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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:



National Park Service

SEA GRANT OUTREACH

# Increasing Safety at Sea Caves

**WEATHER AND WAVE CONDITIONS CAN QUICKLY TURN A SPECTACULAR KAYAK TRIP INTO A DANGEROUS SITUATION**

The Apostle Islands National Lakeshore has become a world-class destination for sea kayaking, but some of the most popular attractions can also be treacherous. At several spots around the archipelago, years of waves and ice carving through sandstone cliffs formed sea caves, a breathtaking series of delicate arches, vaulted chambers, and hidden passageways that are most easily explored by kayak.

However, under certain conditions, the sea caves can quickly change from awe-inspiring to terrifying. As waves roll into and reflect off of the cave walls, they can intensify and capsize even experienced kayakers. Once out of their boats, paddlers face the threat of hypothermia in water temperatures that hover in the mid-40s for most of the summer and rarely exceed 60 degrees. In addition, the surrounding steep cliffs make seeking safety on shore nearly impossible.

The danger is real and sobering. Over the last five years, two people have died while kayaking near the mainland sea caves about a mile east of Meyers Beach.

"Both of them were experienced athletes, and they were not unaware of the weather forecast. They just underestimated what the impact would be on them in that location," said Bob Krumenaker, National Park Service superintendent of the Apostle Islands National Lakeshore.

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Aquatic Sciences Chronicle

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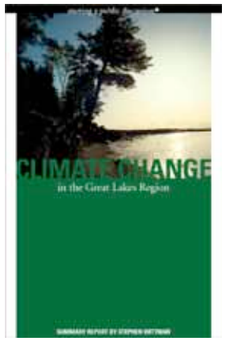


Riding on the heels of its successful 2007 lecture series "Climate Change in the Great Lakes: Starting a Public Discussion," Wisconsin Sea Grant has been awarded a $293,000 grant from the NOAA Climate Program Office Sectoral Applications Research Program (SARP).

The two-year grant partners Wisconsin Sea Grant with the University Corporation for Atmospheric Research's Cooperative Operational Meteorology, Education and Training (COMET) Program to develop centralized training for Sea Grant Extension agents and specialists to enable them to deliver consistent, science-based messages regarding the likely effects of climate change in coastal areas.

Wisconsin Sea Grant and COMET will develop an interactive Web site to serve as a portal for the training course and permit NOAA and Sea Grant climate researchers to interact to bring up-to-date scientific information to coastal stakeholders. The resulting "wiki"—a collection of Web pages on climate-related topics that allows approved individuals to contribute or modify content—will help disseminate timely coastal climate information (climate change impacts, research results, reports, publications, etc.), and will continue to grow as new knowledge and information become available. The wiki will increase interaction between key NOAA scientists and coastal stakeholders through Sea Grant Extension and provide a forum for current climate science discussions.

## 2009ScienceExpeditions

photos: John Karl

At Wisconsin Sea Grant's station at UW-Madison's "Science Expeditions 2009," visitors learned about the relationships between phosphorus, zebra and quagga mussels, and excessive algae. They watched live mussels filter plankton via a high-definition monitor, examined mussels under microscopes, explored an interactive computer module, and saw video footage of the problem at its worst.

Wisconsin Sea Grant's Vicky Harris and John Karl developed the computer module and guided visitors through it. Project Assistant Tim Tynan produced the computer activity.

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

SEA GRANT RESEARCH

# Zebra Mussels Hang On While Quagga Mussels Take Over

The zebra mussels that have wreaked ecological havoc on the Great Lakes are harder to find these days—not because they are dying off, but because they are being replaced by a cousin, the quagga mussel. Yet zebra mussels still dominate in fast-moving streams and rivers.

Research conducted by Suzanne Peyer, a doctoral candidate in the UW-Madison department of zoology, shows that physiological differences between the two species might determine which mollusk dominates in either calm or fast-moving waters.

"Zebra mussels quite rapidly colonized rivers close to the Great Lakes right after their introduction, within a year or two," Peyer explained. "Quagga mussels were introduced in the Great Lakes around 20 years ago, but they are still not found in the rivers or tend to be present only in low numbers."

The mussels are similar in many ways. Their habitats overlap, and both are suspension feeders that filter water to extract their food. Yet the cousin species are different in many ways, too. Zebra mussels prefer to attach to a hard surface while quagga mussels can live on soft bottoms, such as sand or silt. Zebra mussels also prefer warmer water temperatures and do not grow as big as quagga mussels.

Peyer's research focused on the ability of the mussels to attach to underlying material. Both species attach to rocks, sand, silt, or each other by producing tiny but strong "byssal" threads composed of protein strands. These threads act as an adhesive that enable the mussels to attach to surfaces, regardless of how slippery the surface is. Byssal threads are the reason mussels are so difficult to remove from boats or water intake pipes.

Peyer collected both mussel species from Lake Michigan. In the lab, she subjected the mussels to different water velocities that simulated river flow conditions. Her research results supported her hypothesis that zebra mussels are able to produce more byssal threads than quagga mussels do, enabling them to attach more securely to underlying material. This allows them to hang on where water is flowing, such as in a river or stream.

According to Peyer's research advisor, Prof. Carol Eunmi Lee at the UW-Madison Center of Rapid Evolution, no one has ever looked at differences in attachment between these species as an explanation for their distribution patterns in North America.

Zebra and quagga mussels have permanently changed the Lake Michigan ecosystem. Before the mussels invaded, Lake Michigan water was mostly cloudy, and millions of tiny microorganisms provided a food base for fish. Because the mussels filter the microorganisms, the waters today are surprisingly clear, allowing light to penetrate to greater depths, which in turn promotes prolific nuisance algae blooms. The mussels have also colonized shallow water, beaches, and water intake pipes in layers up to eight inches thick.

"We need to be aware of the distinct differences between the two species," Peyer said. "If we understand the differences in their biology, we might help to make management more efficient and more effective in the end."

The results of her UW Sea Grant-funded research were published in the July 1 issue of the *Journal of Experimental Biology*. —CRB

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


Bob Rashid

**Suzanne Peyer (above) conducted research showing that zebra mussels attach more securely to underlying material, allowing them to dominate in streams and rivers. Quagga mussels dominate in quiet water.**


Richard Betz

# Kayaking Reading List

Dreaming about summer vacation? If you're ready for beautiful scenery, nice weather, and some exercise while discovering hidden treasures of the Great Lakes, try sea kayaking! To learn how to kayak, find good places to go, and read stories from kayakers who have been there, check out Wisconsin's Water Library resources. Wisconsin residents can request a book for free on the library Web site, *http://www.aqua.wisc.edu/waterlibrary*.

**GUIDE TO SEA KAYAKING ON LAKE SUPERIOR AND LAKE MICHIGAN**
By Bill Newman, Sarah Ohmann, and Don Dimond. Guilford, Connecticut: The Globe Pequot Press, 1999.

Written by three expert kayakers, this guide gives full descriptions of 49 trips. Mile-by-mile descriptions and detailed maps help kayakers to paddle safely and confidently on these two Great Lakes.

**WILD SHORE: EXPLORING LAKE SUPERIOR BY KAYAK**
By Greg Breining. Minneapolis: University of Minnesota Press, 2000.

Experienced kayaker Greg Breining's adventure of paddling more than one thousand miles around Lake Superior offers an insider's look at camping on pristine islands and shorelines, visiting places of rare beauty and solitude, and exploring remote historic sites and isolated communities.

**NORTHWOODS WHITEWATER: A PADDLER'S GUIDE TO WHITEWATER OF MINNESOTA, WISCONSIN, ONTARIO AND MICHIGAN**
By Jim Rada. Excelsior, Minnesota: Sangfroid Press, 2006.

The result of decades of first-hand research, this book is for those hoping to experience the best whitewater in the northwoods. It features technical yet spirited descriptions of every significant run in the area, plus colorful tales of the author's journeys. A detailed rating system assists kayakers and canoers in choosing the best spot based on their level of experience.

**HOW'S THE WATER?: PLANNING FOR RECREATIONAL USE ON WISCONSIN LAKES AND RIVERS**
Edited by Tamara Dudiak and Robert Korth. UW Extension and UW-Stevens Point, 2002.

Statistics, history, and descriptions of different water sports and leisure activities of Wisconsinites, compiled by UW-Stevens Point and UW Extension.

**WATER-BASED TOURISM, SPORT, LEISURE, AND RECREATION EXPERIENCES**
Edited by Gayle Jennings. Oxford: Elsevier, Inc., 2007.

This volume was compiled for professionals, academics, and students who seek to resolve pressing problems and opportunities of coastal tourism management, coastal zone management, fishery management, and marine protected area management in the context of sustainable development.

Please visit the Water Library at
***http://aqua.wisc.edu/waterlibrary* for more information.**
Anyone in Wisconsin can borrow these books. Just email *askwater@aqua.wisc.edu*


Jim Lubner

James Hurley

*L to R: Paul Herder, earth science teacher and team coach, Marshfield H.S.; Caroline Joyce, Wisconsin Lake Sturgeon Bowl coordinator, UW-Milwaukee School of Education; Bruce King, superintendent, Marshfield School District; Jim Lubner, Sea Grant education coordinator; Christine Phillipe, team manager; Alex Jensen, team captain; and team members Elisa Prebble, Seth Berger, and Michael Josephson. Front: Priya Pathak.*

# Marshfield High School Wins National Ocean Sciences Bowl

In a come-from-behind race to the finish, Marshfield High School pulled off its first-place victory at the 12th annual National Ocean Sciences Bowl competition held in late April in Washington, D.C.

The five Marshfield students made up a 45-point deficit in the last six minutes of the competition, which featured 25 high school teams from across the country.

"In my eight years of coaching, I have never been involved in, nor heard of a recovery like this in any match anywhere, let alone in the finals at the Smithsonian Institute and in front of an elite crowd of scientists, dignitaries and the brightest young science minds in the country," said teacher Paul Herder.

The Marshfield team earned the right to represent Wisconsin in the national competition by winning the Wisconsin Lake Sturgeon Bowl, supported in part by UW Sea Grant. UW Sea Grant Education Coordinator Jim Lubner accompanied the Wisconsin students to Washington, D.C. Lubner also arranged a field experience for the team on Virginia's Eastern Shore following the competition.

"This team represents the best of the best," said Marshfield High School Principal Gordie Sisson. "As they left the school on the way to their flight, I jokingly told them to not come home without a victory. Little did I realize that they would accomplish just that."

The prize for winning the event is an all-expenses paid trip to the Smithsonian Tropical Research Institute in Panama.

# New Maritime History GEOCACHES

A high-tech treasure hunt, lots of fresh air, and a dash of Wisconsin's maritime history—these elements combine in 10 new geocache trails in Manitowoc.

Geocaching involves using a hand-held geographic positioning system (GPS) to search for a "cache," a small container hidden by another geocacher. Participants get the latitude and longitude (now often called "GPS coordinates") of the cache location from a Web site, and they navigate to that location with their GPS units. Finding the cache itself, however, is done the old-fashioned way—by simply looking around.

For Manitowoc's maritime geocaches, each trail leads participants along a series of waypoints. At each waypoint, visitors interpret clues—found on anchors, signs, buildings, and other maritime artifacts—to find the next waypoint.

Trail themes include "Manitowoc Shipbuilders," "Two Rivers' Fishing Traditions," and "The Manitowoc Shipbuilding Company at War." The Wisconsin Maritime Museum in Manitowoc has GPS units available free of charge for visitors to use, plus a booklet describing each trail.

The trails were established by the Wisconsin Historical Society as part of a project funded by UW Sea Grant.

The Wisconsin Historical Society created the trails as part of a UW Sea Grant-funded project.

Tamara Thomsen

## ASC DROPLETS

### Become a Lamprey Hunter!

Wisconsin Sea Grant is joining an effort by the Great Lakes Fishery Commission to help track how many sea lampreys are in the Great Lakes and where they are. For 50 years, sea lamprey control efforts have reduced the population by 90 percent in many areas. Despite continuing control efforts, lamprey numbers have rebounded recently in Lake Michigan. Great Lakes fishers can lend a hand by volunteering to become a "Lamprey Hunter." By keeping track of where they see (and don't see) lampreys, fishers can help control crews better target their efforts. Visit *www.glfc.org/sealamp/lampreyhunter* to learn how to participate, and contact UW Sea Grant Aquatic Nuisance Species Specialist Phil Moy via email at *pmoy@aqua.wisc.edu* or phone (920) 683-4697.

photo: Great Lakes Sea Grant Network Exotic Species Graphics Library

### Mashing Things Up in Web Mapping

David Hart, UW Sea Grant's geographic information systems specialist, explored the expanding world of "mapping mashups" with urban and regional planning students last spring through a course he taught at UW-Madison. A "mashup" pulls data from different Web sources to produce a unique end product (such as a real estate Web site that maps homes for sale along with information about schools and churches, as well as proximity to businesses like grocery stores and coffee shops). Hart's students reviewed existing mashups, created tutorials to demonstrate how to build one, and then created their own mapping mashups to meet a social or business purpose. Their final projects ranged from mapping routes, amenities, and points of interest for a bicycle tour around Lake Michigan to visualizing Amtrak monthly ridership data between Milwaukee and Chicago over a period of eight years. The final projects are posted at *maps.aqua.wisc.edu/urpl590-spring09/mashups/index.htm*.






photos: Helena Ryvander

# Increasing Safety at Sea Caves

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Krumenaker said that conditions at Meyers Beach, where kayakers launch their boats, may seem easily manageable. However, after rounding a bend to approach the sea caves, paddlers can face significantly larger waves. Gene Clark, UW Sea Grant coastal engineering specialist, said the unique topography of the caves—combined with certain weather and wave conditions—are often to blame for the sometimes treacherous conditions.

"It's not just one combination of conditions that can cause a dangerous situation—it's going to be different angles, different waves, different winds, and different wave periods," Clark said. "We want kayakers to know the current conditions so that they can decide whether or not to paddle out to the remote sea cave location."

With support from the Wisconsin Coastal Management Program, Clark teamed up with Chin Wu, a UW-Madison civil and environmental engineer, to find out if there was some way to measure the waves near the sea caves in real-time and transfer that information back to kayakers, outfitters, and park service staff.

One appeal of exploring the sea caves is also the biggest challenge to the monitoring project—the area is very remote, with no electricity or phone lines. Clark and Wu are testing a system that includes a wave sensor on the lake bottom that monitors the size of the waves in the area. The sensor is linked by an underwater cable to a wireless, solar-powered modem mounted out of sight on the cliffs. From there, data about the real-time wave conditions can be transmitted by cell phone frequency and posted to the Internet.

Clark, Wu, and UW-Madison graduate students Josh Anderson and Kevin Lin tested some of the wave monitoring equipment this last winter, when a thick layer of ice allowed foot travel from Meyers Beach to the sea caves. They are also working with the City of Bayfield, Inland Sea Society, local outfitters, Friends of the Apostle Islands National Lakeshore, and park staff to determine the best format for presenting the real-time data from the wave sensor so that it's most useful for kayakers.

Krumenaker stressed that the system is still in development and will be tested throughout this summer. Although it won't be available to the public immediately, he has high hopes for the system's eventual success.

"We expect it will save some lives," he said. —KSK

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

Kathleen Schmitt King

*Chin Wu (left), a UW-Madison civil and environmental engineer, and Gene Clark (right), UW Sea Grant coastal engineering specialist, point out some of the cliffs where a transmitter could be mounted to warn kayakers about dangerous wave conditions near the popular Mawikwe Bay sea caves.*

Robert F. Beltran

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**a joint newsletter from UW Sea Grant and UW Water Resources**

## CALENDAR OF EVENTS

**STATE OF LAKE MICHIGAN AND GREAT LAKES BEACH ASSOCIATION JOINT CONFERENCE**
**SEPTEMBER 29–OCTOBER 1**
Milwaukee, Wisconsin
*www.aqua.wisc.edu/solm/*

**SOCIETY OF ENVIRONMENTAL JOURNALISTS 19TH ANNUAL CONFERENCE**
**OCTOBER 7–11**
Madison, Wisconsin
*www.sej.org/initiatives/sej-annual-conferences/AC2009-main*

**2009 MERCURY SCIENCE & POLICY CONFERENCE FOCUSING ON THE GREAT LAKES & NORTHEAST REGIONS**
**NOVEMBER 17–18**
Chicago, Illinois
*www.newmoa.org/prevention/mercury/conferences/sciandpolicy/*

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**Wisconsin's Lake Superior Water Trail Map**
Inland Sea Society

Map and resource guide. A general resource guide for paddlers, providing information about access, resting, and camping sites suitable to kayaks and small boats. Photo copyright John and Ann Mahan.

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