St. Croix Watershed Research Station

Highlights of 2009 -2010

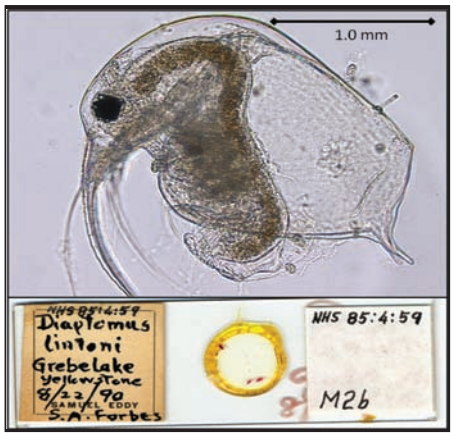
EPA Honors Research and Education with 2009 Gulf Guardian Award

The Research Station and the Science Museum of Minnesota were recently awarded a prestigious *Gulf Guardian Award* by the Environmental Protection Agency's Gulf of Mexico Program, recognizing both environmental research and educational efforts focused on the Mississippi River. The Minnesota Pollution Control Agency made the nomination to honor two efforts: the Station's innovative research on long-term changes in water quality in the upper Mississippi River, and the Science Museum's local and national outreach about that research and other water conservation and environmental stewardship issues. "We're very pleased to be recognized by the EPA," says Station Director, Dan Engstrom. "We know that the research at our facility in Minnesota has far-reaching effects – down the length of the Mississippi River and worldwide. We're grateful that the EPA has acknowledged the importance of our research, and we're honored to be given this award for work that happens nearly 2,300 miles from the Gulf of Mexico."

Photo: Dan accepted the Gulf Guardian Award for the Science Museum in Biloxi, Mississippi. L to r: Dr. Harold Leggett, Secretary of the Louisiana Department of Environmental Quality , Dr. Jane Watson, Associate Director, Water Quality Protection Division, U.S. EPA Region 6 in Dallas, Dr. Dan Engstrom, and Bryon Griffith, Director, Gulf of Mexico Program, US EPA

Deep Thoughts About Shallow Lakes

Joy Ramstack, Mark Edlund, and Research Associate Will Hobbs have begun a three-year research project, funded by the National Science Foundation, to explore the ecology and history of shallow Minnesota lakes. Shallow lake ecosystems function differently than deep lakes in that they tend to exist in, and can switch between, one of two semi-stable, ecological states – either a turbid, algal-dominated condition, or a clear-water state with abundant aquatic plants ("weeds"). Researchers hope to find out what triggers the change from one state to another, collect sediment cores to learn when and how frequently state changes have occurred over the past hundred years, and determine if there are differences in the amount of carbon buried in lake sediments in the turbid- vs. clear-water states. Understanding the drivers of state changes in these lakes, as well as how the lakes have responded over time to changes in their watersheds, will be extremely useful to lake managers and the environmental research community. This work is a collaboration with researchers at the University of St. Thomas and the University of Minnesota. Undergraduate students from St. Thomas will conduct independent research projects at the Research Station within the larger study.



What Lurks Beneath: Studying the Smallest Aquatic Animals

Almost all freshwater systems contain zooplankton, a diverse group of microscopic organisms. They include three groups of animals: crustaceans (pictured here), rotifers (named for wheel-like mouthparts), and single-celled organisms like amoebae. Zooplankton are important in aquatic systems because they link 'bottom-up' processes like nutrient inputs to 'top-down' processes like changes in fish or aquatic plants. Toben Lafrancois, a Research Associate at the Station, is working on several projects involving these organisms. He is studying zooplankton from Minnesota lakes and rivers to assess eutrophication. In an exciting new field of research, zooplankton are being identified in sediment cores, supplementing diatom-based reconstructions of past lake conditions. Toben is also collaborating with the Mountain Studies Institute, the Natural Resources Ecology Laboratory, and others to answer questions about high elevation lakes using zooplankton as indicators of change. The Station has a valuable set of zooplankton samples taken in the 1890s by the great U.S. limnologist, Stephen A. Forbes (bottom picture). These historically important slides represent unique biological samples of western mountain lakes (including those in Yellowstone National Park) before fish introductions and other major environmental changes.

Mercury Concerns at the Agassiz Refuge

The Lake Agassiz National Wildlife Refuge is a wetland and waterfowl oasis in the flat agricultural landscape of far northwestern Minnesota. As part of a long-term management program to control invasive plants and improve waterfowl habitat, the US Fish and Wildlife Service (USFWS) periodically draws down water levels in the wetland pools, drying them out for a year or more. However, water-level fluctuations in lakes and reservoirs are known to increase mercury contamination in fish, principally through changes in sediment chemistry and microbial activity associated with drying and rewetting of bottom sediments. Although well documented in boreal systems, such effects have not been investigated to any extent in prairie regions where underlying hydrochemical conditions are quite different. The USFWS has recently contracted with the St. Croix Research Station for a new study to determine if increased biotic exposure to mercury is an unintended consequence of such hydro-management. The study involves the monitoring of mercury concentrations in sediments, fish, and aquatic invertebrates before and during the pool drawdown and following re-flooding.

Toben Lafrancois sampling aquatic invertebrates from an air-boat at the Agassiz Refuge

Erin Mortenson in the Lead-210 lab

Research Station Dating (not that kind)

Lake sediments and peat cores are widely used to study environmental history, and one of the most important ingredients in such studies is an accurate chronology. For studies of human impacts (for example, pollution, eutrophication, or erosion), which typically focus on the last 100-200 years, the dating method of choice is lead-210. Lead-210 is a naturally occurring radioisotope in the uranium-238 decay-series and is formed in the atmosphere from the radioactive decay of an intermediary, radon-222. The Research Station is recognized internationally for this specialized type of dating, and has lent its expertise to research projects from the far corners of the globe – from the Antarctic peninsula to the spine of the Andes, from tropical Africa to the Asian steppes. The station's labs have analyzed and dated more than 600 sediment cores from 400 lakes involving scientific teams from more than 100 research institutions. Roughly half of those cores are for the Station's own projects, and many of them are from closer to home (190 from Minnesota lakes alone). Lab Technician Erin Mortenson ably manages the day-to-day operations of the Station's core-dating facilities.

Lake Pepin Sediment Redux(ion)

More than a decade has passed since Research Station scientists first probed the bottom of Lake Pepin to help unravel the recent environmental history of the upper Mississippi River. The results of that study are now a critical benchmark for current efforts to reduce soil erosion from our agricultural watersheds and the resulting turbidity that impairs our rivers and imperils Lake Pepin. This natural riverine lake is again the center of attention for graduate student, Dylan Blumentritt (University of Minnesota – Geology), who is trying to figure out where exactly the sediment is coming from and what environmental changes have caused inputs to rise 10-fold over the last 150 years. Dylan is using state-of-science geochemical methods to "fingerprint" how much of the sediment is coming from erosion of agricultural fields vs. river channels and how those different inputs have changed over time. This is a critical question because the answers will determine where in the landscape we can most effectively focus restoration efforts and dollars. Most recently Dylan, along with Station scientists, Shawn Schottler and Dan Engstrom (also Dylan's graduate advisor), collected a new set of sediment cores from Lake Pepin in the exact same locations originally cored in 1996. Preliminary results of this work show that infilling rates have not slackened appreciably and that upwards of a half-meter of new sediment has since accumulated in the upper (and shallow) end of the lake.

Dr. Carrie Jennings (MN Geological Survey), Dylan Blumentritt, Dan Engstrom and Shawn Schottler with sediment core from Lake Pepin