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UCDAVIS 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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RESEARCH UPDATES

Research Efforts to Control Invasive Species

Aquatic invasive species from around the world continue to threaten the Lake Tahoe basin. Work to identify the most effective mechanisms for controlling the populations of Asian clams continues. Current projects are focused on controlling the spread of the Asian clam population in Emerald Bay. Researchers are working collaboratively to experiment with different methods of eradication.

Research is also being done in the southern part of the lake on Curlyleaf pondweed. Curlyleaf pondweed is an invasive aquatic weed that is increasing in density in Lake Tahoe. It reproduces via vegetative shoots called turions, which are extremely resilient and hard to kill. Researchers are working on identifying possible means for controlling the spread and reproduction of this invasive species using bottom barriers of several materials (jute, rubber, and polyethylene). Three sets of these barriers are currently out in Lake Tahoe.

Laser optical plankton counter deployment during PARASOL experiment in August 2011 (see Page 7)

Post-doctoral researcher Allison Gamble is also studying the effects of Mysis shrimp on Tahoe's food web. Mysis were deliberately introduced into Lake Tahoe in the 1960s. Mysis are a big predator on smaller zooplankton, and also an important food source for fish. They undertake a diel (within 24-hours) vertical migration every night, where they migrate from the bottom of the lake to close to the surface, one of the longest vertical migrations in nature. If we scaled the Mysis to the size of a human, it would be equivalent to moving 50 miles (or 1700 laps of a pool) vertically up and back down in a single night. Allison is comparing the historical densities of Mysis shrimp to current densities in Lake Tahoe, Emerald Bay, Fallen Leaf Lake, and Donner Lake, and addressing how ecosystem characteristics influence food web dynamics. Her research will provide new insights into the evolving Tahoe food web.

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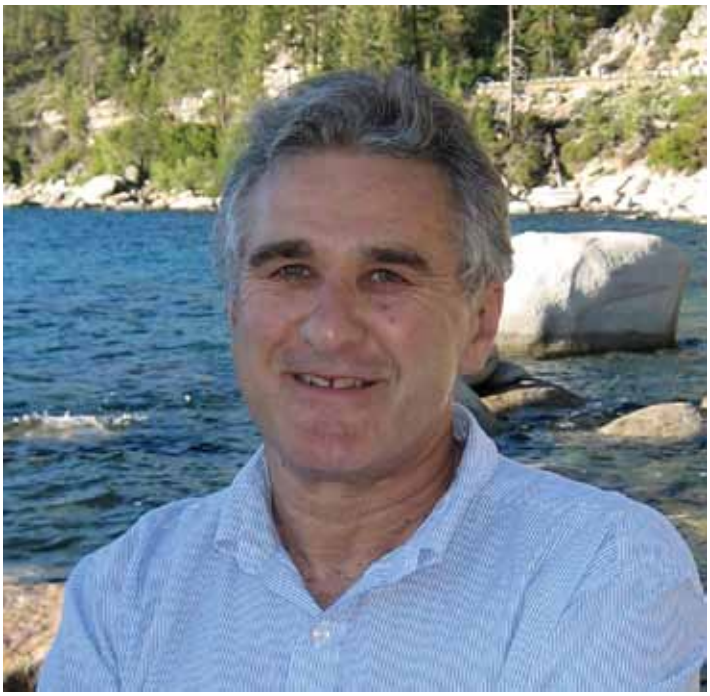
LETTER FROM THE DIRECTOR



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

Scientists at TERC have just submitted what will be the final set of research proposals under the Southern Nevada Public Lands Management Act, better known as SNPLMA. For the last ten years these funds, approximately $3.5 million per year, were available on a competitive basis to fund research that was deemed both scientifically rigorous and important to the efforts to restore Lake Tahoe. Over the years, TERC and its collaborators have been able to write proposals that received substantial funding from these SNPLMA funds. The results of that funding has led to the development of a range of products including tools for modeling lake clarity and quantifying pollutant inputs from urban areas, a better understanding of nearshore water quality using remotely sensed data, and the impact of the Angora fire on the lake. Many other projects are still underway, and will be completed in the next two years. Many of the actions that will be undertaken at Tahoe in the coming years will be based on the findings of this research.

What happens in the coming years, as conditions change and new questions and new threats to Lake Tahoe arise? That is difficult to know. Traditional science funding, from sources such as the National Science Foundation, is usually targeted at generalized questions. If the research is addressing a Tahoe-specific question, NSF will expect local entities to fund it. Locally, however, funding for most everything is in short supply, and likely to remain so for some time to come. Private and philanthropic funding has always been an important part of TERC's budget, and our hope is that this will remain strong.

Research divers Rietta Hohman and Katie Webb use spectral imaging camera to photograph pondweed substrate

My concern, as we use the science conducted to date to guide the restoration of Lake Tahoe, is that we stay mindful of the fact that our knowledge is always incomplete. What seems in 2011 as the best strategy may in time be found wanting. We will only know this if monitoring and focused research is continued, and ways to conduct that in affordable ways are found. The other essential ingredient is the willingness of management agencies to continue to work with scientists to assess progress and, if necessary, to adapt the strategies. In more robust economic times, this is how things happened and how progress was made. The challenge is to ensure that it continues to happen.

As 2011 draws to a close, I want to thank all those who helped us with the many things we were able to accomplish this year. This ranges from our incredibly dedicated staff, our volunteer docents, the many students and interns that work through TERC, our partners in other research institutes and in the numerous Tahoe agencies, those who visit our education centers, and those of you who have helped fund our research and education programs. I wish you all a safe and peaceful holiday season, and look forward to seeing you in 2012.

EDUCATION AND OUTREACH

Education Center Visitor Numbers Continue to Grow

Keeping track of who visits the Thomas J. Long Foundation Education Center in Incline Village and the Eriksson Education Center in Tahoe City is an important part of what we do. The data shows that each year the number of visitors grows by more than 10 percent. Part of this is due to the ever-improving range of exhibits and programs, and part is due to better promotion and word-of-mouth. Our 2011 total education contacts are already over 8,000 for the year, indicating that our face-to-face contacts and impacts continue to expand.

Lake Tahoe in Depth Wins 3D Movie Award

The 3D movie "Lake Tahoe in Depth" won the "Best of the Fest" Award at the 2011 3D Film Festival in Los Angeles! Come see the cutting-edge technology that earned this prestigious award at the Thomas J. Long Foundation Education Center in Incline Village during regular operating hours Tuesday through Friday from 1-5pm.

Visitor Exit Survey Now on New Touch Screen

The next time you visit the Thomas J. Long Foundation Education Center, please check out the touch screen exhibit on the back wall of the Education Center

"Lake Tahoe in Depth" won Best of the Fest at the 3D Film Festival

located between the boat and the Otellini 3D Visualization Lab. It is now a fully interactive computer where visitors can complete the visitor exit survey, enter their email address to receive TERC news and updates and play the educational "Clarity Challenge" game.

Youth Sciences Institute

TERC is gearing up for its annual Youth Sciences Institute program for 20 high school students in grades 9, 10 or 11. This amazing opportunity allows students considering pursuing science and

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UPCOMING EVENTS

January 5, 2012: Family Science Day (2 – 5 pm) bring the family to explore winter science activities!

February 23, 2012: Transportation Sustainability (6 – 7 pm) with Dan Sperling, Director UC Davis Institute of Transportation Studies and Tom Turrentine, Director UC Davis Plug-in Hybrid Electric Vehicle Research Center

March 14, 2012: Science Expo (3 – 6 pm) for families with a focus on Life Science. School groups will attend the Science Expo March 12, 13, 14 and 15.

March 22, 2012: Climate Change Lecture (6 – 7 pm) with Howie Spero, Director of the UC Davis Stable Isotope Laboratory

April 11, 2012: Biophotonics (6:30 – 7:30 pm) with Marco Molinaro of the UC Davis Center for Biophotonics Science and Technology

May 22–24, 2012: Tahoe Science Conference – Environmental Restoration in a Changing Climate

August 11, 2012: Annual Children's Environmental Science Day

Families are invited to the Science Expo on March 14

EDUCATION AND OUTREACH

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technology careers to explore various scientific fields with hands-on activities and research with scientists. The program is held on Wednesdays from 4-6 pm starting January 25 and lasting through May. Applications for this exclusive program are due December 16 and can be found on the TERC website or by contacting Andrea Wilkins at alwilkins@ucdavis.edu or 775-881-7560, ext. 7474.

Greening the Garden

The native plant demonstration garden at the UC Davis Tahoe City Field Station was in full bloom this year. With the extra wet year, the relatively new garden was thriving, but so were the weeds. Katie Merrill, SNAP AmeriCorps member, organized eight volunteer work days to remove invasive species such as bull thistle and pepperweed, and to plant native species such as Mountain pride penstemon, Creeping snowberry, Jacob's Ladder, Mountain Blue flax, and more Large-leaved lupine. This was also the first summer that TERC, in collaboration with the Tahoe Resource Conservation District, hosted the Green Thumb Gardening Series. Throughout July and August local gardeners gathered at the Field Station to listen to speakers talking about everything from backyard forestry to habitat gardening to composting.

We are looking forward to continuing this series and are excited to see how the garden will change and grow next year.


DALE HORCHNER

Participants at the Green Thumb Gardening Series learn about native plants


HEATHER SEGALE

Youth Sciences Institute (YSI) participants learn about fish with fisheries biologist Brant Allen. Applications for YSI 2012 are due in December 2011.

Lectures Available Online

TERC is now recording many of the evening lectures and will make these available on UCTV online at http://seminars.uctv.tv/Host.aspx?hostID=27.

2011 SPECIAL EVENTS

Children's Environmental Science Day: Over 500 people attended the 12th annual Children's Environmental Science Day in 2011. The event was a great success with 40 hands-on science activities and many partnering organizations.

World Lakes Student Conference: Hosted by Professor Emeritus Charles Goldman, the Third World Lakes Student Conference hosted ten international students studying lakes around the world along with some of the world's premier limnology professors and researchers. All convened to discuss the state of lakes worldwide and the future direction for inland water monitoring and data processing.

Ignite… Museums as a Catalyst for Sustainability: Lake Tahoe was one of seven sites around California to host the California Association of Museums' Green Museums Initiative Regional Roundtables to engage museum, environmental, and community leaders in a dialogue to explore how museums can inform, educate, and inspire their audiences about the impact of environmental change.

Haunted Hatchery and Chamber Mixer: Bat conservationist Corky Quirk of Nor Cal Bats showcased live bats and cleared up some myths and mysteries for a Masters of the Night bat lecture.

FEATURED STAFF: ALLISON GAMBLE

Allison Gamble TERC's Newest Post-Doctoral Researcher

Allison Gamble, TERC's new post-doctoral researcher in the area of aquatic ecology, came to work with us in July from Lake Superior in Duluth, Minnesota where she obtained her Ph.D. in Water Resources Science from the University of Minnesota. She traveled around the world conducting research before landing in beautiful Lake Tahoe, including spending five months in Costa Rica studying coral reef fish, working in Alaska, Minnesota, California, and gaining a Master's Degree in Fisheries and Aquatic Science in New York at Cornell University. Allison is currently working on several projects here at TERC involving studies on Asian clams, Curlyleaf pondweed, and on the zooplankton *Mysis diluviana*.

Allison Gamble conducting nighttime Mysis research

Research diver Brant Allen collects pore water samples from under the Curlyleaf pondweed bottom barrier

The Asian Clam work is a continuation of work started by the previous ecology post-doctoral researcher, Marion Wittmann.

GEORGE MALYJ RECEIVES UC DAVIS CITATION FOR EXCELLENCE AWARD


George Malyj, TERC Program Manager, at the Golden State Star Party near Mount Shasta

George Malyj, TERC Program Manager, received the 2011 Citation for Excellence Award from the UC Davis Staff Assembly. George has been in the Department of Environmental Science and Policy for 34 years, during which time he facilitated research and education at Lake Tahoe through the Tahoe Research Group and now the Tahoe Environmental Research Center. He is an indispensible part of the program, including functioning as the administrative liaison between TERC and literally dozens of agencies and other research institutions.

With his vast knowledge of 'all things UC Davis' and his limitless patience and kindness, he has helped countless students, staff and faculty navigate their way through the maze of administration. George graduated from UC Davis with a B.S. in biochemistry.

Congratulations George!

PATTY ARNESON, TERC'S "POINT PERSON"

TERC collects thousands of data points each week. These require entry and retrieval, data quality checking, as well as processing into meaningful quantities and graphic presentation. Since 1979, Patty Arneson has been the Tahoe "point person" who does all this and more. Patty graduated from UC Davis with an M.S. degree in limnology with Charles Goldman. As well as serving as data manager, Patty oversees part of our algal lab measurements, and produces all the graphics for the Lake Tahoe State of the Lake Report. Patty's role within TERC is truly critical to the scientific efforts at Lake Tahoe.

Patty Arneson, TERC's "Point Person"

PRITCHARD AWARD

Geoff Schladow, Bill Fleenor and Laura Doyle received the Donald W. Pritchard Award.

Authors Stephen Monismith, James Hench, Derek Fong, Nicholas Nidzieko, Bill Fleenor, Laura Doyle and Geoff Schladow were awarded the Donald W. Pritchard Award for Estuaries and Coasts Geophysics Paper, "Thermal variability in a tidal river". The Pritchard Award recognizes the author(s) of the best physical oceanography paper published in Estuaries and Coasts within a two-year interval. The paper came from a collaborative project between UC Davis and Stanford University in the Sacramento-San Joaquin delta. Schladow was the Principal Investigator.

STAFF AND VISITORS: COMINGS AND GOINGS

Thank You Leanne Burns and Katie Merrill

As 2011 comes to a close, TERC bids a fond farewell to our amazing SNAP AmeriCorps members – Leanne Burns and Katie Merrill. Over the past year, each of them has contributed substantially to the education and outreach programs and brought science to life for our Tahoe residents and students through field trips and events. Thank you for your year of service with AmeriCorps and TERC. Leanne Burns will stay on a part-time basis to help with the National Science Foundation Informal Science Education grant in 2012.

Education Program Team AmeriCorps members Andrea Wilkins (2011-2012), Leanne Burns (2010-2011) and Katie Merrill (2011)

Welcome Andrea Wilkins

Our new Parasol Americorps member, Andrea Wilkins, began her year of service in September 2011. Andrea is originally from Maryland and has studied environmental sciences, psychology and biology. She will be coordinating, promoting, and interviewing students for the 2012 Youth Sciences Institute. Welcome Andrea.

TERC Visiting Researchers

TERC had a great many visitors during 2011, all of whom played a role in enriching the work we do. They included Jack Kelly and Peder Yurista (EPA); Warwick Vincent and Shohei Watanabe (Laval University); Sasha Tozzi and Irina Ilikchyan (UC Santa Cruz); Andrea Hoyer, Juanfran Reinoso and Carlos Leon (University of Granada); Anastasia Myadzelets (Russian Academy of Sciences); and Yosuke Yamashiki, Masato Kato, Masaki Azuma, and Pedro Chaffe (University of Kyoto).

RESEARCH, CONTINUED FROM PAGE 1

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PARASOL: Scientists Collaborate From Around the World on Experiment

During August, the lake was buzzing with scientists from around the world at Tahoe for a week-long research project called "PARASOL" (PARticulates And SOlutes in Lakes). Scientists and students from TERC, the EPA National Health and Environmental Effects Research Laboratory in Duluth, and the University of Kyoto completed a circumnavigation of the lake, taking measurements of all the physical properties and the suspended particles and organisms that comprise the lake's ecosystems. These measurements will allow us to know how the nearshore water quality changes around the lake. In addition, the team devoted extra effort to studying conditions in Marla Bay and Emerald Bay. The work was exhausting, often starting before 6 am, and usually ending well after dark. Many thanks to those wonderful TERC supporters who allowed us to moor our research vessels at their private docks around the lake, saving valuable time and gas. Also many thanks to the great team of TERC staff, interns and volunteers who helped with the logistics of moving hundreds of samples from lake to lab, ferrying people and equipment and keeping everybody well-fed all week. The data from this project is still being analyzed at Tahoe, Davis, DRI, Duluth and Kyoto.

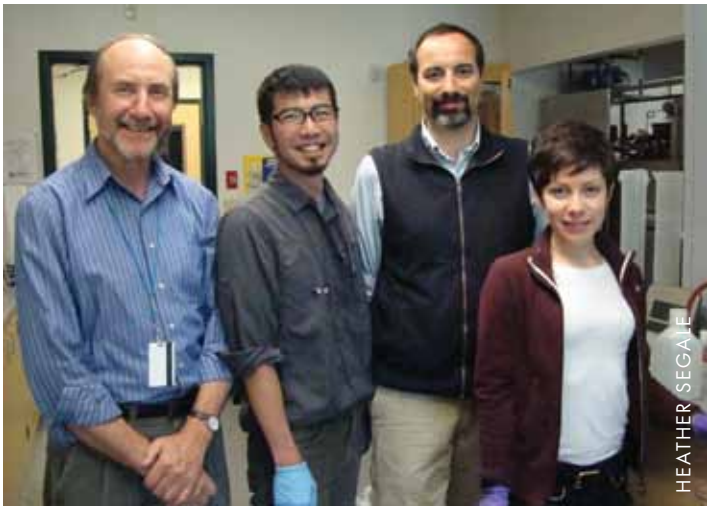
Scientists from around the world participate in the PARASOL experiment

Microbial Plankton Survey

Three weeks following PARASOL, a new group of collaborators filled TERC's laboratories to conduct a preliminary survey of the microbial plankton of Lake Tahoe. This time the visitors were from Laval University in Quebec, and UC Santa Cruz. Most of what lives in Lake Tahoe is invisible, and it has only been in the last few years that tools such as flow cytometry and DNA sequencing have allowed us to see this hidden world and learn about how it is impacting the features of the lake that we do see. The results of this experiment are being used as the basis of new proposals to the National Science Foundation.

Input of Sediment

TERC post-doctoral researcher Alexander Forrest and graduate student Paul Stumpner deployed a current-measuring instrument in Lake Ohau in New Zealand in November 2011. This collaborative project with Dr. Richard Levy of GNS Science will provide information on the input of sediment to this glacial lake. What we have learned at Lake Tahoe is being applied in many parts of the world. Conversely, what we learn in New Zealand will help us to better understand Lake Tahoe.



Microbial research with Warwick Vincent and Shohei Watanabe (Laval University, Quebec) and Sasha Tozzi and Irina Ilikchyan (UC Santa Cruz)

Paul Stumpner and Alexander Forrest study sediment input on Lake Ohau, New Zealand

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☐ **YES**, I wish to support the Tahoe Environmental Research Center with the gift amount shown below.

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