



UC DAVIS

TAHOE ENVIRONMENTAL RESEARCH CENTER



THE TAHOE ENVIRONMENTAL RESEARCH CENTER (TERC) IS DEDICATED TO RESEARCH, EDUCATION AND PUBLIC OUTREACH ON LAKES AND THEIR SURROUNDING WATERSHEDS AND AIRSHEDS. LAKE ECOSYSTEMS INCLUDE THE PHYSICAL, BIOGEOCHEMICAL AND HUMAN ENVIRONMENTS, AND THE INTERACTIONS AMONG THEM. THE CENTER IS COMMITTED TO PROVIDING OBJECTIVE SCIENTIFIC INFORMATION FOR RESTORATION AND SUSTAINABLE USE OF THE LAKE TAHOE BASIN.

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TERC Deploys Autonomous Underwater Vehicle

TERC will begin an experiment this August when we will deploy an autonomous underwater vehicle (AUV) in Lake Tahoe. The AUV, known as Gavia, resembles a torpedo but is equipped with a broad suite of scientific instruments. These include high resolution cameras, side scan sonar, fluorometers for detecting algal chlorophyll and dissolved organic material, water temperature and conductivity, and water current velocity. The Gavia is programmed ahead of time to tell it what course to follow, what depth to dive to and how far off the bottom to cruise.

The Gavia will be used as part of TERC's study of aquatic invasive species in the lake. The Gavia will perform a complete circumnavigation of the lake at a depth of about 18 feet. This is the depth at which the heaviest concentrations of Asian clams have been found to date. Along the way it will take high resolution images of the lake bottom twice every second, as well as measuring other

water quality parameters. The images will be analyzed the same day, and help rapidly guide researchers to find new areas of the lake that are impacted by invasive clams. To date clams have only been detected in the south-east corner of Lake Tahoe. The Gavia will also help map areas of the lake that are being impacted by a new

filamentous green algae.

The Gavia project is being conducted in collaboration with the University of British Columbia. It is funded by both California and Nevada state agencies, and is part of a concerted effort by researchers from both UC Davis and UNR to meet the challenges being posed to Lake Tahoe by invasive species.



Autonomous underwater vehicle (AUV), known as Gavia, resembles a torpedo but is equipped with a broad suite of scientific instruments

BRANT ALLEN

LETTER FROM THE DIRECTOR

Summer Research Underway

Summer at Lake Tahoe brings with it the chance to enjoy many of the wonderful attractions and activities that make the lake an international destination. It also brings to the fore many of the challenges that TERC research is presently addressing. Not least among these is the threat posed by aquatic invasive species.

Last year TERC researchers discovered extensive beds of Asian clams in some of the shallow embayments of the lake. With funding from state and federal agencies, TERC scientists have been leading the efforts to learn more about these newest invaders and design methods to control them in Lake Tahoe. The threat posed by these fingernail sized invaders is dire. Aside from covering the sandy shallows with their discarded shells, they act as a stimulant for the growth of bright green filamentous algae within yards of the lake's shore. They may also help facilitate the

establishment of other invasive species, one of the key research themes being explored in our labs.

This summer has also brought with it additional challenges as TERC tries to weather the impacts of the financial crises faced by both the state and the university. With invasive species, lake warming and the ever present threats to lake clarity demanding the input of the best available science, the resources to achieve all this are being spread very thin.

My personal thanks and sincere appreciation go out to all the TERC staff, students, interns and volunteer docents who continue to do all that is needed under increasingly trying conditions and the imminent imposition of work furloughs.



Geoffrey Schladow, Ph.D., Director Tahoe Environmental Research Center



Researchers investigate extensive beds of Asian clams in Lake Tahoe

RESEARCH

Fatty Acid Research

Often when we speak of 'fats' it is with a certain hostility: we are avoiding them, reducing them, burning them. An entire industry has risen to help us fight our perpetual war with fat. But scientists at the UC Davis Tahoe Environmental Research Center (TERC) are interested in what fatty acids (part of a fat molecule) tell us about the health of our lake. They are studying fatty acids from the plants and animals of Lake Tahoe in the hopes that it will help them better understand this complex ecosystem.

The gas chromatograph has the appearance of a white magician's box, and what it accomplishes doesn't do much to dismiss the notion. A small glass vial containing fats (or fatty acids) is placed into the machine. The chromatograph gingerly sucks up one millionth of a liter from the vial and pushes it through a pinhole-wide tube over a length of 30 feet. Each of the fatty acids in the sample (there are dozens of different types depending on their length and the type of chemical bonds they have) are separated based on size and charge. Each fatty

acid has its own piece of real estate in the tube. Using helium the chromatograph then pushes the fatty acids out, one by one, into a small flame. The smallest fatty acids will travel fastest through the tube and reach the flame first. The degree to which the flame rises allows the machine to determine how much of each fatty acid there is. The more that is burned, the more you had in the first place. From the printer emerges a two-foot long scroll with a silhouette of sharp peaks stretched across the horizon of the page. Each peak represents a single fatty acid. The taller and wider the peak, the more of that particular fatty acid was present in your sample.

Scientists have found that each phylum of algae (such as blue-green algae or diatoms) have a specific fatty acid fingerprint. The result is a unique silhouette of peaks as recognizable as the Tetons. These patterns of fatty acids are seen not only in the plants that produce them but also in the animals that eat those plants and in the animals that in turn eat other animals. Using this information scientists at TERC are studying what



Anne Liston utilizes the gas chromatograph to measure fatty acids and study the transfer of nutrients through the food web

different lake species eat and how energy moves through this ever-changing ecosystem.

Healthy Fats, Healthy Fish

Energy travels up the food chain from plants up to the most successful predators. Energy from the sun is absorbed by algae in the lake and used to create sugars, fats and proteins, the process we know as photosynthesis. Sugars and fats are used, in part, as fuels that fire the engines of reproduction and growth. When zooplankton, tiny animals drifting along in the lake, eat the algae then that energy and the particular fatty acid signature in the algae is transferred to the zooplankton. If the zooplankton are eating algae that are high in omega-3 fatty acids, then they seem to have a better

chance of survival.

TERC chemist Anne Liston has been perfecting the methods we use to study fatty acids.

"It used to be a question of 'how much carbon is being consumed?', but not the quality of the food. Omega-3 is a measure of the quality of the food (consumed by zooplankton). Omega-3 consumption correlates with faster, bigger, and better reproductive success in zooplankton."

Omega-3 containing algae are the health-food of the aquatic world.

It turns out that in lake systems high in omega-3 producing algae, the movement of energy in the system is more efficient. Although there may be less food (algae) at the bottom of the food

RESEARCH

Fatty Acid Research, Continued

chain, the food that is available is very nutritious and quickly makes its way to the top predators: fish. In lakes that have low omega-3 fatty acid levels, there seems to be

an overabundance of algae and few fish. This is akin to having unlimited access to Twinkies, but nothing else. Sure you'll stay full, but the lack of nutrition will prevent you from ever

building that addition to your house, getting a promotion, or raising kids. The same appears to be true in our lakes. By studying the fatty acids in Lake Tahoe, scientists

will be able to compare the quality of food here to that found in other lakes around the world and to follow subtle changes in the lake's ecosystem.

EDUCATION AND OUTREACH

Science Expo a Huge Success

On February 26 and 27, UC Davis TERC, Sierra Nevada College and Lake Tahoe School partnered once again to host one of our most exciting events, the Science Expo, held in the Tahoe Center for Environmental Sciences. Now in its fourth year, the Science Expo offered countless hands-on activities, experiments, and demonstrations, all free to the public. The Expo, part of the North Lake Tahoe Snow Festival, centered on the theme of "Snow, Water, Ice and Earth." Students and families moved between areas devoted to the four themes, participating in interactive exhibits such as:

- How does climate change affect the Earth?
- Earth's seasons and weather
- Snow-survival skills
- Science of water

- Liquid nitrogen and dry-ice demonstrations
- 3-D visualizations of Lake Tahoe and plate tectonics

This year approximately 540 students and 150 adults attended the Expo, with 70 individuals graciously donating their time as volunteers. Amongst that group were over a dozen boys from the Rite of Passage program for at-risk youth volunteering at the Expo. It was really encouraging to see these boys, many of whom couldn't think of even one science-related memory from childhood, learning about topics from glacial movement to static electricity, and then in turn teaching young kids. They also helped just with their presence—they showed the younger students that even high-schoolers can get into science and have fun with it. It was a great chance for the Rite of Passage students to be good role models. Said Brad

DeBoe of RoP, "It's so much better actually doing activities and teaching kids yourself. It's more interesting and you learn a lot."

There were numerous community organizations contributing their expertise to the activities as well, including the American Red Cross, Tahoe Rim Trail Association, Great Basin Outdoors School, IVGID, Tahoe Resource Conservation District, Sierra Watershed Education Partnerships, Tahoe Baikal Institute, and Taylor Creek Visitor Center. The Parasol Tahoe Community Foundation also supported the event with grant funding.

The Science Expo was truly a collaborative effort,



Students remove a snow core to learn about snow

and it continues to garner enthusiasm because of the passion and contributions of so many people in the Lake Tahoe community. Not to mention that it offers a unique opportunity for kids and adults to learn about important environmental science concepts while having fun—from crawling into a snow cave to seeing dry ice bubble in water. We hope to see you at the Science Expo next year (March 10 - 12, 2010)!

EDUCATION AND OUTREACH

Video Upgrades & Thematic Field Trips

The video exhibits in the Thomas J. Long Foundation Education Center were recently upgraded to allow for separate showing of the six different video segments and to provide English or Spanish captioning for the hearing impaired or English-language learners. These changes will also facilitate introduction of our new thematic education programs for school groups visiting the education center.

Student field trips will

now feature five different thematic units directly tied to state science standards:

1. Water on Earth
2. Plate Tectonics
3. Shaping Earth's Surface
4. Ecology
5. The Lake Tahoe System

Teachers will choose one of these themes and two corresponding activities for their field trip. The information the students receive during their field trip correlates with state science standards and because the information



Youth Science Institute participants conducting experiment in Biology Lab

is all interrelated, it will be easier for the students to understand it and remember. We have also added new pre- and post-visit activity suggestions for teachers related to each theme. Thematic programs will also encourage

multiple visits, since each visit will be different. If you are interested in learning more about student field trips, please contact Heather Segale, education and outreach coordinator, (775) 881-7562.

Upcoming Events

TERC will be hosting the tenth annual **Children's Environmental Science Day** on Aug. 7, 11 a.m. - 2 p.m., at the Tahoe Center for Environmental Sciences. This free community event is aimed at children 8 and up and will offer unique hands-on activities designed to create an awareness of environmental sciences.

Monthly lectures are held throughout the year, see <http://terc.ucdavis.edu> for the TERC calendar of events.

World Water Issues Film Festival presented by UC Davis TERC and Sierra

Nevada College:

- Sept. 30—**Flow** (www.flowthefilm.com): Irena Salina's award-winning documentary investigating what experts label the most important political and environmental issue of the 21st century—the World Water Crisis.
- Oct. 14—**Blue Gold: World Water Wars** (www.bluegold-worldwaterwars.com): The rampant overdevelopment of agriculture, housing and industry increase the demands for fresh water well beyond the finite supply, resulting in the desertification of the earth.

- Oct. 28—**Poisoned Waters** (www.pbs.org/wgbh/pages/frontline/poisonedwaters/): A far-reaching investigation into America's great waterways that are in peril. A new wave of pollution is killing fish, causing mutations in frogs, and threatening human health.
- Nov. 11—**Student Association for International Water Issues Presentation & Panel Discussion** (www.unr.nevada.edu/~saiwi/): The Student Association for International Water Issues (SAIWI) is a student organization at UNR, working to develop an understanding

of global water issues and promote community empowerment through education.

Jan. - May, 2010—**Youth Science Institute**: A 15-week afterschool program for high school students to work with scientists, conduct experiments, take a ride on the UC Davis research vessel and much more.

March 10-12, 2010—**Science Expo** (see page 4)

March 16-17, 2010—**Tahoe Basin Science Conference**

June 12 - 16, 2010—**Great Lakes of the World (GLOW) Conference VI**

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The Friends of Tahoe group provides funding to supplement research, education and engagement activities of the Tahoe Environmental Research

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Center and promote understanding and conservation of the natural resources of the Lake Tahoe Basin and other lake systems.

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