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ASC
Aquatic Sciences Chronicle
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UNIVERSITY OF WISCONSIN SEA GRANT INSTITUTE UNIVERSITY OF WISCONSIN WATER RESOURCES INSTITUTE

INSIDE:

ASC video still/John Karl

WATER RESOURCES RESEARCH

STREAM SEDIMENTS SERVE IMPORTANT ROLE IN ECOLOGICAL BALANCE

Labeling samples. Undergraduate Research Assistant Ashley Winker (l) and UW–Oshkosh Professor of Biology and Microbiology Bob Stelzer are investigating the role that deep stream sediments play in removing nitrogen from the environment.

The Green Revolution—not the kind that celebrates Earth Day, solar panels and recycling but the one related to food production—has used various technologies to meet the world's nutritional needs by growing more food per acre. The use of nitrogen fertilizer is one tool that has allowed for increased food production. Crops need nitrogen to make their own food, but since they can't take it directly from the air, nitrogen fertilizer, often in the form of anhydrous ammonia, is added to enrich the soil and maximize yields. Adding more fertilizer than crops need to grow results in surface and groundwater contamination.

Worldwide, there is more available nitrogen in our environment than ever before because of fertilizers and burning of fossil fuels, according to Bob Stelzer, associate professor of biology at UW–Oshkosh. Stelzer is interested in the overall balance of the many forms of nitrogen in the environment.

Too much nitrogen in our lakes and streams can lead to excessive plant growth, degraded recreational experiences and fish kills. The

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Aquatic Sciences Chronicle

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The Aquatic Sciences Center is the administrative home of the **University of Wisconsin Sea Grant Institute** & the **University of Wisconsin Water Resources Institute.**

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FEATURED SEA GRANT STUDENT

Geography Prof to Call Wisconsin Home, Again

It's full circle around for former Sea Grant student, Rob Roth, who graduated from UW–Madison with bachelors and masters degrees in cartography and geographic information systems. Roth returns to the department of geography this fall as an assistant professor.

Roth credits Sea Grant with providing him with exposure to the field of geovisualization of complex problems, including coastal erosion issues. As a research assistant of Sea Grant's GIS specialist David Hart, Roth explained, "I was presented with increasingly complex problems and was given equally increasing freedom to identify novel solutions, an approach I appreciated as a fledgling researcher." He went on to earn a Ph.D. in Geography from Penn State University, a place recognized as the leading academic institution worldwide on cartographic visualization.

"Robert's publication record as a doctoral student has been exemplary, and he has developed many innovative interactive mapping and analysis tools," said Hart.

programpeoplenews

Moy Named Assistant Director for Research

Phil Moy is the new assistant director for research for the Aquatic Sciences Center (ASC). In this role, Moy will assist in monitoring the progress of Wisconsin Sea Grant's 42 currently funded research projects and the Water Resources Institute's nine; identify new areas for research, incorporating those into strategic plans; and oversee the activities of the Sea Grant marine advisory services staff.

Moy holds a Ph.D. in zoology-fisheries from Southern Illinois University and has been on the Wisconsin Sea Grant staff for 12 years, serving as the marine advisory specialist on fisheries and aquatic invasive species.

He also served as acting director for outreach and research twice—while the then-director of research had been on leave to work in the NOAA National Sea Grant Office and since February of this year.

"My time here has been very rewarding, and I look forward to applying my experience to the challenges offered by the assistant director position," Moy said. He noted that the program has opportunities to chart new directions, particularly since two longtime Sea Grant outreach specialists retired in June. "This will catalyze us to determine some possible new focus areas for our outreach efforts," he said.

Change aside, some things remain stable, Moy said. "We look forward to continuing our good working relationships with Great Lakes and Sea Grant partners, and reaching out to constituency groups—existing and new."

Moy is also committed to the ongoing productive collaborations with state agencies, the departments of Natural Resources, Health Services and Agriculture, Trade and Consumer Protection; academic communities; resource managers; and water professionals in the private sector.

"This is an important position for ASC. Phil's accepted offer to lead our research grant-making program that funds Wisconsin's premier aquatic scientists, and our team who shares that science, is good news," said Anders Andren, Wisconsin Sea Grant director.

Top: Submitted photo, bottom: Carolyn Betz/ASC

Lubner Retires From UW Sea Grant

After Three-Plus Decades of Service

Jim Lubner served for 33 years as an outreach specialist and education coordinator.

Top to Bottom: Bob Rashid, Sturgeon Bowl, Jim Lubner

When Jim Lubner arrived for his first day with Wisconsin Sea Grant, he had no idea he'd be spending the rest of his career with the organization.

The year was 1978, and he was the first employee at the program's new Milwaukee field office, located in the building that now houses the modernized UW–Milwaukee School of Freshwater Sciences.

And by "office," we mean a half-height cubicle partition in the middle of a former loading dock.

"UW Sea Grant would not be the organization it is today without Jim Lubner's critical contributions," said Director Anders Andren. "It's very hard to imagine it without him."

Right after he got the job, Lubner told one of his advisors at UW–Milwaukee about the Sea Grant gig. The response? "Well, that's okay… until a real job comes along. "

"I had more hope for it than that," deadpanned Lubner.

It didn't take long for his hope to be rewarded. Lubner began taking advantage of small professional connections that ended up making a big difference.

In his first year, Lubner worked with the U.S. Coast Guard Auxiliary to implement a boating safety curriculum in the greater Milwaukee area. In the 1980s, he and the U.S. Coast Guard Marine Safety Office in Milwaukee created easy-to-understand guidance on the regulations for charter boat operators and implemented a voluntary Coast Guard inspection program for their vessels.

Later, Lubner landed a spot on the Milwaukee County Local Emergency Planning Committee. He noticed that many of the city's industries had nothing in place to prevent toxic materials from flowing through the storm sewers directly into Milwaukee's lakes in the event of a chemical spill.

"Today, we don't even need to ask the question," said Lubner of the safety covers that are now routinely provided for the drains. "Sometimes, these little things end up having a big influence."

Lubner is grateful for UW Sea Grant's support over the years. "The key to Sea Grant has always been about people and connections," Lubner said. "We've had less rigidity and a lot of support over the years."

In another of his proudest accomplishments, Lubner became a mentor for the Marshfield High School National Ocean Sciences Bowl (NOSB) team that made history by winning NOAA's science contest three years in a row.

Lubner holds adjunct academic status with the UW-Milwaukee School of Freshwater Sciences and plans to remain involved with the annual Lake Sturgeon Bowl, the regional competition that feeds into NOSB. And, of course, spend some time camping, hiking and traveling with his wife, Linda.

"I've had so many opportunities to travel to interesting places, lakes and oceans and to work with so many amazing people," reflected Lubner. "It's been an absolutely wonderful career." —ARC

Harris Retires From UW Sea Grant

After 37-year career working to preserve and improve the environment in Wisconsin

Vicky Harris devoted her career to protecting and restoring the environment of Green Bay.

Vicky Harris has always loved Lake Michigan. She remembers boating the stagnant and befouled waters of the Fox River with her family, wearing rubber gloves her mother made the children wear to keep them from touching the slime molds and bacteria on the lock walls.

When she retired in June, she ended a 37-year career devoted to protecting and restoring the environment in and around Green Bay. Those who worked with her know her as a tireless dynamo, a coalition-builder routinely steering multiple projects at once. Last year, the Nature Conservancy honored Harris and her longtime collaborator, former UW Sea Grant sub-programmer and husband, Bud Harris, with a lifetime achievement award.

"Vicky is a part of that select group that works tirelessly and effectively to preserve and improve the environment in Wisconsin," said Anders Andren, UW Sea Grant director. "She made it her personal and lifelong mission, and her tireless work ethic is a genuine inspiration to all of us."

Harris became UW Sea Grant's first Green Bay-based water quality and habitat specialist early in her career. Although she only stayed for two years, two of her earliest projects were crucial to her future—working with scientists and stakeholders to develop the first-ever ecosystem research and outreach strategy for Green Bay and an ecosystem rehabilitation plan for the bay. Later she would use this experience to coordinate the Green Bay and Fox River Remedial Action Plan (RAP) for the Wisconsin Department of Natural Resources (WDNR).

"We were the first of 43 RAPs in the Great Lakes to be approved by the International Joint Commission," said Harris. "We created a series of technical and stakeholder committees, and we engaged a lot of people. The RAP was a launching pad for the largest PCB cleanup in U.S. history. "

When Harris returned to Wisconsin Sea Grant in 1999, she brought with her the process of public engagement she'd used throughout her career, including a decade of assistance to the port of Green Bay on plans to restore Green Bay's Cat Island Chain.

She also chaired an outreach team to involve the public in a total maximum daily load project for the Fox River, a WDNR plan to curtail phosphorous and suspended solids levels in the waters where she'd boated as a child.

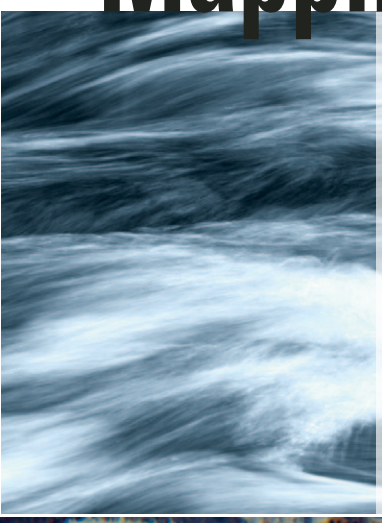
More recently, Harris, working in conjunction with the Wisconsin Marina Association, has spearheaded Wisconsin's Clean Marina program, a statewide effort designed to promote environmentally responsible boating and marina management practices. In the first year and a half, a whopping 28 marinas have joined the program and 11 were certified as clean marinas by adopting the program-required practices.

Don't expect Harris to disappear from Green Bay's environmental scene.

"I enjoy working with people who care about the future of our planet and our environment," said Harris. "I don't expect I'll ever give it up." —ARC

Top to bottom: Bob Rashid; Mike Heine, UW-Green Bay; Bob Rashid

Mapping the Nearshore Food Web



UW Sea Grant-funded researchers are plotting out who's eating whom near the shores of Lake Michigan.

Gathering samples. Research Assistant Erin Wilcox (above right) deploys a plankton net in Lake Michigan. The work is helping scientists chart the complex changes that have recently occurred in the nearshore food web. One of the many organisms involved is the invasive round goby (above).

An environmental food web is an intricate, organic and delicate thing. Eliminate a strand here or introduce a new one there, and the entire structure can collapse.

That's why researchers have paid such close attention to the food webs in Lake Michigan, where the appearance of several aquatic invasive species has threatened to upset the natural balance.

Harvey Bootsma and John Janssen, Wisconsin Sea Grant-funded professors at UW–Milwaukee's School of Freshwater Sciences, have their sights on the waters close to shore.

"A lot of our work has focused on what role round gobies may be playing," Bootsma said. "Up until now, the near shore has been neglected. From what we're seeing, there are some unique things going on. We've had a lot of changes in the last five years."

He's referring to a massive influx of round gobies, one of several aquatic invasive species that have set up shop in Lake Michigan's waters. In the case of the goby, the impact seems tied to strength of numbers. In short—they're legion. And they eat copiously.

"When we dive to do our research, there are at least a hundred swimming around us, watching us work," said Bootsma. "Numerically, they're clearly dominant in the nearshore zone."

Bootsma and Janssen are performing their research in conjunction with similar research teams in Indiana and Illinois, to see if conditions in one state are being replicated in others.

Existing research suggests that one of the round goby's preferred entrees is the quagga mussel, which is not the first case of one aquatic invasive species noshing on another.

However, Bootsma and Jansen's research is revealing that round gobies don't actually feed on quagga mussels until they grow larger—between two to four inches long. By conducting a chemical analysis of stable isotopes and fatty acids found in the gobies' body tissue, they're able to determine what the gobies are really eating.

"The mussels are actually a side dish," said Bootsma. "Most gobies, and especially the younger ones, are actually subsisting on other types of food."

Those other types include oligochaetes and chironomids, tiny benthic organisms that live in the Cladophora algae that have come to clog the shallow shorelines of Lake Michigan.

The question then becomes whether the round gobies' trips to the invertebrates section of the Cladophora buffet are, in effect, swiping sustenance from other nearshore fish, including yellow perch and spot-tail shiner. It's also unclear whether other Lake Michigan species like trout and salmon may be able to use the plentiful gobies as a food source to replace offshore food web components that have been affected by other invaders.

"We know that lake trout and brown trout are eating lots of round gobies," says Janssen. "But we also know that more pelagic species, like Chinooks, cohos and steelhead are not."

After spending months analyzing data collected from hundreds of samples, Bootsma and Janssen (as well as the research teams in Indiana and Illinois) are ready to head back out onto Lake Michigan and begin examining other sites.

"We're interested in learning if the patterns around Milwaukee County are typical of the whole lake," explained Bootsma.

If they are, their work could help to determine how the carrying capacity of Lake Michigan may have changed, which would affect decisions related to fish stocking and nutrient management. Stay tuned. —ARC

Watch video at **aqua.wisc.edu/chronicle**.

Top to bottom: video still, John Karl, ASC; Michigan Sea Grant

Mercury!

Mercury is a naturally occurring element—Hg on the periodic table, atomic number 80—found in air, water and soil. It exists in several forms: elemental or metallic mercury, inorganic mercury compounds and organic mercury compounds. In addition to listening to the Water Resources Institute's podcasts about mercury, pull up a chair and read some of these titles, available from the Water Library.

ECOSYSTEM RESPONSES TO MERCURY CONTAMINATION

By Reed Harris, David P. Krabbenhoft, et al., eds.Boca Raton, Fla.: CRC Press: 2007.
The editors outline the infrastructure and methods needed to measure, monitor and regulate the concentration of mercury present in the environment. They propose a set of indicators to use as a measure of changing mercury concentrations in air, water, soil and aquatic life.

IMPORTANCE OF GROUNDWATER IN PRODUCTION AND TRANSPORT OF METHYLMERCURY IN LAKE SUPERIOR TRIBUTARIES

By R. W. Stoor. Madison: University of Wisconsin Water Resources Institute: 2002.
This study looked at the spatial and temporal patterns in mercury (Hg) and methylmercury concentrations in groundwaters and hyporheic zone waters at two contrasting sites and examined relationships to and covers biogeochemical conditions and local hydrology.

MERCURY FATE AND TRANSPORT IN THE GLOBAL ATMOSPHERE: EMISSIONS, MEASUREMENTS AND MODELS

By Nicola Pirrone, ed. New York: Springer: 2009.
This book highlights major issues related to the interactions of mercury with terrestrial and aquatic ecosystems, and evaluates the relative contribution of anthropogenic and natural sources to the global atmospheric mercury budget.

MERCURY SPECIATION ALONG A GROUNDWATER FLOWPATH

By David E. Armstrong, Christopher L. Babiarz, et al. Madison: University of Wisconsin, Water Resources Institute: 2006.
An investigation designed to provide information on the importance of hyporheic zones as a site for MeHg formation and transport into surface waters. The report also details the forms of inorganic Hg(II) and MeHg in the hyporheic zones, and examines the influence of speciation on both Hg(II) bioavailability for methylation, and MeHg transport into surface waters and food webs.

Anyone in Wisconsin can borrow these books.
Just e-mail *askwater@aqua.wisc.edu.*

Left to Right: Podcast cover image showing nesting loon, in the iTunes store. Trevor Schott collects dissolved organic carbon (DOC) samples on the Sheboygan River. Levels of methylmercury, the form of mercury that bioaccumulates in the food chain, tend to correlate with DOC.

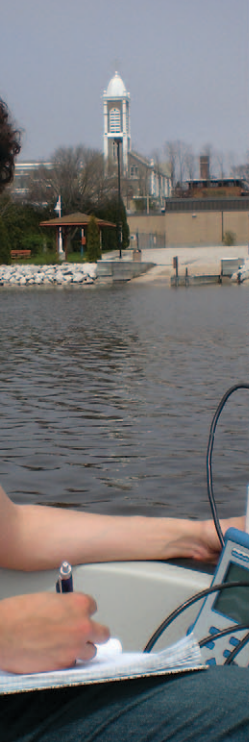
Wisconsin Leads in Mercury Research at Halifax Conference

The Tenth International Conference on Mercury as a Global Pollutant was held in Halifax, Nova Scotia, in July. Previous conferences were held in Sweden, Canada, Germany, Brazil, Japan, Slovenia, China and Madison, Wisconsin, in 2006. The four organizers of the Wisconsin conference were among the more than 1,000 experts to attend the Halifax meeting.

Some of the world's top mercury researchers are based in Wisconsin. They have worked with public health and resource management agencies to set the standards in the collection, measurement, analysis and evaluation of mercury in water, air, sediments, fish, wildlife and people.

The Great Lakes region was the subject of a special session at the Halifax conference because of its significant in the understanding of mercury as a worldwide pollutant. The region is particularly vulnerable to mercury contamination because of the granite bedrock, thin acidic soils, abundant wetlands and lakes with low nutrient concentrations.

The Madison Declaration on Mercury Pollution, passed at the Wisconsin conference, summarizes the scientific and technical conclusions of the international experts on environmental mercury pollution. It continues to serve as the scientific foundation for U.S. policy-making on mercury reduction. The 2006 conference was co-hosted and sponsored by Wisconsin Sea Grant.



Measuring Mercury in Lake Michigan Tributaries

It's been 15 years since the EPA initiated the Lake Michigan Mass Balance Study to measure concentrations of mercury, PCBs and other pollutants in the air, water, sediments and food webs of Lake Michigan. Christopher Babiarz is using Sea Grant funding to monitor how mercury has changed in four Wisconsin tributaries. Babiarz is an assistant scientist in UW-Madison's Environmental Chemistry and Technology Program.

Eleven tributaries in the Lake Michigan watershed were included in the original study. One of them, the Fox River, was the single largest contributor of mercury to Lake Michigan, supplying almost as much mercury as the other 10 tributaries combined, according to the study results published in 2004. The new research project, which includes the Fox River, focuses on the form of mercury that is found in the suspended particulate matter.

"High flow rates during the spring melt can stir up bottom sediments and transport the associated mercury to the coastal zones of Lake Michigan," said Babiarz. "Most fish live in these relatively warmer and shallower waters, and most of the annual mercury loading occurs during the spawning season."

A demonstration dredging project on the Fox River, reduced industrial uses and lower emission standards have been implemented since the original mass balance study was conducted. Those reductions could be reflected in today's mercury concentrations in the tributaries.

"This project will provide an interim benchmark before caps on mercury are completely met," said Babiarz.

Reductions are being phased in over time, and additional cleanup projects have begun on all four of Wisconsin's tributaries through the Great Lakes Restoration Initiative.

Reduction of mercury is a worldwide goal for improving public health.

Podcast Series Lets You Take Mercury With You Wherever You Go

The many sides of mercury are the focus of a seven-part audio podcast series—easily downloadable and free—from the Water Resources Institute. The series looks at mankind's long relationship with the only metal that exists in liquid form at room temperature. Also covered is Wisconsin research on how mercury moves through the environment and the effect it has on the living things it touches.

Download "Water, Wisconsin and the Mercury Cycle," by visiting the WRI pressroom *wri.wisc.edu* and finding the link to iTunesU. Funding for the production was provided by the U.S. Geological Survey.

Loon photo—Michele P. Woodford; Trevor Schott photo—Christopher Babiarz

Three-Peat for Wisconsin High School Students in National Ocean Competition

Marshfield is virtually dead center in Wisconsin and just about in the middle of the continental U.S. Despite being hundreds of miles from saltwater, the city produces some pretty briny kids.

That fact was again apparent at the spring 2011 National Ocean Sciences Bowl in Galveston, Texas, where the Marshfield High School team captured the national crown for the third year in a row. The five youngsters bested 25 other schools, many in sea-coastal states. The team lost only one match during the two-day event.

Wisconsin Sea Grant provides financial and personnel support for the Lake Sturgeon Bowl, which has taken place for nine years. That state competition is the qualifying arena for the national competition. It is held in February in Milwaukee.

After the victory, Wisconsin Sea Grant's Education Coordinator Jim Lubner said, "I was extremely proud of how these fine young people, from both finalist teams, conducted themselves. Every time I attend one of these competitions I am reminded of how bright our future will be if these young people are able to realize their potential as leaders in a diversity of fields."

First prize for the winning team includes a week-long trip to Puerto Rico this summer, with a visit to the El Junque rain forest, nighttime kayaking on a bioluminescent lagoon and a variety of other activities.

1st Place Team

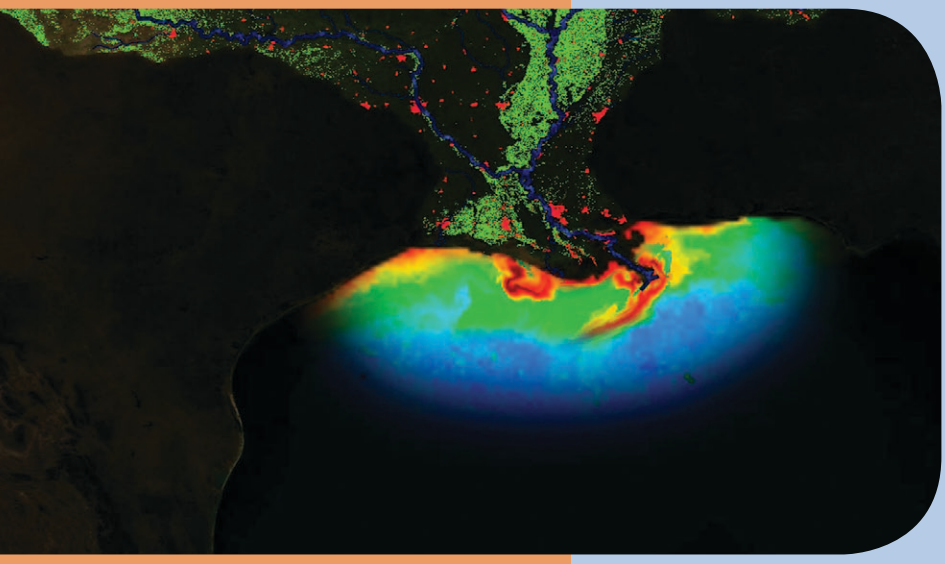
Marshfield High School

Marshfield, Wis.

National Ocean Sciences Bowl—Will Ramos, Consortium for Ocean Leadership; ASC video stills/John Karl

STREAM SEDIMENTS

continued from page 1



Dead zone. Nutrients such as nitrogen and phosphorus run off agricultural and urban areas and eventually flow down the Mississippi River. Ultimately, this creates massive dead zones in the Gulf of Mexico. Forty-one percent of the continental U.S. drains through the Mississippi River.

cumulative effects of excess nitrates moving downstream from the Corn Belt have created a "dead zone" in the Gulf of Mexico.

"Can the rate of removal of nitrates keep up with the supply of nitrogen fertilizers?" asks Stelzer. "Right now, supply is winning, and the excess is ending up in our drinking water and in our coastal ecosystems."

Excess nitrates in our drinking water can pose serious human health threats by compromising the ability of blood to carry oxygen, potentially leading to serious health complications. This is particularly dangerous for infants and young children. Excessive nitrate consumption has been linked to increased risks for certain cancers. In Wisconsin, an estimated 9 percent of the state's private wells exceed the safe drinking water standard for nitrates. This problem affects every county in the state and costs millions of dollars to correct. More than 70 percent of the state relies on groundwater for all uses, including drinking water, agricultural, manufacturing and industrial uses.

In a research project funded by the Water Resources Institute, Stelzer is examining the ability of bacteria in sediments below the stream surface to convert nitrates, a form available to plants, into atmospheric nitrogen, which plants cannot use to grow. It is a location where denitrification can occur and has not been previously well studied.

Nutrients can be carried from groundwater to surface water since the groundwater flows from under the stream bed into the surface water. Stelzer has installed a series of wells and specialized groundwater samplers in eight streams in the Waupaca River watershed, one of the hotspots of Wisconsin's excess nitrates. This allows him to create a vertical nitrate profile for each sample location, yielding better understanding about how nitrate behaves in the groundwater beneath the stream.

Preliminary results show that while denitrification rates are higher in the shallower sediments, the deeper sediments are responsible for a large portion of denitrification overall. The denitrification and nitrate profile results suggest that nitrate retention removal is widespread in deep stream sediments, particularly in watersheds with high groundwater nitrate concentrations.

Wetlands, rivers, sediments and wet soils are all places where nitrates are converted back to atmospheric nitrogen that can help balance the overall ecosystem. If a river ecosystem is degraded, such as being channelized and lined with concrete, groundwater and surface water are less likely to interact, and nitrate removal will be reduced.

"It's very important that ecosystems remain as natural and healthy as possible so that removal of excess nitrates and nutrients can take place," Stelzer said. —CRB

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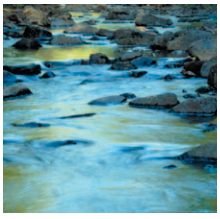
a joint newsletter from UW Sea Grant and UW Water Resources



CALENDAR OF EVENTS

OCT. 9–12, 2011

The Geological Society of America Annual Meeting
Minneapolis
geosociety.org/meetings/2011/

OCT. 10–14, 2011

Joint meetings of Great Lakes Commission, International Joint Commission and Healing Our Waters®—Great Lakes Coalition
Detroit
meeting.ijc.org

NOV. 2–4, 2011

Wisconsin Association for Floodplain, Stormwater and Coastal Management Conference
Waukesha, Wis.
wi.floods.org/annual_conference.htm

NOV. 3–5, 2011

Wisconsin Association of Environmental Educators Fall Conference
Rosholt, Wis.
uwsp.edu/cnr/waee/events/fall.aspx

HISTORICAL MAP POSTERS

In 1841, Congress created the Lake Survey within the U.S. Army Topographic Engineers, which later became part of the U.S. Army Corps of Engineers, and charged it with preparing nautical charts and other navigation aids for the Great Lakes. Four of these Great Lakes navigational maps (created from 1853 to 1876) are available for $8 each online at *aqua.wisc.edu/publications*.

The entire 76-map collection can be viewed online at *greatlakesmaps.org* or at the American Geographical Society Library, University of Wisconsin–Milwaukee (*uwm.edu/libraries/AGSL*).