Lupus	Medical Science	Senior (Spring 2012 Grad)
Cara McGuire	Environmental Conservation	Senior (Spring 2012 Grad)
Jessica Waller	Marine Biology	Senior (Spring 2013 Grad)

#### Graduate Students (directly supported):

Jeff Schloss	Natural Resources and Environmental Studies	PhD candidate
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### **Faculty Staff Supported**

Directly: Jeff Schloss- Extension Professor in Biological Science

Indirectly: Robert Craycraft, Educational Program Coordinator, LLMP UNH Cooperative Extension.