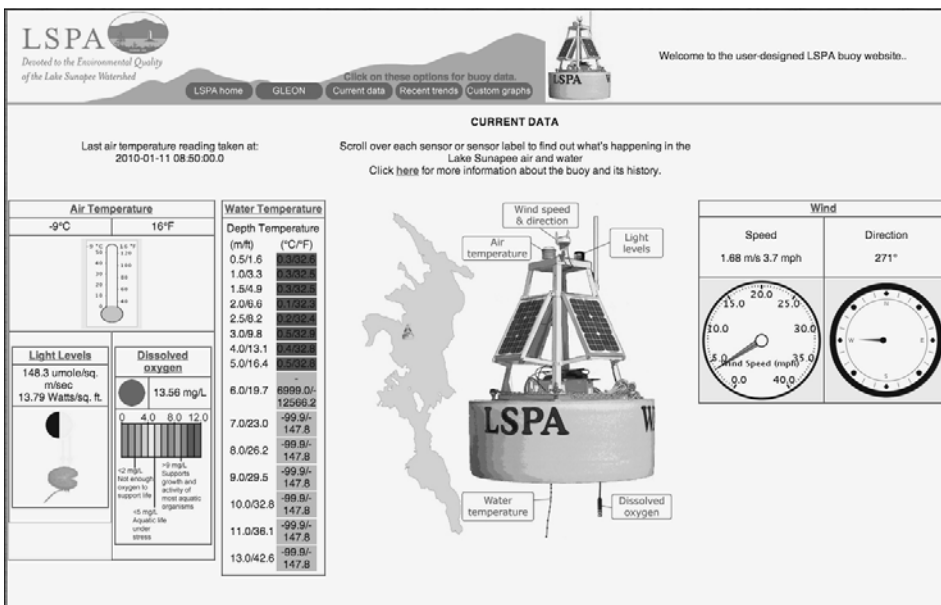




# the Beacon

of the Lake Sunapee Protective Association

February 2010



LSPA's constant, interactive buoy data is now on the web in a test mode. You can access it at [www.lake-sunapee.org](http://www.lake-sunapee.org). Have fun! (But remember the site is still under development, so at times you may find glitches, or it may be unavailable.)

## Scientists Visit LSPA Board

Members of LSPA's Scientific Advisory Committee (SAC) and other researchers working at Lake Sunapee updated the LSPA Board in January on the various research projects they are carrying on in and around the Lake.

### Scientific Advisory Committee

The SAC was established in 2006 by current LSPA Research Director Kak Weathers, as an outgrowth of her sabbatical at LSPA in 2004. The SAC members are a resource for the staff, a source of scientific information, and contributors to research and monitoring of Lake Sunapee.

### Grants

Their activities have led to grants focusing on specific topics (cyanobacteria, mercury, watershed processes) and grants to bring people together (scientists from different fields, scientists and citizens from the watershed, scientists and lake managers). For LSPA, these grants result in equipment (computers, software, buoy instruments), interactions with student and post-graduate researchers and direct contact with the SAC scientists and their work. All the interaction between LSPA's SAC, other researchers, LSPA staff, students, and citizens is a model of new thinking about how scientists can engage with the public. The staff and volunteers of LSPA and facilities of Knowlton House are key

## Lakes in Winter: Under the Ice, What's Going On?

As you are skating, skiing or snowshoeing across an ice-covered lake (or skiing down the slopes of Mt. Sunapee and looking out over a frozen Lake Sunapee) do you ever wonder just what is going on under that ice? There may be a lot more activity than you think in that deep, dark cold. First, it may not be that dark, relatively speaking. Though it may be limited, light does penetrate ice and even snow covered ice to a point. And, though we may not think of it as *warm*, there is thermal activity going on out there.

### Water Temperature Layers

Though in the summer the lake has different layers of water temperature, in the fall, these layers mix as the lake

cools, aided by wind action, until the entire depth is nearly the same temperature.

### Temperature and Currents Under the Ice

Generally, this temperature stability may persist under ice cover throughout the winter, though there is spot variability due to environmental variables such as sun exposure, water depth, currents, proximity to a stream inlet, etc. When the lake is completely ice covered, there are active currents caused by inflow from tributaries and by warming or cooling of water. Under certain conditions, particularly

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*(Science, Cont. Page 3)*



## From the Helm

Happy Winter! We are sending out this small, extra edition of *the Beacon* so that you are hearing from us between the November *Beacon* and our Annual Report, which will come your way in April with audited financial figures.

There is a lot going on under the ice on the Lake during the winter, as well as at LSPA. I hope you will take the time to check out our interactive buoy data now on the web at [www.lake-sunapee.org](http://www.lake-sunapee.org). Note the hyphen. (This is a site we are using while the data presentation is still under development; it will be accessed on our regular LSPA website [www.lakesunapee.org](http://www.lakesunapee.org) when it is finalized by the computer scientists who have developed the buoy data presentation.) It is both entertaining and educational.

We are extremely fortunate at LSPA to have a Scientific Advisory Committee consisting of experts in the field of environmental science. Up-to-date, credible science is the foundation of everything we do at LSPA. The SAC helps LSPA take scientific understanding and put it into accessible, usable terms to help us all preserve and protect the water quality of Lake Sunapee and its watershed. Together we (the SAC and LSPA members) are leading the way in linking scientific research to outreach and education. It is our pleasure to share with you in this issue of *the Beacon* a few of their fascinating and important research projects in and around Lake Sunapee. Enjoy!

Tanya Wilkie, President

### Memorial Contributions

LSPA has recently received contributions honoring the memory of:

**Brenda Fitts**  
**Paul Grevstad**  
**Gerald M. Mayer, Jr.**  
**Eleanor Montgomery**  
**Ellen and Sam Stevens**  
**Jane T. Weathers**  
**Sam White**

Our sincere thanks to the families and friends who thought LSPA an appropriate recipient for these memorial gifts.

### Officers, 2009-2010:

Tanya Wilkie	President
Charlie Forbes	1st. V. Pres.
Dave Macdonald	2nd. V. Pres.
Taffy Beckman	Secretary
Phil Schulz	Treasurer
Jack Holton	Clerk

### Staff:

June Fichter	Executive Director
Robert Wood	Assoc. Exec. Dir.
Kathleen Stowell	Education Dir.
Kak Weathers	Research Dir.
Sue Godin	Office Admin.
Bonnie Lewis	Lab Manager
Geoff Lizotte	Watershed

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### Town Meeting Land Protection Votes

Local voters have the opportunity to vote at this spring's town meetings for some land conservation measures that will protect open land in perpetuity:

In **Springfield**, there is expected to be a warrant article to change the status of roads through Star Lake Farm, while retaining the ability for public recreational use of those roads. By making this change, voters will enable the conservation of over 1600 acres of land that are at the headwaters of major surface streams draining to Lake Sunapee, through a conservation easement to be held by the Ausbon Sargent Land Preservation Trust (ASLPT).

The **Sunapee** Conservation Commission will sponsor a warrant article to place an easement, through ASLPT, on the Town Forest on Ledge Pond, protecting that land in perpetuity. Though not in the Lake Sunapee watershed, Ledge Pond is an area where loons feeding on Lake Sunapee may nest. (For questions, contact Beth McGuinn at ASLPT 526-6555.)

A publication of Lake Sunapee Protective Association Founded 1898

All articles prepared by Staff, Officers, *Beacon* committee or *Beacon* Editor Midge Eliassen unless noted. Photos by Midge Eliassen unless credited otherwise.

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to this successful interaction, with meeting spaces and lodging for scientists. Scientists from the SAC and around the world are beginning to use data from LSPA's water quality buoy in their classroom teaching.

**Nick Baer:**

#### **Watershed and Lake Connections**

Nick Baer of Colby-Sawyer College looks at what biology can tell us about the health of the lake. He works on the flowing streams in the sub-watersheds around the lake. He and his students have worked with Weathers and Celia Chen of Dartmouth to look at small organisms, organic debris, the bioaccumulation of toxic contaminants (such as mercury) and nutrient cycling.

**Dave Richardson:**

#### **The Metabolism of a Lake**

Dave Richardson, of the Cary Institute and SUNY New Paltz, talked of how a lake is a breathing super organism that takes in and lets off gases. Small organisms and plants in the lake take in carbon dioxide and release oxygen into the water. This oxygen is used by fish and micro-organisms (zooplankton). Oxygen levels in the lake are also changed by exchange with the atmosphere, as wind turbulence and changing water temperatures exchange and mix the oxygen between the air and water. The LSPA water quality buoy has an instrument that records the amount of dissolved oxygen in the water, showing the daily cycles of higher oxygen levels in the daytime and lower at night.

The Global Lakes Ecological Observatory Network (GLEON), of which the LSPA buoy is one of several around the world, is studying topics such as lake metabolism, with the goal of understanding the factors that control lake respiration, the daily and seasonal patterns, and their relationship to both clear water and nutrient rich (eutrophic) lakes.

#### **Runoff and Nutrients**

Richardson has also led more frequent sampling of some of Sunapee's tributaries, to look at stream flows and how the streams carry sediment and nutrients (both dissolved and attached

to particles) into the lake. So far, the team sees that both forms (dissolved and attached) contribute similar amounts of nutrients to the lake, and that summer storms yield higher phosphorus concentrations. They have found that the stream that enters Herrick Cove from the wetlands along Columbus Avenue has two or three times the sediment and nutrient concentrations of any other tributary.

**Kathy Cottingham:**

#### ***Gloeotrichia echinulata* "Gloeo"**

Kathy Cottingham of Dartmouth has been working with Kak Weathers and graduate student Cayelan Carey since 2005, studying the cyanobacterium Gloeo that has been blooming in Lake Sunapee since 2004. She noted that the 2009 season saw the maximum abundance of Gloeo at a specific time and place, in a bloom in Newbury harbor in September. The complex life history of this organism includes the ability to make nitrogen, not readily available in lakes, available to other organisms, permitting their enhanced growth.

#### **Pandora's Box Grant**

The core hypothesis behind the work of Sunapee's "Gloeo gang" is that Gloeo facilitates eutrophication. It may do so by releasing nutrients, both phosphorus and nitrogen, which allow the greater growth of other organisms. The "Gloeo gang" includes Cottingham, Weathers, Ewing, LSPA, Carey, another graduate student, Sam Fey of Dartmouth, and many undergraduates. A \$949,000 National Science Foundation grant, "Opening Pandora's Box," is funding continued study of Gloeo in Sunapee. The team's hypothesis is that Gloeo brings nutrients otherwise stored in sediments and in the atmosphere and releases them so other algae and plants grow more readily, hastening eutrophication. The grant will examine Gloeo in a regional context (other lakes in New England) and across time (examining sediment for the history of Gloeo blooms) as well as continuing the in-lake Sunapee research and data collection

#### **Holly Ewing: Ancient History**

Holly Ewing of Bates College

works in paleoecology, looking at how ecosystems change over time, and how terrestrial systems influence lakes. She has taken sediment cores from Lake Sunapee, and will be uncovering both terrestrial and aquatic history from these "tootsie rolls" of mud. She, her students and the other Gloeo collaborators are looking to see if Gloeo occurs before, during or after other signs of eutrophication. Ewing displayed data from a Maine lake that showed Gloeo had been there from before 1800, but increased dramatically in the 1950's. One of her students is now analyzing cores from Lake Sunapee. Although the work is not complete, it is clear that Gloeo has been in Sunapee a long time. Follow-up questions will ask if changes in the watershed have influenced the historic presence of Gloeo. Looking at pollen will show if open land for grazing sheep and other agriculture may have influenced the abundance of Gloeo. The cores are also being analyzed to date the sediment layers accurately.

(*Under the Ice, Cont. from Page 1*)

when clear ice is present, solar radiation will heat water under the ice and cause convection currents. Water can also be warmed by bottom sediments releasing heat that was gained during the previous warmer seasons. Mixing of waters of different temperatures can also occur and is probably due to stronger flows entering from streams. Wind induced movements of large ice masses can also cause displacement and mixing under the ice. Groundwater may transmit some heat to a water body through sediments, if the temperature of the groundwater is relatively warm and the volume is significant.

#### **Algae and Microscopic Animals**

Many species of algae (phytoplankton) overwinter in the sediment in some form of resting stage. These overwintering cells may be spores, cysts, zygotes or vegetative cells that will "re-activate" when growth conditions become favorable again. Algae growth under the ice is usually limited

(*Under the Ice, Cont. Page 4*)



The LSPA staff works hard all winter. At a recent staff meeting, left to right: Bonnie Lewis, Woody Wood, June Fichter, Kathleen Stowell, Sue Godin and Geoff Lizotte.

## Winter Ice Prevention Devices

Reminder! Control your ice prevention devices. The well-monitored opening in the photo below is as big as it needs to be, and the thin ice warning is prominently posted. Remember to get a permit for your device from your town.



## Lakes in Winter: Under the Ice, What's Going On? *Starts Page 1; Cont. from Page 3*

to species that are adapted to low temperatures and low light levels. Sunlight is the limiting factor when there is thick ice and snow cover, but if favorable conditions are present, such as clear ice, lots of sunlight and adequate nutrients, significant growth and even algal blooms can occur. Similarly, microscopic aquatic animal species (zooplankton) that are adapted to winter conditions may do very well under the ice. Some zooplankton over-winter in the water and continue to feed. Others over-winter as resting cells in the sediment. Zooplankton populations generally follow the trajectories of algal populations since they are primarily dependent upon algae as a food source.

### Fish and Other Aquatic Fauna

The activity levels of fish in winter depend upon the species and type of fish. Lake Sunapee has a mix of warmwater and coldwater species. Coldwater species such as trout and salmon may be very active throughout winter. In fact, cooler water temperatures throughout the lake in winter may actually expand their habitat temporarily since these species cannot tolerate the warm summer temperatures near the surface or in shallow areas. On the other hand, warmwater species such as bass or perch become less active and their metabolism may significantly decrease. Activity levels and

metabolism rates of other warmwater fish such as some catfish species may slow down even more and may be called inactive or in “near hibernation”. Some fish may even burrow partially into the mud, sand or other bottom material.

Stoneflies, mayflies, caddisflies, and dragonflies are common overwintering aquatic insects. These and other bottom-dwelling (benthic) organisms over-winter in the sediments of streams and lakes and will usually move from shallow to deeper areas for more “warmth”. Many aquatic organisms can tolerate some amount of sub-freezing temperatures due to various physiological adaptations.

### Aquatic Plants

Though some aquatic plants remain “intact”, i.e., they stay green and continue to photosynthesize, at the end of the growing season most plants “die back” and enter an overwintering stage. Like aquatic animals, aquatic plants also use adaptations for overwintering. These include winter buds, rhizomes, and tubers which store energy for future growth.

Several years ago, LSPA staff and volunteers discovered variable milfoil growing, and looking very healthy, under ice in shallow water at the north end of the lake. So, there can be a lot going on under the ice, though, as in the growth of invasive variable milfoil, we may not think of it as “cool”.

**The Lake Sunapee Protective Association, founded in 1898, is a member-supported nonprofit educational organization. We are dedicated to preserving and enhancing the environmental qualities of the Lake Sunapee region. We strive to achieve this mission through education, research and collaborative action.**