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ASC
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UNIVERSITY OF WISCONSIN SEA GRANT INSTITUTE UNIVERSITY OF WISCONSIN WATER RESOURCES INSTITUTE

INSIDE:

UW WATER RESOURCES RESEARCH

Getting a Grasp on Groundwater

STUDY ASKS HOW AND HOW MUCH WISCONSINITES ARE PUMPING

Non-municipal wells can account for a large — and largely unreported — percentage of groundwater use in the state, according to a recently completed study funded by the Water Resources Institute.

If water were money, Wisconsin would be rich. But even water-rich states need to manage their wealth.

According to Madeline Gotkowitz, that means not just focusing on water quality, but on water quantity as well.

"We don't really know how much water we use," said Gotkowitz, a hydrogeologist at the Wisconsin Geological and Natural History Survey who recently completed a research project that took a closer look at how—and how much—groundwater is used in two Wisconsin counties.

Until recently, only municipalities have been required to report their water usage. That means the state has not known how much water non-municipal wells have been pumping. But state legislation that went into effect last fall will allow the DNR to keep track of how much water is being pumped by non-municipal high-capacity well users such as farms, industries, and businesses. And research like Gotkowitz's can help provide the details.

"The whole idea behind recording the pumping is to answer the questions: who's using it? Where in Wisconsin are they using it? And how much are they using?" said Larry Lynch, a hydrogeologist at the Wisconsin DNR. "We're also tracking for what purpose the water is being used," he said.

continued on page 5 >>

Aquatic Sciences Chronicle

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FEATURED WEB SITE

Great Lakes Maps

www.GreatLakesMaps.org

UW Sea Grant launched a new Web site in response to the popularity of last spring's exhibit of rare maps at the University of Wisconsin–Madison Memorial Library Department of Special Collections. *Making Maps, Mapping History* traced the evolution of mapmaking since the 1600s and the historical influence of the Great Lakes on the history of Wisconsin. The Great Lakes Maps Web site hosts an online version of the exhibit, including audio tours and high-resolution digital maps with zoom-in features.

The site will also host a digital collection of the U.S. Lake Survey maps. The Survey, created in 1841 by Congress, was charged with conducting a hydrographical survey of the Northern and Northwestern Lakes and preparing and publishing nautical charts and other navigation aids.

"The U.S. Lake Survey published 76 maps of the Great Lakes from 1852 to 1882," said ASC librarian Anne Moser. "No public institution has all of these rare historical documents. Putting them online is probably the only way that anyone will ever be able to see them all together," she said.

All 76 U.S. Lake Survey maps will be available online by Fall 2008, according to Tom Dellinger, ASC Web Developer. He added that since launching the Great Lakes Maps site last fall, at least 500 visitors have viewed it each month.

UW Sea Grant and its Wisconsin's Water Library partnered on these projects with UW–Milwaukee American Geographical Society (AGS) Library, UW–Madison Space Science and Engineering Center, UW-Madison Memorial Library Department of Special Collections, UW-System Digital Collections Center and the Wisconsin Historical Society Library and Archives. — KS

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Anne Moser

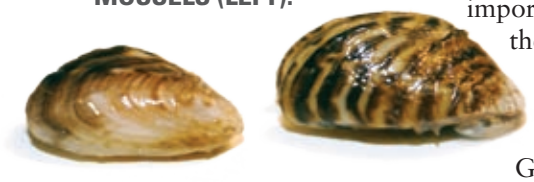
The Aquatic Sciences Center is pleased to welcome Anne Moser and Carolyn Betz.

As ASC librarian, **Anne Moser** replaces JoAnn Savoy, who retired last year. For the past four years, Moser has managed and maintained the Web site for the Wisconsin Water Science Center of the USGS. Previously, she worked for the UW-Madison School of Library and Information Services and ran the special library of the award-winning Local Hazardous Waste Management Program for the Seattle regional area.

SEA GRANT OUTREACH

Quagga Mussels Outpace Zebras as Invader

ZEBRA MUSSELS (RIGHT) ARE RAPIDLY BEING REPLACED IN THE GREAT LAKES BY QUAGGA MUSSELS (LEFT).



QUAGGA MUSSELS MAY HAVE A MORE DETRIMENTAL IMPACT ON THE ECOSYSTEM DUE TO THEIR ADAPTIVE NATURE.

Photos by Dave Brenner, Michigan Sea Grant

It is unusual to find a zebra mussel in Lake Michigan today. This is not a happy ending to the story of the invasive species' takeover of the lake, but rather a surprise twist. The quagga mussel (*Dreissena bugensis*), a cousin to the zebra (*Dreisssena polymorpha*), has rapidly become the dominant mussel species today.

While the two mussels are similar in many respects, it is important to differentiate between them because the quagga may have greater impacts on the Great Lakes environment. Zebra and quagga mussels are both natives of the Caspian and Black Seas brought to the Great Lakes in the ballast water of ocean-going ships. They are both thumbnail-size, hinged mussels with zebra-like stripes. However, the quagga is easily outcompeting its cousin because it can adapt more readily to the Great Lakes environment.

The zebra must attach to hard surfaces in relatively warm water, which has made it the most common in near-shore areas. In contrast, the quagga mussel can thrive on any surface except mud and prefers silt and sand. Quaggas can also tolerate both colder and warmer water temperatures, can spawn in colder water, feed year around, and are found at depths of 300 feet and greater.

Phil Moy, Fisheries and Invasive Species Specialist with the University of Wisconsin Sea Grant Institute, says because the quagga mussel can thrive in colder, deeper waters, we need to get a handle on it as quickly as possible so that it does not dominate Lake Superior waters, a place where zebras do not thrive.

"The $64,000 question is why the quaggas have taken over so quickly," says Moy. He thinks it may be because zebra mussels have paved the way for the new invaders by making the waters clearer and providing the opportunity for quaggas to thrive. — CB

QUAGGA MUSSELS IMPACT

Zebras and quaggas alike are continuing to plague water utilities and other industries, clogging pipes in layers up to eight inches thick. However, quagga mussels may have a greater impact on food web dynamics in the Great Lakes. Quaggas may be the reason Diporea, a small shrimp-like species that serves as a food source for larger fish, is no longer abundant. The whitefish that feed on this amphipod are growing to less than half of their expected size and are showing changes in tissue and fatty acid composition. Algal outbreaks associated with the improved water clarity from the mussel invaders make recreational uses of the lakes less attractive to the public.

Despite these challenges, Moy feels optimistic that the quagga's invasion of Wisconsin's inland lakes can be controlled. The public must take seriously the importance of "clean boating" measures such as draining all water from bilges, ballast, live wells, bait buckets and other containers to avoid carrying unwanted invasives from lake to lake.

Carolyn Betz

Carolyn Betz joins us as a new science writer. Betz will be assuming some of the former duties of John Karl, who has begun producing videos and exhibits about ASC research. Betz first launched her career as a Sea Grant fellow assisting the U.S. House of Representatives Committee on Science and Technology with hearings related to water and agricultural issues. For the past 23 years, she has worked in the Bureau of Watershed Management of the Wisconsin Department of Natural Resources where she specialized in lake management and nonpoint source pollution control efforts.

Hearty congratulations go out to **Jim Lubner** for recently marking 30 years of employment with the Wisconsin Sea Grant Program. As Sea Grant Education Coordinator and Water Safety Specialist, Lubner works from an office at Milwaukee's Great Lakes WATER Institute and holds adjunct appointments in UW–Milwaukee's Geosciences Department and Department of Curriculum and Instruction. In addition to receiving his PhD in biological sciences from UW-Milwaukee, he is a former middle school teacher who has been involved in informal and teacher education since 1978.

ASC DROPLETS

Lake Michigan Top Destination for Fishing

Lake Michigan was the most popular place to fish during 2006–2007, according to results of a statewide mail survey of anglers holding Wisconsin fishing licenses.

However, nearly three-quarters of angler's trips were made to waters other than Lake Michigan, Lake Winnebago, the Mississippi River and the Wisconsin River, hinting at the diversity of fishing in a state with 15,081 lakes and 42,000 perennially flowing miles of river.

Anglers spent more than 71 million hours on Wisconsin waters, and although walleye was their most targeted species, they caught more panfish than anything else. In total, 88.2 million fish were caught in Wisconsin during the 2006–07 license year, and anglers released nearly two thirds.

New Project to Address Climate Change Impacts on Wisconsin

A new statewide project will assess the potential consequences of climate change for Wisconsin's ecosystems, industries, farms and human health and will recommend adaptation strategies.

The Wisconsin Initiative on Climate Change Impacts (WICCI) will organize teams of experts from the University of Wisconsin-Madison, state agencies and other institutions to consider how local and regional shifts in temperature, precipitation and extreme weather could affect key components of the state's quality of life. For more information, visit *www.wicci.wisc.edu*.

Great Lakes Waterfowl Threatened by Botulism

Thousands of waterbirds have died from type E botulism around the Great Lakes, and researchers say invasive species might be to blame.

It appears that quagga and zebra mussels filter out the botulism toxin from nearby mats of decaying *Cladophora* algae and then they're eaten by fish such as the invasive and highly abundant round goby. The infected gobies, which become paralyzed by the toxin, are then easy prey for flocks of migrating, fish-eating waterbirds, such as common loons, red-necked grebes, and long-tailed ducks. For more information, visit Michigan Sea Grant at *www.miseagrant.umich.edu/habitat/avian.html*.

Getting a Grasp on Groundwater

continued from page 1

Gotkowitz said that better records could help the state improve the way it monitors and manages groundwater.

In her study, Gotkowitz and her colleagues focused on Waukesha County, which is experiencing water shortages due in part to concentrated pumping in highly populated municipalities; and on Sauk County, which has no reported shortage. They compared the status and trends of groundwater use for these counties because they have very different patterns of population and land use.

"I wanted to contrast what happens in a suburban and urban county with one that is primarily rural," said Gotkowitz.

Gotkowitz found that there was plenty of room to improve water use records in the two counties. She and her colleagues had to estimate about 75% of total pumping in Sauk County, and 40% in Waukesha County due to the absence of water use records by non-municipal sources.

"We don't want to have to be estimating that….That's too much. It would be a very small effort to get most of that reported," she said.

Gotkowitz found that while highly residential Waukesha County pumps more water overall, their per capita use is much lower than Sauk County, which is primarily an agricultural county with few people.

In Waukesha County, 45% of total pumping is done for residential use followed by 39% for commercial and industrial uses. Due to the patterns of water use, most of the pumping is concentrated where the municipal wells are located and is causing long-term drops in groundwater levels.

In contrast, 45% of pumping in Sauk County is done for commercial and industrial users followed by 39% for agriculture and irrigation. This pattern of water use means that pumping is spread out across the county and has not had major effects on groundwater levels.

Gotkowitz said that getting a grasp on the status and trends in groundwater use can help Wisconsinites protect environmental resources and can inform future economic development. For example, locating even one high-capacity well too close to a trout stream could ruin the stream by drawing water that would have fed the stream. And when trying to locate a new water-intensive industry, planners and developers could compare water usage and the status of groundwater in different regions of the state.

At the most basic level, Gotkowitz said that how much water we're pumping in Wisconsin is "just good to know. Clearly we're going to want to be able to manage this resource." — Elizabeth Katt-Reinders

NOAA Home to Two UW Water Students

Two UW Sea Grant-sponsored students are among 48 nationwide to be awarded a 2008 Dean John A. Knauss Marine Policy Fellowship.

MaryLee Haughwout and David Bylsma both completed the Water Resources Management Master's degree program in the Gaylord Nelson Institute of Environmental Studies at UW–Madison. The program is known for its year-long, hands-on practicum in which students gain practical experience tackling real-world water resource issues through in-depth study and a professional publication of results. Since February, Haughwout and Bylsma have been putting their training to the test in Washington D.C.

Haughwout is working in the Policy, Planning and Analysis Division at NOAA's National Ocean Service. Her primary roles are staffing the NOAA Ocean Council, assisting in reviewing testimony and developing briefing materials for NOAA Administrators on ocean-related issues, and assisting other staff in the office with various projects. "Every day is a bit different!" she said.

Bylsma works in Special Projects, another division of the National Ocean Service. His main focus is supporting water quality and nutrient working groups of the Gulf of Mexico Alliance, a partnership of Gulf state agencies, universities and federal agencies that protect and improve the marine and coastal resources of the Gulf of Mexico. "I am impressed with the structure and organization of the Alliance and would like to use its model for developing a similar alliance of Great Lakes states one day," said Bylsma.

Sponsored by the National Sea Grant College Program, the Dean John A. Knauss Marine Policy Fellowship provides a unique educational experience to students who have an interest in the national policy decisions affecting ocean, coastal, and Great Lakes resources. The one-year paid fellowship places highly qualified graduate students in positions within the legislative and executive branches of government located in the Washington, D.C., area. For more information, visit *www.seagrant.noaa.gov/knauss/knauss.html*. — KS

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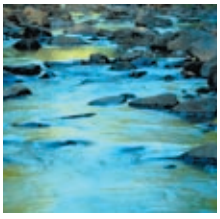

CALENDAR OF EVENTS

APRIL 16–17, 2008

Great Lakes Observing System Annual Meeting
Milwaukee, Wisconsin

www.glos.us

MAY 19–23, 2008

2008 IAGLR Conference on Great Lakes Research
Peterborough, Ontario, Canada

www.iaglr.org

OCTOBER 6–7, 2008

2008 Annual Meeting of the Great Lakes Commission
Quebec City, Quebec, Canada

www.glc.org

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Protecting Wisconsin's Buried Treasure
By Peter Boger
Free download

Groundwater, a critical resource, is monitored and researched by the Groundwater Coordinating Council (GCC) in Wisconsin. This booklet describes some of the council's accomplishments and the challenges it faces. It also includes sources of further information.

A current list of free science journal reprints is available at
www.aqua.wisc.edu/chronicle/reprints