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ASC
Aquatic Sciences Chronicle
www.aqua.wisc.edu/chronicle
UNIVERSITY OF WISCONSIN SEA GRANT INSTITUTE UNIVERSITY OF WISCONSIN WATER RESOURCES INSTITUTE

## INSIDE:



SEA GRANT RESEARCH

# Tiny waterfleas may have BIG CONSEQUENCES

Spiny water flea, unknown location.
Couresy of US Fish and Wildlife Service

Photo by John Karl

*Dr. Craig Sandgren examines a sample of spiny and fishhook water fleas from Lake Michigan. The tiny organisms could trigger an "invasional meltdown" of the lake's food web.*

Standing aboard the research vessel *Neeskay* in Lake Michigan, UW–Milwaukee Associate Professor Craig Sandgren oversees an oceanographic-sized net being pulled up from 100 meters. Considering the enormous size of the net and the large volume of water that is being collected, it's surprising that what he and fellow biology professor John Berges are anxiously looking for are tiny water fleas barely visible to the naked eye. What's more, these tiny species have the capability of significantly changing the existing food web.

The critters are the carnivorous zooplankton *Bythotrephes cederstroemi* (spiny water flea) and *Cercopagis pengoi* (fishhook water flea). Like the zebra and quagga mussels, both are invaders from Eastern Europe that have hitched their way into the Great Lakes through ballast water on ships.

Every other week this summer, the two researchers collected samples off the coast of Milwaukee and several miles out in the open water.

"In their native environment, there are all kinds of checks and balances so the zooplankton are not a problem," said Sandgren during a research cruise in August. "But when they come to a new place, they may become superabundant because they have left behind their natural enemies."

What concerns these scientists is the fact that the two invasive species occupy the same critical spot in the middle of the food web. While two similar species might compete against each other, these tiny fleas may in fact divide and conquer, each devouring separate types of zooplankton. That would leave less food for fish to eat during their critical initial growth periods. Additionally, if they eat zooplankton that normally consume algae, prolific algae blooms may increase in frequency.

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Aquatic Sciences Chronicle

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## FEATURED WEB SITE

# Wisconsin's Water Library's new Web site debuts

**http://aqua.wisc.edu/waterlibrary**

A new Web site for Wisconsin's Water Library (WWL) provides one place for users to locate resources available through the library. This site combines three earlier sites—the original WWL site, a newer WWL site developed for Wisconsin's Year of Water, and the Wisconsin's Water Library for Kids.

The site is intended to extend the reach of the library's services to residents across Wisconsin and offers new navigational tools to provide easier access to information. "It was our goal for users to have a seamless view of the library and its resources whether they are UW students, residents of Rice Lake, or kids from Racine," says Special Librarian Anne Moser.

An important tool on the site is the "Recommendations" feature, which allows users to browse reading lists by topic, finding books and Web sites on frogs, fish, the Great Lakes, or water pollution. Any adult resident of Wisconsin can check out books online from the library and pick them up at their local public or university library.

The site was constructed with the help of ASC staff members Tina Yao, Tom Dellinger, Rich Dellinger, Julia Cameron, and Jennifer Champoux. — AM

# programpeoplenews


Photo by Carolyn Rumery Betz

*Left to right: Phil Moy, Jim Hurley, and Chris Babiarz*

It took two people to fill the shoes of **Jim Hurley** (center), ASC assistant director for research and outreach, over the past year. **Phil Moy** (left), UW Sea Grant fisheries and aquatic nuisance species specialist based at UW–Manitowoc, set up camp in Madison during Hurley's absence to work on Sea Grant-related issues. **Chris Babiarz** (right), assistant scientist in the Water Science and Engineering Laboratory, managed Hurley's Water Resources responsibilities.

During his time away, Hurley served as an associate program officer with the National Sea Grant Program office in Silver Spring, Maryland. The National Sea Grant folks liked Hurley so much that they have asked him to continue on half-time until the end of the year, and he has agreed. Heartfelt thanks are extended to Moy and Babiarz for their outstanding contributions thus far and willingness to fill in for Hurley as he shuttles back and forth between Madison and D.C.

**Carolyn Rumery Betz**, science writer, was awarded the 2008 Water Champion Award by the Dane County Lakes and Watershed Commission for overseeing water quality improvement efforts in the Lake Mendota Priority Watershed Project.

**Anne Moser**, librarian, has been selected to serve as faculty advisor to the Special Libraries Association- Student Chapter at the School of Library and Information Studies.

Wisconsin's Water Library welcomes new project assistant **Jennifer Champoux**, a second-year graduate student in the School of Library and Information Studies. Champoux brings experience with library operations and enthusiasm for top-notch reference services.

Congratulations to **Peter Boger**, ASC Project Assistant, on receiving a M.S. in Land Resources. Boger bids us farewell to pursue a Ph.D. in Environment and Resources at the UW's Nelson Institute for Environmental Studies.



# Making sense of a tangled web within Lake Superior

The story of food web interactions in Lake Superior—essentially who eats whom and who gets eaten by whom—is anything but straightforward. "There are a lot of things we don't know about the world's largest lake," admits Jim Kitchell, director of the UW–Madison's Center for Limnology.

In a Sea Grant-funded research project, Kitchell and his colleagues are in the process of developing a complex computer model to describe the interactions between 48 fish species and three invertebrates in the lake. The research includes examining the sea lamprey (Petromyzon marinus), a jawless, parasitic fish, and the fish it preys upon. Kitchell and his colleagues have observed that the average size of the lamprey—an invader that has made the Great Lakes its home for over 60 years—has doubled over the past two decades. That corresponds with increasing abundance of host species such as salmon, lake trout, and burbot.

As lamprey increase in size, they are more likely to kill than maim the host fish. "Little lamprey are parasites," says Kitchell, "but large lamprey are vampires, and they can kill."

To understand the consequences of increasing mortality rates on prey fish, Kitchell needs to understand what the lamprey are eating. Yet he can't simply look into their stomachs. A sea lamprey uses its sucking disk and sharp teeth to attach to a host fish, drawing out its blood and other bodily fluids until satiated, without taking any visible part of the victim.

Scientists analyze tissues to determine the chemical makeup of the lamprey based upon what it has eaten in the past. The researchers then work backwards and use direct evidence (the size of the lamprey) and indirect evidence (its chemical makeup) to determine how many and what kind of fish the lamprey must have attacked.

The researchers are learning that lampreys attach to more than just trout, and what they prey upon varies in different parts of the lake. They also attack suckers, whitefish, and other species that are lower in the food chain. The deadly nature of their feeding habits may alter food web dynamics in the lake in ways that are not yet known.

Results of the project could be used by fish managers who try to eradicate sea lampreys on specific streams where they come upriver to spawn. Lampricides used to kill the larval lampreys are 99 percent effective, but some larvae escape and enter the lakes. Knowing which species are being eaten in which parts of the lake can help managers target their applications to locations that need the most protection.

Fish managers have learned that a completely successful lamprey control program is unrealistic. "It's a continuing battle," commented Kitchell. "Cost is a constraint, so it's wise to focus efforts on the streams that produce lampreys most harmful to the most important fishery resource." — CRB

Photos courtesy of U.S. Environmental Protection Agency

**"LITTLE LAMPREY ARE PARASITES," SAYS KITCHELL, "BUT LARGE LAMPREY ARE VAMPIRES, AND THEY CAN KILL."**

# Students learn field skills to measure climate change

UW–Madison students spent a week in the Apostle Islands in July, conducting field work as part of an eight-week interdisciplinary class investigating the impacts of climate change on the Great Lakes.

UW Sea Grant Coastal Engineering Specialist Gene Clark, along with Civil and Environmental Engineering Professors Chin Wu, Dante Fratta, and Trina McMahon, led students in conducting water, geological, and environmental assessments on the nearshore area of Lake Superior.

Photos by Gene Clark

*Students partner with National Park Service staff to deploy and retrieve field instruments to measure waves, currents, and nearshore turbidity.*

*An anemometer is installed at Little Sand Bay Harbor to measure wind speed and direction.*

wisconsin'swaterlibrary

# Grant Nets Invasive Species Books

Wisconsin's Water Library has some great new books about invasive species, thanks to a grant from the Friends of UW–Madison Libraries. From histories of non-native species and the effects they have had on ecosystems to information about specific invaders, these books offer information and resources for UW researchers working with fishery restoration projects and Wisconsinites concerned about protecting our natural resources and slowing the spread of exotics.

A few of the new titles include:

**ALIENS IN THE BACKYARD: PLANT AND ANIMAL IMPORTS INTO AMERICA / BY JOHN LELAND. COLUMBIA, S.C.: UNIVERSITY OF SOUTH CAROLINA PRESS, 2005.**

John Leland recounts the origins and impacts of nonindigenous species on the environment and the resilience of ecosystems confronted with invasions.

**BIGHEADED CARPS: A BIOLOGICAL SYNOPSIS AND ENVIRONMENTAL RISK ASSESSMENT / BY CINDY S. KOLAR. BETHESDA, MD.: AMERICAN FISHERIES SOCIETY, 2007.**

This book contains a detailed risk assessment and biological synopsis of the bigheaded carps of the genus *Hypophthalmichthys*, which includes the bighead, silver, and largescale silver carps.

**BIOLOGICAL INVADERS IN INLAND WATERS: PROFILES, DISTRIBUTION AND THREATS / EDITED BY FRANCESCA GHERARDI. DORDRECHT ; LONDON : SPRINGER, 2007.**

The book examines the identity, distribution, and impact of freshwater nonindigenous species and the dynamics of their invasion.

**BIOLOGICAL INVASIONS: ECONOMIC AND ENVIRONMENTAL COSTS OF ALIEN PLANT, ANIMAL, AND MICROBE SPECIES / EDITED BY DAVID PIMENTEL. BOCA RATON, FLA.: CRC PRESS, 2002.**

This volume reconfirms the diverse and unpredictable roles that non-native species assume as they invade new ecosystems and cause destruction of vital crops and forests, major damages to ecosystems leading to loss of biodiversity, soil erosion, and water loss. In addition, it covers the effect of imported disease organisms on human health and livestock.

**BLACK CARP: BIOLOGICAL SYNOPSIS AND RISK ASSESSMENT OF AN INTRODUCED FISH / BY LEO G. NICO, JAMES D. WILLIAMS, AND HOWARD L. JELKS. BETHESDA, MD.: AMERICAN FISHERIES SOCIETY, 2005.**

This book offers a detailed assessment of the risks posed by the invasion of the black carp, a large mollusk-eating cyprinid fish native to eastern Asia.

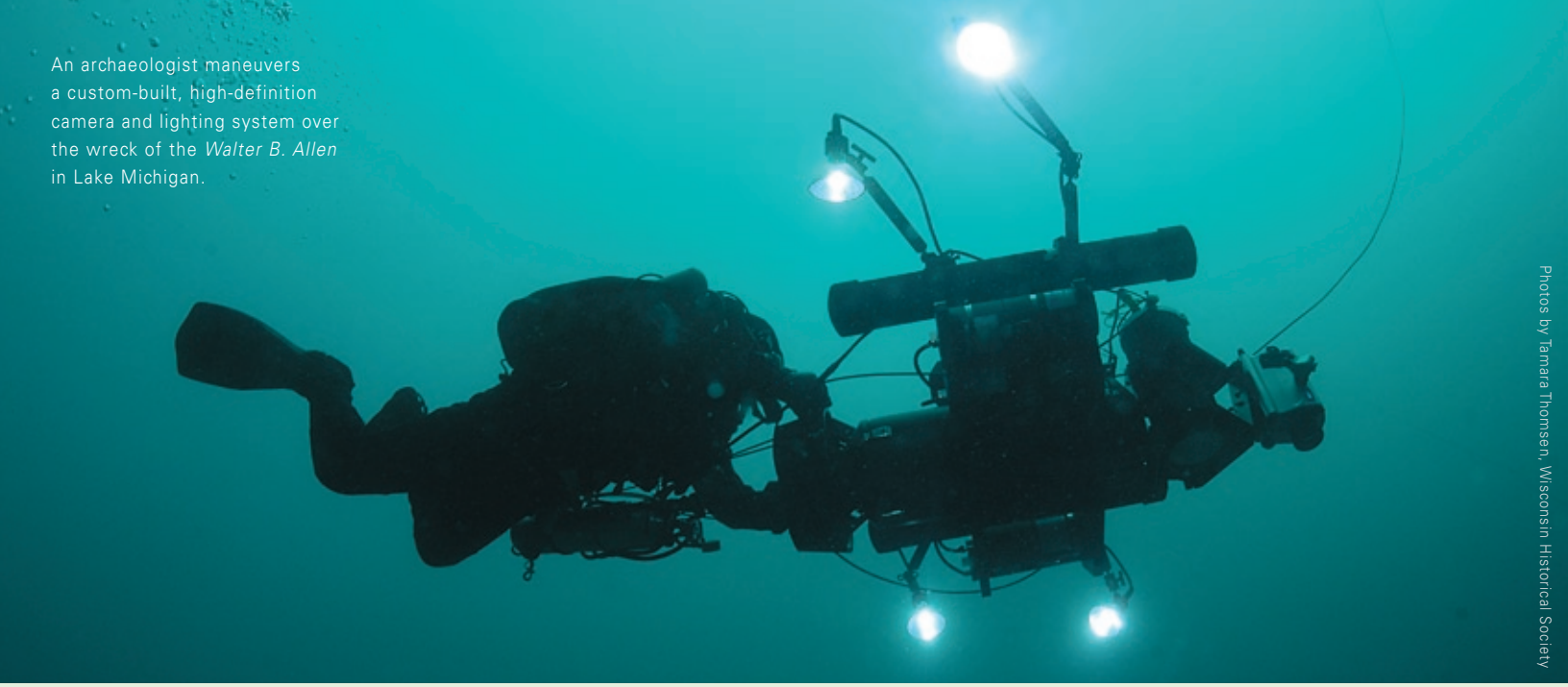
**INVASIVE SPECIES: VECTORS AND MANAGEMENT STRATEGIES / EDITED BY GREGORY M. RUIZ AND JAMES T. CARLTON. WASHINGTON, DC : ISLAND PRESS, C2003.**

*Invasive Species* presents new analyses of mechanisms of species transfer, or vectors, as the latest contribution from the Global Invasive Species Programme (GISP). Contributors assess invasion vectors and vector management in terrestrial, freshwater, and marine ecosystems for major taxonomic groups in a variety of regions around the world.

## 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*



An archaeologist maneuvers a custom-built, high-definition camera and lighting system over the wreck of the *Walter B. Allen* in Lake Michigan.

Photos by Tamara Thomsen, Wisconsin Historical Society

# In pursuit of 3-D shipwreck images

**July 2008, Lake Michigan:** A technician from the Advanced Imaging & Visualization Laboratory at the Woods Hole Oceanographic Institution (WHOI) and underwater archaeologists from the Wisconsin Historical Society (WHS) experimented with techniques for producing three-dimensional, photo-mosaic images of shipwrecks. Lake Michigan's clear water and exceptionally well-preserved shipwrecks provided perfect testing grounds.

**Careful planning.** Evan Kovacs (left), operational scientific services contractor at the WHOI lab, and Keith Meverden, WHS underwater archaeologist, discuss the day's work. "We're always looking for the shot that people say we can't get," Kovacs said of WHOI's optics lab.

**Getting the data.** Keith Meverden, WHS underwater archaeologist, carefully steers the imaging rig over the deck of the *Walter B. Allen*, off Sheboygan in Lake Michigan. Funded by Wisconsin Sea Grant, the work documented the condition of seven deep-water shipwrecks while testing the 3-D imaging technology. After working out kinks in customizing lenses, processing chips, and lighting systems, software will be written to convert the video data into three-dimensional images.

**A 2-D version.** A two-dimensional photo-mosaic of the schooner *Walter B. Allen*. To produce this image, Tamara Thomsen, WHS underwater archaeologist, manually arranged 120 still images selected from 35,000 images collected in the pilot project.

For more photos, see http://picasaweb.google.com/tamarathomsen/WHOIPhotoMosaicWeek

# ASC DROPLETS

### Great Lakes Compact signed into law

President Bush signed the Great Lakes-St. Lawrence River Basin Water Resources Compact into law on October 3, 2008. It places strict restrictions on water diversions and sets uniform standards for monitoring new water use proposals within the basin. Sea Grant Water Quality Specialist Vicky Harris received one of the pens that Governor Jim Doyle used when he signed the compact on behalf of the State of Wisconsin.

Photo by Mike Heine, UW–Green Bay


### Online discussion group on climate change forms

We invite you to share your thoughts about climate change in the Great Lakes region via our online discussion forum at *www.seagrant.wisc.edu/climatechange*. Post evidence that the climate is changing in the area where you live; suggest what, if anything, can or should be done to stop global warming; and describe what actions, if any, you have taken or plan to take to reduce your "carbon footprint." The forum is an outcome of a 2007 seminar series, Climate Change in the Great Lakes Region: Starting a Public Discussion, sponsored by UW Sea Grant, the Wisconsin Coastal Management Program, and NOAA.

### The cost of invasive species to the Great Lakes

The cost of invasive species to the Great Lakes regional economy is estimated to be about $200 million for 2006, according a study conducted by the Center for Aquatic Conservation at the University of Notre Dame. Preliminary findings indicate that aquatic invasives have cost the U.S. sport fishing industry $124 million and the commercial fishery $2 million. Tourism is down by about $47 million, while increased costs for raw water users are about $27 million.

# Tiny water fleas may have big consequences

*continued from page 1*

"Adding invasives changes the dynamics of the food web in very unpredictable ways," John Berges said. "The more invasive species there are, the greater the problems become."

The scientists are able to make comparisons with the data Sandgren collected in the 1990s when only the spiny water flea was on the scene, but before the fishhook water flea and zebra and quagga mussels were introduced to Lake Michigan, further complicating the system.

*Lauren Simmons works on her undergraduate research project.*

Sandgren and Berges are also conducting hundreds of experiments in their labs under controlled conditions. The two can manipulate light, temperature, and nutrients to see how the primary producers, zooplankton grazers, and invasive species respond.

The researchers are developing a basic understanding of what the two water fleas eat to better predict their impacts on the food web. Unlike fish, which can be cut open to examine the contents of their stomachs, these carnivorous water fleas feed like spiders, sucking out the contents of their prey and leaving the hard parts behind.

"If you imagine the tiny animal they eat is a can of soup, they squeeze out the soup and leave the can behind," explained Sandgren. "We're trying to read the label without having the can."

Berges reports that thus far they have developed specific antibodies for six prey species that will allow them to identify those species in the "soupy" gut contents of the invasive water fleas.

Next summer, the two biologists will examine the spatial distribution of the zooplankton to see if the nearshore and offshore environments that they have already sampled are representative of all of Lake Michigan.

As Sandgren examined the water sample raised from the depths of Lake Michigan, he observed the tiny creatures swimming around.

"This isn't the mixture of species I had expected to see at all," he said, shaking his head and chuckling. "It's really exciting. We keep realizing that whenever we think we know what's going on, we find something different. It's just such a complicated system." — CRB

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

Photos by John Karl

*Graduate student Paul Engevold sprays down the oceanographic-sized sampling net to capture water fleas in the collection cup.*

*Jeremy Bates*

# Bates awarded Weston fellowship

Jeremy Bates of Brule, Wis., has been awarded the 2008 Carl J. Weston Memorial Scholarship. Bates is an undergraduate assistant in the UW Sea Grant/Wisconsin Department of Natural Resources-supported "Clean Boats, Clean Water" project under the supervision of Sea Grant Invasive Species Specialist Phil Moy. Bates is one of six watercraft inspectors who work at key boat launches to increase awareness of problems caused by invasive species and teach boaters how to inspect and clean their watercraft to avoid transporting hitchhikers to other lakes.

Bates, an Iraq war veteran and member of the Wisconsin National Guard, is an undergraduate student at UW-Superior, where he is majoring in biology with minors in chemistry, geographic systems, and criminal justice. He is interested in a career in natural resources management of Lake Superior.

Established in 1995, the Weston Memorial Scholarship supports undergraduate students interested in Great Lakes and ocean issues. If you would like to make a tax-deductible contribution to the UW Sea Grant Undergraduate Scholarship Fund, please contact Mary Lou Reeb at *mlreeb@aqua.wisc.edu* or (608) 263-3296.

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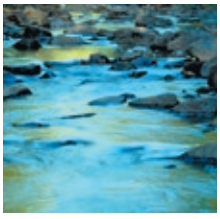
# Aquatic Sciences Chronicle

a joint newsletter from UW Sea Grant and UW Water Resources



## CALENDAR OF EVENTS

### MYSTERIES OF THE GREAT LAKES

**JUNE 2008 – MARCH 19, 2009**

Milwaukee Public Museum
Milwaukee, Wis.
*www.mpm.edu/imax*

### MAMI WATA: ARTS FOR WATER SPIRITS IN AFRICA AND ITS DIASPORAS

**OCTOBER 18, 2008 – JANUARY 11, 2009**

Chazen Museum of Art
Madison, Wis.
*www.chazen.wisc.edu*

**NOVEMBER 18, 2008, 6:00PM**
Room L150, Chazen Museum of Art

**Groundwater: Wisconsin's Buried Treasure**
Anders Andren, director of the UW Aquatic Sciences Center

**Global Warming and its Implications for Wisconsin/Great Lakes Waters**
John J. Magnuson, member of the Nobel Prize-winning Intergovernmental Panel on Climate Change

These lectures are held in conjunction with the Mami Wata exhibit and organized by the UW Aquatic Sciences Center and the Department of Art History.

*http://aqua.wisc.edu/watermatters*

## VISIT THE ONLINE STORE

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

**Protecting Coastal Investments: Examples of Regulations for Wisconsin's Coastal Communities**
by Brian Ohm, Urban & Regional Planning, UW–Madison

This is a resource guide of best practices for Wisconsin's Great Lakes coastal communities dealing with coastal erosion. It describes the causes of coastal erosion and suggests ordinance language that can be used by communities to address locally identified needs. The appendix is an inventory of current coastal setback provisions found in local ordinances in Wisconsin.

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