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All Arsenic Is Local

HIGHLIGHTS **IMPORTANCE OF** WELL

NATER

Probing the ground near Lake Geneva, geologists have found that the geologic and chemical conditions behind arsenic in well water there are **STUDY** distinctly different from those in the Fox River Valley to the north. The finding illustrates the difficulty of predicting arsenic concentrations in new or existing wells, experts say, and it highlights the importance of having well water tested annually.

In the Fox River Valley, arsenic in drinking water has con-**TESTING** cerned people for nearly two decades, according to Madeline Gotkowitz, a hydrogeologist with the Wisconsin Geological and Natural History Survey and an outreach specialist with UW-Extension. Studies in the area have shown that groundwater is most readily accessible in a permeable layer of rock called the St. Peter Sandstone, Gotkowitz said. This aquifer, or water-bearing formation, rises relatively close to the surface in this part of the state, providing a convenient source of water.

However, significant municipal, agricultural, and industrial use of that groundwater has drawn down its level, exposing a thin, fairly welldefined layer of arsenic-bearing sulfide minerals to oxygen. These particular minerals dissolve in the presence of oxygen, releasing the arsenic into the groundwater.

Thus, one solution for well owners in the region is to drill deeper or shallower wells that access water from other aquifers, Gotkowitz said. It may be costly, but it is often practical and effective.

The picture is much different in southeast Wisconsin, and solutions there are more challenging, according to Tara Root, a graduate student working with hydrogeologist Jean Bahr at UW-Madison. For her Ph.D. thesis, Root examined the geochemical conditions behind high levels of arsenic reported near Lake Geneva, in Walworth County.

With support from the UW Water Resources Institute, Root used special drilling methods to collect the first intact core of the area's primary aquifer. It's 300 feet of clay, silt, sand, gravel, and boulders deposited by glaciers tens of thousands of years ago and known as the Quaternary formation. Root also obtained sediment samples from previous drilling efforts in the area, and she had all the samples analyzed to determine their chemical composition.

Root found that arsenic in the Quaternary aquifer is associated not with sulfide minerals, but with iron-hydroxide minerals, and these are dispersed widely throughout continued on page 5 >>



Counties where arsenic levels have exceeded 10 ppb in public or private wells. Adapted from Wisconsin Department of Natural Resources maps.

Aniversity of Wisconsin

Aquatic Sciences Chronicle

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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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FEATURED WEB SITE MEET THE ONLINE CHRONICLE

We invite you to visit the Aquatic Sciences Chronicle Online, the companion Web site to this newsletter. The online *Chronicle* is a one-stop source for the latest news from the Aquatic Sciences Center, the administrative home of UW-Madison's Sea Grant and Water Resources institutes.

Besides providing an archive of stories from this newsletter and PDF versions of past issues, the online Chronicle will provide time-sensitive news and other information that doesn't fit our quarterly printing schedule. Visit the Chronicle Web site to sign up for occasional email updates of online content – we'll let you know when the latest news stories are posted and keep you updated on new developments that occur in the meantime. You can also sign up to receive the print issues of this free newsletter.

And, as always, we welcome your comments. Please send them to *chronicle@aqua.wisc.edu*.

people news

ASC Director Anders Andren was voted presidentelect of the National Institutes for Water Resources at the March 2005 NIWR annual meeting in Washington, D.C. NIWR comprises 54 Water Resources Research Institutes located at land grant universities nationwide.

Wisconsin Sea Grant was well represented among speakers at the May 2005 meeting of the International Association for Great Lakes Research in Ann Arbor, Mich. Coastal Engineering Specialist Gene Clark spoke about closing the gap between what we know and don't know about rip currents, Earthwatch Radio Producer Richard Hoops spoke about using radio and online audio for Great Lakes outreach, and GIS Specialist David Hart spoke about applying geographical information systems to Great Lakes coastal planning and management.

University of Wisconsin

Anders W. Andren

Sign of the Times

TRACING SOURCES OF BEACH-CLOSING CONTAMINANTS MEANS BUSY SUMMER FOR RESEARCHER



As temperatures and humidity climb this summer, many Wisconsin residents will head to Lake Michigan beaches for relief. But instead of running into the water, beachgoers are increasingly running into bright red signs signaling closed beaches and unsafe swimming conditions.

Sandra McLellan is trying to find out why so many of these signs are showing up. With funding from UW Sea Grant, McLellan is searching for the source of contaminants along the Lake Michigan coast, hoping to arm management agencies with better information to clean up beaches.

"This information is really important for the decision makers," says McLellan. "It's very difficult to decide where to put financial resources to improve water quality if you don't know where the pollution is coming from."

Beach managers post closings when the amount of *Escherichia coli* (*E. coli*) in the water exceeds standards recommended by the U.S. Environmental Protection Agency. *E. coli* is a bacterium that causes minimal health risk to swimmers, but in high numbers it can indicate the presence of other dangerous bacteria and viruses that can sicken beachgoers.

Although elevated E. coli numbers can be a good indicator of poor water quality, they tell nothing about the source of the contamination. So researchers in McLellan's lab at the UW-Milwaukee Great Lakes WATER are trying to squeeze out as much information as they can from water samples taken along the coastline.

To find out if pollutants originate from humans, McLellan checks for resistance in *E. coli* to antibiotics, which people use and wild animals don't. Tracing the origins of nonhuman pollutants can be more challenging. Possible sources range from gull droppings in the sand to rainwater that flows to beaches after running off

lawns, farms, streets, or construction sites, picking up animal waste, fertilizer, pesticides, trash, and many other pollutants along the way. To weed through these possibilities, McLellan, a bacterial geneticist, looks for genetic markers in another species of indicator bacteria. Certain types of *Bacteroides* can be linked to fecal matter from specific host animals, such as cows or humans.

The investigative work doesn't end in the laboratory. McLellan routinely heads out to the beaches to confirm her findings. For example, bacteria that appear to be primarily from humans would send her looking for evidence of sewage overflows or faulty sewer pipes, some of which are nearly 100 years old in certain areas of Milwaukee.

McLellan usually isn't alone on these scientific beachcombing trips. Often accompanying her are beach managers, city officials, and others who know the territory.

"That's why I think our research has been really successful to date," McLellan says, "because we're not doing it in a vacuum."

McLellan says one encouraging finding from her research is that poor water quality at beaches doesn't seem to be signaling that Lake Michigan as a whole is experiencing the same level of contamination.

"We've found that most of the *E. coli* we detect in these beach areas usually comes from a very localized source," she says. "That's good news because it means there are management practices that can be put in place to fix some of these



The idea of the "perfect" lawn may be changing from one that is weed-free to one that is free of chemicals and pesticides. To learn more about the history of the American lawn and environmentally friendly alternatives, view our reading list at www.aqua.wisc.edu/waterlibrary/ lawn.asp. Any Wisconsin resident can check out books for free. Some available books are:



The Lawn: A History of an American Obsession. Virginia Scott Jenkins. Washington, D.C.: Smithsonian Institution Press, 1994.

This absorbing chronicle of what many consider to be 20th century America's greatest folly—the lawn—

is also a wake-up call for readers to stop worrying about the Joneses and start focusing on the state of the environment.



Redesigning the American Lawn: A Search for Environmental Harmony. 2nd ed. F. Herbert Bormann, Diana Balmori and Gordon T. Geballe. New Haven: Yale University Press, 2001.

Extremely readable, this book offers strategies for designing and managing lawns to reduce their damage to the environment as well as suggesting alternatives to the conventional lawn.

Ø



Rodale Organic Gardening Basics, Vol. 1: Lawns. Emmaus, Penn.: Rodale Press, 2000.

The editors of Rodale's Organic Gardening have packed this easily read guidebook with helpful in-

formation about creating and maintaining a lush lawn without chemicals.



Spreading Knowledge, Stopping Exotics

Emblazoned on Kellie Thatcher's bright blue T-shirt are the words "Clean Boats, Clean Waters." Thatcher fills in the details of that simple message when she greets people at boat ramps this summer and talks about the importance of keeping boats free of aquatic invasive species.

She and four other college students are working at ramps from Door County to Sheboygan on Lake Michigan and along Wisconsin's Lake Superior coast

They're also inspecting the boats, helping people launch or retrieve them, and handing out brochures, stickers, and walletsized "Watch Cards"

> For his second summer, Paul Skawinski is working as an inspector on Lake Michigan boat ramps, telling people how to keep their boats free of exotic species.

that help identify zebra mussels, round gobies, Eurasian milfoil, and other trouble-making invasive species.

"One man the other day was particularly interested," Thatcher said recently. "He had just bought a new motor to replace one that was ruined by zebra mussels."

The tiny mussels can clog engine cooling systems and become virtually impossible to remove.

This is the second summer UW Sea Grant has participated in the Clean Boats, Clean Waters program run by the Wisconsin Lakes Partnership, a collaboration of the Wisconsin Department of Natural Resources, the Wisconsin Association of Lakes, and the University of Wisconsin-Extension. The program is conducting similar work with more than 350 volunteers and DNR employees on smaller lakes throughout the state. UW Sea Grant Invasive Species Specialist Phil Moy is supervising the students working at Great Lakes ramps.

Last summer the students talked with more than 1,100 people at 33 ramps, Moy said.

Students Scott Allen and Paul Skawinski are also working Lake Michigan ramps, and Amanda Bade and Jenna Scheub are stationed at Wisconsin's Lake Superior ramps. They each work one morning during the week and two full days between Fridays and Sundays.

Moy will be looking for more students next summer. He can be reached at (920) 683-4697 or *pmoy@aqua.wisc.edu*.

Lake Sturgeon Victory Sends Students to the Bayou



milfoil illustration-Michigan Sea Grant / Dave Brenner

L to R: Cullen Haselby, Andrew Olson, Shea Chyou, Sixing Liang

For the fourth year in a row, a team from Marshfield High School represented Wisconsin at the National Ocean Sciences Bowl (NOSB), a national competition of ocean and Great Lakes knowledge for high school students. Marshfield vied with 24 teams at the competition in Biloxi, Miss., sponsored by the Consortium for Oceanographic Research and Education.

Jim Lubner, UW Sea Grant education coordinator, accompanied the Marshfield team to the tournament, which was followed by a field trip that included snorkeling, bird watching, and shark dissecting, plus visits to the J.L. Scott Marine Education Center & Aquarium and the Grand Bay National Estuarine Research Reserve.

Marshfield qualified for the NOSB after taking first place in the Lake Sturgeon Bowl in February. Twenty-one teams from around Wisconsin competed in the event, which was sponsored by Sea Grant and the UW-Milwaukee Great Lakes WATER Institute.

This year the Lake Sturgeon Bowl featured both varsity and junior varsity teams, allowing newcomers a chance to get their feet wet in the event's fast-paced format.



Arsenic continued from page 1

the aquifer. Further contrasting with Fox River Valley conditions, arsenic bound to these hydroxide minerals enters groundwater when oxygen levels are low, which is the case with the relatively old water throughout the deep Quaternary aquifer.

Consequently, drilling deeper in the Quaternary is unlikely to reach water with lower arsenic concentrations, Gotkowitz says. And drilling below the thick aquifer is prohibitively expensive for residential well owners. Well owners here must often resort to buying bottled water or installing in-home treatment systems.

The finding that the geological sources of arsenic are so different near Lake Geneva than in the Fox River Valley – and the fact that few such detailed studies have been conducted in many parts of the state – makes it difficult for geologists to accurately predict when a new or existing well is likely to yield low-arsenic water, Gotkowitz says.

In light of these findings, Gotkowitz urges all owners of private wells in Wisconsin to have their water tested annually for arsenic and nitrates, a contaminant that comes from fertilizers, animal wastes, and septic systems.

"Getting your water tested should be considered part of the cost of buying a house or drilling a well," Gotkowitz said. "If you have your own well and you live in Wisconsin, you should have your water tested. It's that simple," Gotkowitz said.

For more information on arsenic in Wisconsin, see the Wisconsin DNR arsenic page, *www.dnr.state.wi.us/org/wa-ter/dwg/arsenic/index.htm* and the ASC arsenic fact sheet at *aqua.wisc.edu/publications/productslist.aspx?CategoryID*= 17& selection=1. — JK

STATS FOR P.A.T.

This summer, UW Sea Grant staff will begin contacting current investigators as well as former students to help document the program's impacts and accomplishments in preparation for its five-year federal evaluation in May 2006. The National Sea Grant Office evaluates each of the 31 Sea Grant programs using an external Program Assessment Team (PAT). The PAT review evaluates program quality and affects the merit portion of the overall Wisconsin Sea Grant program core funding from

KNOW YOUR WATER LAB CENTER FOR WATERSHED SCIENCE & EDUCATION UNIVERSITY OF WISCONSIN-STEVENS POINT

www.uwsp.edu/cnr/watersheds



The Center for Watershed Science and Education is a UW-Extension and UW-Stevens Point College of Natural Resources center that assists citizens, communities, and businesses in their water resources needs through education, applied research, technical assistance, planning, and partnership building.

The center provides drinking water testing and interpretation for thousands of Wisconsin citizens annually and works with dozens of lakes and rivers groups on the health of their surface waters. Through its Groundwater Guardian Program, the center is working to build groundwater knowledge and leadership skills in Wisconsin citizens. Center staff members are also playing pivotal roles in a number of state groundwater issues, including helping to draft Wisconsin's 2004 Groundwater Quantity Legislation.

For additional information, contact Director George Kraft, gkraft@uwsp.edu.

Andy Janicki, a UW-Stevens Point undergraduate student, records pH and temperature data as part of a water quality assessment of Shawano Lake.

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CALENDAR OF EVENTS

AUGUST 18

Deadline for Proposals for Special Sessions

2006 Conference on Mercury as a Global Pollutant Madison, Wisconsin

www.mercury2006.org

SEPTEMBER 27-29, 2005

Great Lakes Commission Annual Meeting Ann Arbor, Michigan www.glc.org

OCTOBER 1, 2005

Joint Solicitation for Groundwater Research & Monitoring Proposals

Wisconsin Groundwater Coordinating Council University of Wisconsin Water Resources Institute www.wri.wisc.edu/funding.html

NOVEMBER 1-3

State of Lake Michigan/State of Green Bay Conference Green Bay, Wisconsin www.aqua.wisc.edu/solm/

NEW PUBLICATIONS & REPRINTS

Now Available at the ASC Publications Store *aqua.wisc. edu/publications/*

Working with Engineers and Contractors on Shore Protection Projects

by Gene Clark, Matthew Clark, and Philip Keillor 4 pages, fact sheet Free

Stabilizing Coastal Slopes on the Great Lakes by Ronald Chase, Tuncer Edil, Alan Kehew, Philip Keillor, and David Mickelson

12 pages, fact sheet Free

Lake Michigan in Motion: Responses to an Inland Sea to Weather, Earth-Spin, and Human Activities by Clifford H. Mortimer

304 pages Cloth \$45, Paper \$24.95

"Temporal and Spatial Patterns of Insect Emergency from a Lake Michigan Coastal Wetland," Richard A. MacKenzie and Jerry L. Kaster, *Wetlands* 24(3):688-700, 2004

"Method for Analysis of TAG Formed by Reaction of Fish Oil with Hydrogenated Soybean Oil," Arnoldo Lopez-Hernandez, Carlos F. Torres, Hugo S. Garcia and Charles G. Hill, Jr, Journal of American Oil Chemists' Society, 81(8):743-747, 2004

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