

Summers are short, but volunteer participation is long-term in New Hampshire

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A nearly 50-year history of water quality monitoring in New Hampshire

The University of New Hampshire's (UNH) Lakes Lay Monitoring Program (LLMP) is a citizen-based monitoring program that was established in 1979 and has since grown to become one of the largest and longest-running volunteer lake monitoring programs in the United States. UNH LLMP originated in response to public concerns around declining water quality and changing watersheds. UNH faculty, staff, and students pioneered the incorporation of trained volunteers for frequent, cost-effective monitoring in New Hampshire lakes. Shortly after, in 1985, the New Hampshire Department of Environmental Services (NHDES) added a program of their own, the Volunteer Lake Assessment Program (VLAP). Together, the two programs have covered water quality monitoring for over 300 lakes in the Granite State.

Each year, hundreds of volunteers contribute thousands of hours collecting and processing water samples that inform statewide assessments and long-term trend analyses (Figure 1). Along the way, volunteers receive hands-on training in scientific monitoring techniques and learn to identify emerging threats to lake health – from aquatic invasive species and harmful cyanobacteria blooms to the impacts of stormwater runoff. Their dedication not only deepens our understanding of New Hampshire's lakes but also helps ensure these treasured waters remain healthy for generations to come.

How low can the LLMP go when testing low-nutrient lakes?

For over 40 years, LLMP has run



Figure 1. LLMP interns train volunteer monitors on how to use sampling equipment.



Figure 2. Georgia Bunnell prepares a set of total phosphorus samples to be analyzed.

their nutrient samples by hand (Figure 2). The phosphomolybdate ascorbic acid method allows the lab to measure total phosphorus concentrations as low as 0.8 ppb, and 0.3 ppb for orthophosphate. Precise detection limits are crucial for many New Hampshire waterbodies that are oligotrophic, meaning they naturally contain very low nutrient concentrations. These analytical techniques provide a better understanding of how the lakes are biologically changing over time, even at the smallest scale. Total nitrogen is also analyzed spectrophotometrically, with a detection limit of 100 ppb.

Although these techniques can be intricate and time-sensitive, they provide competitive laboratory skills and freshwater chemistry knowledge to student interns that they will carry with them into their future careers. As one of the only laboratory facilities in the state that utilizes these methods, LLMP conducts comprehensive water quality monitoring from 118 waterbodies historically. With nearly 1,000 lakes in the state, there is always more to do!

A statewide network of volunteer lake monitors

Each year, VLAP brings together hundreds of volunteer monitors for a workshop focused on reinforcing lake ecology concepts, retraining volunteers on EPA-approved water sampling methods, and highlighting emerging threats such as aquatic invasive species, stormwater runoff, and harmful boating practices (Figure 3). The workshop also provides an opportunity for volunteers to connect directly with state biologists at NHDES, strengthening communication and support across the program. Educating volunteers provides them with the necessary training to carry out monitoring independently, sustaining the program's long-term success.

The Jody Connor Limnology Center at the NHDES offices in Concord processes most of the samples for the majority of waterbodies participating in VLAP, but with over 180 lakes in VLAP, the program relies heavily on the Colby-Sawyer College (CSC) satellite lab in New London, NH, managed by Teriko MacConnell and operated in partnership with the Lake Sunapee Protective Association.



Figure 3. Volunteer monitors attend the annual VLAP workshop at the Lake Sunapee Protective Association Center.

This facility extends program capacity by supporting sample analysis and volunteer coordination, effectively bridging monitoring efforts between the Sunapee region and the rest of the state. VLAP and LLMP also collaborate with several partner organizations that engage local communities in water quality monitoring efforts, such as the Green Mountain Conservation Group, Winnisquam Watershed Network, Lake Winnepesaukee Alliance, Acton-Wakefield Watershed Alliance, Newfound Lake Region Association, Wentworth Water Association, and Squam Lakes Association. Additionally, several lakes participate in both VLAP and LLMP, which strengthens monitoring efforts across programs and provides a more comprehensive dataset to inform additional research questions.

A future of collaboration and comprehensive monitoring

As lakes throughout New Hampshire and the world continue to experience adverse impacts from warmer temperatures and extreme weather events, the need for more freshwater monitoring has increased to better understand how our lakes are changing with the climate (Figure 4). LLMP and VLAP both advocate for more sampling during

critical periods, such as late summer when lakes are fully stratified as well as after lake turnover, so both researchers, lake managers and volunteers alike can analyze the seasonal behavior of lakes, especially as cyanobacteria blooms and phosphorus loading continue to become prevalent issues. Open communication between volunteer programs and the public is key to strengthening education and research while building relationships with lake communities.

New Hampshire's water quality monitoring efforts are effective because of strong coordination between NHDES, VLAP volunteers, CSC, UNH, LLMP volunteers, and partner organizations operating under standardized methods. This allows multiple volunteer programs to function as a cohesive network, generating high-quality data that feed into the state's Environmental Monitoring Database to inform lake management decisions and keep the public informed through the [NHDES Lake Information Mapper](#) and the [LLMP Lake Reports](#). Monitoring New Hampshire's lakes is a unique collaborative effort that is made possible by the hundreds of dedicated volunteer monitors across several programs and organizations.



Figure 4. A loon on Squam Lake, one of the lakes participating in LLMP.

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