

ASC

Aquatic Sciences Chronicle

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

UW WATER RESOURCES RESEARCH

From Farmland to Suburbia



John Karl

GROUNDWATER AND UNSEWERED SUBDIVISIONS

Across the country, new housing developments are sprawling past city limits – and past city sewerage systems. That’s fueled concern about how dense clusters of septic systems might affect groundwater. Could they contaminate wells used for drinking water? Might those contaminants include pain relievers, antibiotics, and hormones? Will bacteria in drinking water become resistant to antibiotics?

Hard data for answering those questions have been scarce, according to Ken Bradbury, a hydrogeologist at the Wisconsin Geological and Natural History Survey and UW-Extension. But that’s changing with two studies about four miles northeast of Sun Prairie, Wis. They’re both monitoring groundwater before, during, and after 78 acres of farmland are transformed from corn and soybeans to houses, septic systems, and private wells.

In one study, Bradbury, UW geologist Jean Bahr, and graduate student Jeff Wilcox are looking at water quality as the land turns residential. Before housing construction began in 2003, the researchers installed wells for collecting water samples and equipment for monitoring flow rates of surface water, groundwater, and septic system effluent. Wilcox constructed a map of the area’s geology and developed a computer model of groundwater flow that can be adapted to other sites as well.

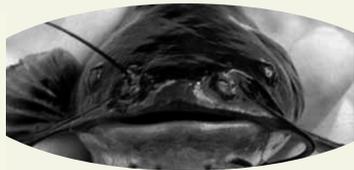
After five houses were built and residents moved in, the team found that overall nitrate concentrations in groundwater had decreased slightly, probably due to decreased agricultural inputs at the site. Septic system effluent contained elevated nitrate and chloride, as well as acetaminophen, a caffeine metabolite, and two hormones. Nine of 10 samples contained estrogenically active compounds. However, no pharmaceuticals or hormones were detected in the groundwater.

These results are preliminary, and it may take five to 10 years of monitoring before the full story can be told, Bradbury said. Wilcox’s computer

Graduate students Jeffrey Wilcox (l) and Trevor Ghylin take water samples from a well in a new, unsewered subdivision.

continued on page 5 >>

2 WHAT’S THAT FISH?

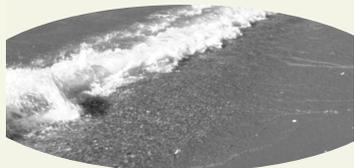


3 WHERE THE WIND BLOWS



4 ENLIGHTENED ENGINEER

4 STATE OF LAKE MICHIGAN AND ITS BEACHES



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University of Wisconsin Water Resources Institute is one of 54 Water Resources Research Institutes nationwide authorized by the federal Water Resources Research Act and administered through the U.S. Geological Survey. www.wri.wisc.edu



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You can receive email notices about new postings to the **Chronicle Online**. Just sign up at www.aqua.wisc.edu/chronicle. We'll send you occasional links to announcements and news from the Aquatic Sciences Center.



A mugshot of a black bullhead highlights its conspicuous barbels.



New faces at the ASC: Tom Dellinger and Jane Conohan.



FEATURED WEB SITE

Wisconsin Fish Identification System

www.wiscfish.org/fishid

This new Web site shows anglers or anyone with an itch for ichthyology how to identify what's dangling at the end of their lines. Users can fish through more than 4,000 photos covering all 162 native Wisconsin species and 12 invasive species that have taken up residence here. The photos show different angles, life stages, and body features—such as the snout shape of a slimy sculpin or the body patterning of a pirate perch. The site also includes a taxonomic key, an illustrated guide to fish anatomy, and an illustrated glossary.

John Lyons, Wisconsin Department of Natural Resources; Paul Hanson, University of Wisconsin Center for Limnology, and Elizabeth White, UW Sea Grant Institute, created and produced the Wisconsin Fishes site, the product of five years and hundreds of slimy photo shoots around the Badger state.

The online system and a downloadable version of its companion CD can be found at www.wiscfish.org. The CD version of the site is also available for purchase at the ASC publications store: www.aqua.wisc.edu/publications.

people news

The ASC welcomes our new Administrative Assistant **Jane Conohan**. Jane comes to the ASC with seven years' experience at UW-Madison. As an avid downhill skier and instructor, Jane's counting on lots of snow this winter.

As if one weren't enough....**Tom Dellinger**, brother of **Rich**, recently joined the ASC's Information Technology team for one year as a Web developer. Tom is enhancing all ASC Web sites and the Interactive Project Reporting Online (iPRO) system. An unsubstantiated rumor alleges that Tom is an excellent tennis player.

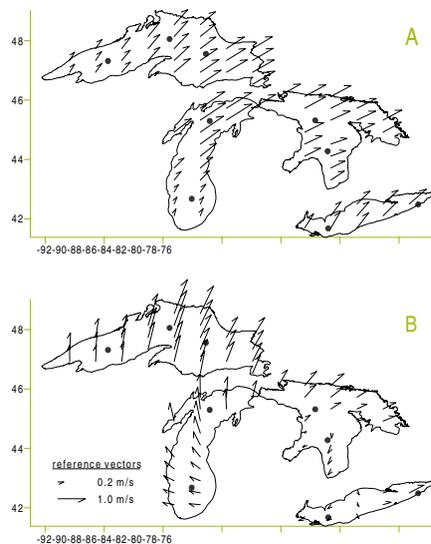
Congratulations to ASC Editor **Elizabeth White**, husband **Eric**, and son **Benjamin** on the Thanksgiving Day birth of their baby girl, **Katherine Rebecca White**. Elizabeth will be taking maternity leave until March.

The UW Sea Grant *Biennial Report 2002-2004* was recognized with an Award of Excellence in the 35th annual design competition of the University and College Designer's Association, held September in San Diego. Congratulations to **Tina Yao**, designer and art director; **Amy Kittleson**, designer; **John Karl** and **Kathleen Schmitt**, writers; **Stephen Wittman**, writer and editor; and American Printing.

UW SEA GRANT RESEARCH

Where the Wind Blows

SHIFTING WINDS COULD BE STIRRING UP GREEN BAY



Average August wind field over the Great Lakes basin in (A) 1981-1985 and (B) 1995-1999. Waples and Klump are examining how this shift in wind direction is affecting sediment accumulation and resuspension in Green Bay.

Waples and Klump are taking cores of the bay's bottom to determine how fast sediments are accumulating, and they're performing other tests to find out how many times sediments resuspend in the water column before they settle down for good. After collecting their final year's worth of data this summer, they'll compare their results to data Klump and colleagues collected in the 1980s as part of another Sea Grant study of sediment resuspension and transport in Green Bay.

The researchers hypothesize that the shift in wind direction is mixing up Green Bay, breaking down the normal summer layers of warm and cold water, and creating a much warmer and more oxygenated bottom habitat. Waples said these changes could dramatically alter the biogeochemistry of the system. Klump added that the shifting winds might also shed light on why total phosphorus levels in lower Green Bay have increased over 20 percent since 1999, while the amounts flowing out of the Fox River have remained relatively stable. —KS

Summer winds blowing across northern Lake Michigan have shifted dramatically over the past 15 years. Researchers supported by UW Sea Grant say the change in the weather might trap tons of sediments and nutrients in Green Bay instead of letting them drift out to the open water of Lake Michigan.

James Waples, a biogeochemist at UW-Milwaukee's Great Lakes WATER Institute, first noticed the shift in wind direction while studying air/water gas exchanges in Green Bay. Trying to solve a discrepancy in annual gas exchange estimates for two particular years, he dove into a database of local hourly wind vectors.

"I noticed that while wind speeds were, on average, the same each year, the average wind direction was quite different," Waples said.

The finding prompted him to pore over more than 20 years of data collected from meteorological buoys throughout the Great Lakes. He found a large-scale shift in summer wind direction over the entire Great Lakes basin, beginning around 1990. Over Green Bay, average summer wind directions changed from southwesterly to easterly.

"This shifting wind field may change the circulation pattern of Green Bay during the summer," said J. Val Klump, director of the Great Lakes WATER Institute and a partner on the current study. He said that in the summer, most of Green Bay separates into layers of warm and cold water. Typical winds blowing along the length of Green Bay usually push warm surface water out to Lake Michigan. At the same time, colder water from the lake moves into the bottom of the bay.

An increase in easterly winds blowing across Green Bay could essentially shut down this "conveyor belt" to Lake Michigan, Klump said. That means instead of traveling out to Lake Michigan, more sediments would remain in Green Bay, which receives roughly 27 dump trucks of it from the Fox River every day.

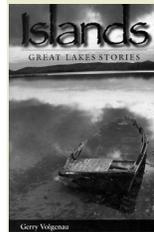
Original figures published in Waples, J.T. and J.V. Klump, (2002), *Biophysical effects of a decadal shift in summer wind direction over the Laurentian Great Lakes*, *Geophys. Res. Lett.*, 29 (8), DOI: 10.1029/2001GL014564.

Bet You Didn't Know!

Any Wisconsin resident can check out these books and others at www.aqua.wisc.edu/waterlibrary.

Did you know . . .

There are 35,000 islands in the Great Lakes?



Islands: Great Lakes' Stories. Gerry Volgenau. Ann Arbor, Michigan: Ann Arbor Media Group, 2005.

Newspaper reporter and travel author Volgenau writes about the fascinating past and present of 20 of those islands. Should you want to visit, all 20 are accessible by ferry or bridge.



The worst Great Lakes storm on record occurred on November 7, 1913?

White Hurricane: A Great Lakes November Gale and America's Deadliest Maritime Disaster. David G. Brown. Camden, Maine: International Marine/McGraw-Hill, 2002.

Personal accounts and contemporary newspaper stories tell the story of the 1913 storm, when 19 ships were lost and 238 sailors died on the Great Lakes.



We still cannot fully explain how snowflakes are formed?

The Snowflake: Winter's Secret Beauty. Text by Kenneth Libbrecht;

photography by Patricia Rasmussen. Stillwater, Minnesota: Voyageur Press, 2003.

Physicist Libbrecht details the creation of snowflakes and photographer Rasmussen provides amazing photographs. You will never look at snowflakes the same way.

Other suggested titles are available at www.aqua.wisc.edu/waterlibrary/books_knowmore.asp.



An Illuminating Industrial Experience

Joshua Koch ended his master's degree program in December on a promising note. Koch earned a civil and environmental engineering degree from UW-Madison, and he describes the small drinking water disinfecting unit he worked on as "promising," if still inefficient.

It currently produces "less than a shot glass" of disinfected water per minute, Koch said.

Koch's challenge was to boost the efficiency of the unit. To do that, he worked with the Sheboygan office of Pentair, a Minnesota-based manufacturer of water filters and other equipment. Koch's work was supported by a Sea Grant Industry Fellowship.

The device is intended to work beneath household sinks or in other point-of-use applications. It uses a process called photocatalysis, in which light is used to initiate chemical reactions. In this design, water is pumped through coils of clear plastic that are partly coated with titanium dioxide (TiO_2). The coils wrap around a tube-shaped ultra-

violet light bulb. Light striking the TiO_2 starts a process that turns some water molecules into hydroxyl radicals, which are more deadly to microorganisms than chlorine or ozone.

The reaction now runs best at low pH levels, and Koch, working with advisors Marc Anderson and Greg Harrington, has been searching for a compound to add to the TiO_2 that will keep it running quickly at pH levels typical of drinking water.

Koch hopes the real-world experience gained through his fellowship will boost the efficiency of landing a good job in environmental engineering.

A bright future: With a Sea Grant Industry Fellowship, Joshua Koch gained real-world engineering experience and a master's degree in civil and environmental engineering.

State of Lake Michigan and its Beaches

About 200 scientists, resource managers, and interested citizens gathered Nov. 2-3 in Green Bay for the joint meetings of the State of Lake Michigan Conference and Great Lakes Beach Association.

Speaking at the opening plenary session, Judy Beck, of the U.S. Environmental Protection Agency Office of the Great Lakes, emphasized the dynamic nature of Lake Michigan. "As we're standing here talking," she said, "that lake out there is changing."

Beck reported that positive and negative changes are happening side by side. Partial clean-up in 10 Areas of Concern has shown that ecosystems do respond positively, Beck said, but mercury, PCBs, and other contaminants remain a problem in many places. Beck urged resource managers and researchers to remain flexible and remember the necessity of adaptive management.

Victoria Harris, UW Sea Grant water quality specialist and conference coordinator, also spoke at the plenary session. Harris noted that 13 of Lake Michigan's 33 watersheds flow through Green Bay, giving the bay great influence on the lake.



Prominent among them, Harris noted, is the "mother of all Areas of Concern," the Fox River, which is the single largest contributor of contaminants to the lake.

A CD of conference presentations is expected to be available in January. Contact Vicky Harris at (920) 465-2795 or harrisv@aquawisc.edu for details.

The conference was sponsored by the Lake Michigan Forum, U.S. Environmental Protection Agency, UW Sea Grant Institute, and Wisconsin Coastal Management Program.

Suburbia continued from page 1

model indicates that the septic plumes could eventually reach some wells. However, Bradbury said the chemistry of those plumes may change substantially by that time. As water travels slowly through soil and rock, the contaminants may be removed by attaching to soil particles or by being broken down by microbes – processes by which septic systems purify effluent. The rates and end-products of these processes are well understood for nitrates and chloride, but not for hormones and other pharmaceuticals, Bradbury said.

More details about the project are available at www.geology.wisc.edu/~hydro/SV.

Another project at the site is looking at whether residential development is causing bacteria in groundwater to become more resistant to antibiotics. That could potentially create a “reservoir of antibiotic resistance” that could reduce the effectiveness of antibiotics for humans, according to Trina McMahon, assistant professor of civil and environmental engineering and lead scientist on the project.

McMahon emphasized that this is only a theoretical possibility at this point, and no one yet knows whether septic systems contribute significantly to antibiotic-resistant bacteria in groundwater.

To find out, McMahon and graduate student Trevor Ghylin are using cutting-edge genetic technology to test groundwater for DNA associated with antibacterial resistance.

Any DNA associated with antimicrobial resistance detected in pre-development groundwater samples must come from other sources, such as naturally occurring resistant bacteria or those in runoff from agricultural lands, McMahon said. However, finding more kinds or amounts of DNA from antibiotic-resistant bacteria after the septic systems are in use would indicate a contribution from the septic systems, McMahon said.

Both studies are funded through the Wisconsin Groundwater Research and Monitoring Program (www.wri.wisc.edu/wgrmp/wgrmp.htm). — JK

UPCOMING FELLOWSHIP APPLICATIONS

Applications for the following fellowships are expected to be due in early 2006: National Marine Fisheries Service-Sea Grant Joint Graduate Fellowship Program in Population Dynamics, National Marine Fisheries Service-Sea Grant Joint Graduate Fellowship Program in Marine

Resource Economics, Dean John A. Knauss Marine Policy Fellowship. For more information, please see <http://seagrant.wisc.edu/funding/FundingInfo/gradopps.asp>.



KNOW YOUR WATER LAB

WISCONSIN STATE LABORATORY OF HYGIENE ENVIRONMENTAL HEALTH DIVISION

www.slh.wisc.edu/ehd

Since 1903, the Wisconsin State Laboratory of Hygiene (WSLH) has helped protect the health of citizens and the environment through research, education, and outreach. The Environmental Health Division, housed in a 76,000-square-foot laboratory on the east side of Madison, specializes in analytical chemistry and environmental biology.

WSLH works closely with other state departments, health care practitioners, and private citizens to monitor waterborne disease outbreaks, test wastewater effluents, ensure safe drinking water, and establish fish consumption advisories. As part of the University of Wisconsin, the laboratory is operated by faculty, academic staff and professional chemists and biologists, and its clinical health division is located on campus.

The WSLH is nationally recognized as one of the top public health laboratories and one of only two in the United States affiliated with a major university.

For more information, please visit www.slh.wisc.edu/ehd or contact William C. Sonzogni, WSLH Environmental Health Division Director, at sonzogni@mail.slh.wisc.edu or (608) 224-6200.

Miel Barman, an advanced environmental toxicologist at the WSLH, reviews the growth of breast cancer cells as part of a UW Water Resources Institute-funded study on endocrine disruptors in groundwater.

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Aquatic Sciences Chronicle

a joint newsletter from UW Sea Grant and UW Water Resources



CALENDAR OF EVENTS

FEBRUARY 2-3

Wisconsin Wetlands Association Annual Wetland Science Forum

Madison, Wis.
www.wiscwetlands.org/2006forum.htm

MARCH 2-3

30th Annual Meeting Wisconsin Section of the American Water Resources Association

Elkhart Lake, Wis.
www.awra.org/state/wisconsin

MARCH 4

Lake Sturgeon Bowl

Milwaukee, Wis.
www.uwm.edu/Dept/GLWI/sturgeonbowl

MAY 22-26

International Association for Great Lakes Research Annual Conference

University of Windsor, Windsor, Ontario
www.iaglr.org/conference/2006

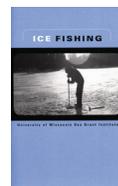
NEW PUBLICATIONS & REPRINTS

Now available at the ASC Publications Store aquatic.wisc.edu/publications/



Best Management Practices for Aquaculture in Wisconsin and the Great Lakes Region

edited by Jeffrey A. Malison,
Christopher F. Hartleb
124 pages, paperback
\$40



Ice Fishing

by Warren Downs, edited by
Elizabeth White
24 pages, illustrated booklet
\$1.50

Spatial Patterns in Assemblage Structures of Pelagic Forage Fish and Zooplankton in Western Lake Superior, Timothy B. Johnson, Michael H. Hoff, Anett S. Trebitz, Charles R. Bronte, Timothy D. Corry, James F. Kitchell, Stephen J. Lozano, Doran M. Mason, Jill V. Scharold, Stephen T. Schram, and Donald R. Schreiner, *Journal of Great Lakes Research*, 30(1):395-406, 2004

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