2013 volume 2

## Aquatic Sciences Chronicle

aqua.wisc.edu/chronicle UNIVERSITY OF WISCONSIN SEA GRANT INSTITUTE UNIVERSITY OF WISCONSIN WATER RESOURCES INSTITUTE

## **INSIDE**:



Go With DUFLOW



Julia Noordyk



Hamilton at the Dashboard



#### PREDICTING THE TOXICITY OF METALS TO GREAT LAKES COASTS

Containers of Chlamydomonas reinhardtii wait for analysis in Martin Shafer's lab at the University of Wisconsin-Madison. Researchers are evaluating the effects of toxic metals copper and cadmium on Great Lakes shoreline ecosystems.

here's nothing like listening to rain falling on a metal roof. Although the sound can be pleasant, Wisconsin Sea Grant researchers are prone to think about the trace amounts of metal the rain carries off the roof and into the environment.

Take copper and cadmium. A team of University of Wisconsin-Madison researchers have discovered key factors in predicting how and at what levels these metals harm the shoreline environment of the Great Lakes and what protective measures coastal organisms adopt in response. That's allowed regulatory agencies—the Environmental Protection Agency (EPA) for one—to refine tools to protect Great Lakes coastal regions from the metals.

Copper and cadmium get into the environment through wastewater and industrial discharges, copper piping and roofs, and natural sources like rocks. Both metals can be toxic in aquatic environments and are regulated by the EPA and Wisconsin Department of Natural Resources. However, the forms and toxicity of these metals in the environment have been difficult to measure.

#### Aquatic Sciences Chronicle

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The Aquatic Sciences Center is the administrative home of the University of Wisconsin Sea Grant Institute & the University of Wisconsin Water **Resources Institute.** 

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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. *wri.wisc.edu* 



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## Join the Conversations uwiscseagrant.tumblr.com

Have you checked out Great Lakes Takes, UW Sea Grant's blog on Tumblr? We've recently launched a recurring feature called "Conversations." About once a month, two of our outreach specialists engage in an extended email discussion about a topic of interest, and you get to listen in. So far, aquatic invasive specialist Tim Campbell and social scientist Jane Hamilton chatted about the economic impact of aquatic invasives, while Tim and fisheries outreach specialist Titus Seilheimer wrangled over the differences between "aquatic invasive" and aquatic nuisance" species. Want a recap? Surf to uwiscseagrant.tumblr.com and search "conversations."

#### You Spoke Up. We Heard. **More Stories, Keep Print Copies**

Thanks for speaking up. More than 125 of you did. Geologists, boat captains, educators, researchers, biologists and more. All disparate disciplines but bonded by an interest in aquatic sciences. These people responded to our survey about the Aquatic Sciences Chronicle that was in the field from late February through April.

The feedback will guide us as we select stories for future issues. We heard, for example, that some readers would like an expanded number of stories, but requested the stories themselves be shorter. We heard that you'd like more waterrelated research information and updates on some previously told stories. Finally, it seems the print version of the Chronicle, not the online one, is the preferred format. That tells us that we will continue to offer both.

Just because the survey has concluded does not mean you have lost the chance to let us know what you think about the publication, or other aquatic sciences matters. You can reach us through following ways:

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#### WATER RESOURCES INSTITUTE RESEARCH



#### It's one of the biggest crises facing the Great Lakes in the modern era, and Charles Melching finds himself right in the middle of it.

Or, perhaps more accurately, behind the scenes of it. Backed by funding from the U.S. Army Corps of Engineers (Corps), through the University of Wisconsin Water Resources Institute, Melching, an environmental consultant and former professor at Marquette University, is using a computerized model to predict what will happen to the water flow-and water quality-in the Chicago Area Waterways System (CAWS) if the Corps reseparates the Mississippi River basin from Lake Michigan within the CAWS. This hydrologic separation is one of the alternatives proposed to permanently prevent aquatic nuisance species, including the invasive Asian carp, from colonizing and potentially ravaging the lake's ecosystem.

The model's known as DUFLOW, and it's designed to map out the hydraulic and water quality properties of the entire river system, including predicting how flows and water quality might fluctuate when sewage systems overflow in cases of heavy rainfall. Melching, who developed the model in conjunction with Marquette University for the Metropolitan Water Reclamation District of

#### UNIVERSITY OF WISCONSIN

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Greater Chicago (MWRDGC), will be looking at two separation scenarios and a baseline "without project" scenario.

According to Melching, the major factor influencing the baseline scenario is the MWRDGC's and Corps' plans to open two reservoirs to store combined sewer overflows along the Chicago and Calumet rivers. By 2017, it is anticipated that one reservoir will be fully operational while the other will be partially operational.

> The first separation scenario involves building a barrier between the Lake Michigan basin and the Mississippi River basin near the current Lake Michigan diversion points on the North Shore Channel at Wilmette, Il., the Chicago River in downtown Chicago, and Calumet River at the O'Brien Lock and Dam in southeast Chicago. This scenario is similar to the "closing of the locks and gates" advocated by Great Lakes states governors to the federal courts, and it may have significant effects on potential flooding in the Chicago area.

The second separation scenario involves re-

The Chicago Area Waterways System (above) would experience the effects of a possible separation between the Mississippi River basir and Lake Michigan **Charles Melching** developed a model to evaluate those effects under two different scenarios

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#### wisconsin'swaterlibrary



## Reading to inspire future marine scientists

Children of all ages often see themselves growing up to be whale scientists or dolphin caretakers. But the marine sciences include so many diverse fields-from biology to ocean engineering to environmental education. The Water Library has created a list of children's and young adult books that illustrate the different careers and just might inspire the next Jacques (or Céline) Cousteau

#### **ENVIRONMENTAL PIONEERS**

By Patricia Byrnes. Minneapolis: Oliver Press, 1998. This book profiles people who have been influential in the environmental movement-John Muir, Jay Norwood "Ding" Darling, Rosalie Edge, Aldo Leopold, Olaus and Margaret Murie, Rachel Carson, David Brower and Gavlord Nelson

#### FORECAST EARTH: THE STORY OF **CLIMATE SCIENTIST INEZ FUNG**

By Renee Skelton. New York: Franklin Watts, Scholastic, 2005. This book, part of the "Women's Adventures in Science" series, is the story of a scientist and her science, drawing on firsthand accounts from Inez Fung and her friends, family and colleagues. It tells how a quiet girl from Hong Kong grew up to become one of the world's most respected climate scientists.

#### **THE FROG SCIENTIST**

By Pamela S. Turner. Boston: Houghton Mifflin Books for Children, 2009. Tyrone Hayes works to discover the effects pesticides have on frogs and, in turn, us.

#### **MANFISH: THE STORY OF JACQUES COUSTEAU**

By Jennifer Berne. Illustrated by Eric Puybaret. San Francisco: Chronicle Books, 2008. Before Jacques Cousteau became an internationally known oceanographer and champion of the seas, he was a curious little boy. In

this lovely biography, poetic text and gorgeous paintings combine to create a portrait of Jacques Cousteau that is as magical as it is inspiring.

If you wish to see more books on this topic, visit our recommended reading list at go.wisc.edu/dd81x2

Anyone in Wisconsin can borrow these books. Just email askwater@agua.wisc.edu.

## programpeoplenews



## **Providing the Latest and Best Information**

We've updated several of our fact sheets to provide the most up-to-date information about coastal engineering, cold weather and water pollution.

All are available by free download from our publications store (aqua.wisc.edu/publications). Look for "Nitrate in Groundwater," "Arsenic in Groundwater," "Mercury, Fish and Aquaculture," "Danger, Thin Ice," "Hypothermia: Surviving in Cold Water," "Stabilizing Coastal Slopes on the Great Lakes," and "Working With Engineers and Contractors on Shore Protection Projects."



## **Barry Johnson** Where is he now?

Barry Johnson, now a branch chief at the U.S. Geological Survey, Upper Midwest Environmental Sciences Center, in La Crosse, Wis., was supported as a Ph.D. student by Wisconsin Sea Grant during the 1980s for two projects. For the first, Johnson developed a computer model to look at the effects of a commercial harvest quota system on the yellow perch population in Green Bay. For the second, he helped develop a general fish bioenergetics model that could be applied to different species. Retired University of Wisconsin-Madison professor James Kitchell guided Johnson in these projects.

Johnson said the fish bioenergetics model gained him more professional attention than his perch work, thanks in part to the power of Sea Grant outreach.

"Jim Kitchell and his students had developed a number of fish bioenergetics computer models that were specific to particular species," Johnson said. "My work built on that and on a general model developed by post-doc Steve Hewitt that managers could apply to any species for which they had appropriate information." The model was designed to help managers determine how fish grow and how much they eat under different environmental circumstances and conditions of fishing mortality, Johnson said.

With the help of former Sea Grant Green Bay Outreach Program Manager Cliff Kraft, Johnson developed a series of workshops to teach resource managers and researchers how to use the bioenergetics model.



Preparing communities for coastal storms, enhancing the Madison and a bachelor's in zoology from Colorado State water quality of Green Bay, protecting wetland habitats-University. does all this sound like a job for a super human? Well, Julia She brings a varied perspective, having worked in a wetland Noordyk is up to the challenge. She began work as Wisconsin in the south of France, taught zoology in Madison and helped Sea Grant's water quality and coastal communities specialist with the condor recovery program in California. out of the Green Bay Field Office in March. With all this traveling under her belt, Noordyk is looking

Her position is a combination of existing and new duties. Noordyk will be learning about the Green Bay habitat from Sea Grant's Vicky Harris before Harris completes her postretirement projects this summer. Given Harris's 37 years of experience, some would say absorbing this knowledge will be a super-human feat in itself. Coordinating the Great Lakes Sea Grant coastal storm hazard network to deliver mitigation and coastal storms adaptation products across the Great Lakes will be among the job's new duties. Her position will be partially funded by the NOAA Coastal Storms Program Office.

A former NOAA coastal management fellow, Noordyk comes to Sea Grant from the Maine Coastal Program where she was a senior planner working on outreach programs in offshore wind energy, water quality and coastal public access. Noordyk has a master's degree in conservation biology and sustainable development from the University of Wisconsin"My time in Madison prepared me to be an independent researcher at the highest level," Johnson said. "The folks in Madison are at that level, and you can't help but have some of that rub off on you."

"It was an excellent experience," Johnson said. "The kind of experience I would hope all Ph.D. students could have."

Johnson sums up the Sea Grant student experience like this. "Students can get funding from a variety of sources, but Sea Grant's infrastructure, both in Madison and around the state, provides extended support that was critical for the work I did and in bridging the academic and management communities."- MEZ

# **Julia Noordyk** New Water Quality and Coastal Communities Specialist

forward to putting down roots in Green Bay. "This job is the first official step into my career," Noordyk said. "I'm excited about the chance to become part of the community and to be able to work within it."

In fact, helping communities is what attracted her to her new Sea Grant job. "I like working with people and using tools to get groups together to solve problems," Noordyk said. "I am also thrilled to work on the environmental pieces -the water quality, habitat restoration and coastal hazards. These are the type of issues I can't wait to dig into."

"We are pleased that Julia has decided to join us at Wisconsin Sea Grant," said Phil Moy, University of Wisconsin Sea Grant assistant director for outreach and research. "Her enthusiasm. skills and abilities make her a terrific addition to our staff."

Although she will miss her colleagues and the beauty of Maine, Noordyk is looking forward to exploring northeastern Wisconsin and being closer to family. Apparently, even super heroes need support. — MEZ



establishing the natural divide between the Lake Michigan basin and the Mississippi River basin near the beginning point of the man-made Chicago Sanitary and Ship Canal.

"In this scenario, we're saying we'll let the original Chicago and Calumet rivers (and the effluent from two large wastewater treatment plants) drain back to Lake Michigan," Melching explained. "Everything else, including the majority of the pumpback of captured and treated combined sewage, will go to the Mississippi River basin."

This scenario, while accomplishing the goal of blocking Asian carp from reaching Lake Michigan through the waterway, will have a far more dramatic effect on the water quality of both the CAWS and the lake.

"The big question is, if we do this, how much of a pollutant load is going into Lake Michigan?" asked Melching.

Melching and his team are still months away from answering that question-in fact, they only submitted their initial model results to the Corps in February, with a full draft report due in June. He's quite aware of the public scrutiny his work will generate.

"It's interesting. All the work I've done in the waterway prior to this project was dealing with conditions as of now," said Melching. "Now I'm looking at what's projected to happen in the future. Can we properly characterize the changes in a logical, defensible way?"

As Melching knows, the health and survival of the Great Lakes ecosystem may depend upon it. -ARC

## **SEA GRANT INSTITUTE RESEARCH** HEAVY METAL

continued from page

Martin Shafer and a team of UW-Madison researchers are studying the effects of copper and cadmium on algae and the effects of dissolved organic matter on copper and cadmium.

because, according to Martin Shafer, associate are to the effects of metal pollution." scientist at the University of Wisconsin-Madison College of Engineering, "There's a lot going on there. It's an area of growth for plants and animals, and there are a lot of metal inputs to it. Also, there's a lot happening that can affect the availability and toxicity of metals."

State Lab of Hygiene, looked at the impact of copper and cadmium on a single-celled phyto-

plankton, Chlamydomonas reinhardtii. When this flagella-driven alga is exposed to metals, be damaging to cells when produced in excess.

> important to understand toxthe project and now a post-

The researchers focused on nearshore regions producers and we need to know how sensitive they

The researchers looked at production of both glutathione and ROS to identify measures of exposure and how to predict toxicity before cell death occurs, which, Shafer said, only makes sense. "Traditionally, long-term toxicity tests measure cell death. That's sort of late in the game if you want The project, also supported by the Wisconsin to protect organisms. We looked at understanding potential toxicity before the organism is killed or had its growth significantly affected."

Researchers also looked at the effect that dissolved organic matter (DOM) has on trace metal it produces an antioxidant called glutathione toxicity in water. The root beer-colored streams to protect itself. Glutathione and other anti- of northern Wisconsin provide good examples oxidants may protect cells from substances of DOM. The color comes from dissolved plants called reactive oxygen species (ROS), which and other carbon-based materials that get into the form in the presence of metals and can water. As it turns out, DOM is a good thing.

> "We demonstrated it takes very little DOM to dramatically reduce the toxicity of copper and "We studied algae because it's cadmium to phytoplankton," Shafer said. "DOM binds to the copper and cadmium and keeps it from icity at all levels of the food binding to the phytoplankton cells. We discovered web," said Tasha Stoiber, what levels of DOM are needed to out-compete the former graduate student on cells for the metal and prevent its toxicity."

> With these inputs in mind, the team has modidoctoral researcher at the fied a model that regulatory agencies use to calcu-University of California, Davis. late safe standards for copper and cadmium in the 'Phytoplankton are the primary environment. Shafer said the EPA is changing its approach based on these and other findings. — MEZ

## **Dashboard Repair UW SEA GRANT GRAD STUDENT RESTORES ONLINE HYDROLOGIC TOOL**

Six years ago, David Hart, geographic information sys- individual icons to view a static radar image of the total tems outreach specialist for Wisconsin Sea Grant, hired precipitation from a storm. several graduate students to create an online hydrologic 'What we want the dashboard to show is how a storm dashboard that let users view spatial, geophysical and affects Green Bay once the storm gets through the watertemporal storm data in the Green Bay watershed. shed and out into the bay itself. How does it change the Hart was inspired to develop the dashboard by a big water there?" said Hamilton.

storm event that hit Duluth in October 2005, sending plumes of red clay sediment blooming out into Lake Superior. "I wanted to know the story of what happened," said Hart. "Where and how did the storm hit?"

Before the dashboard, motivated users could find the hydrologic data that told the story, but not in one place.

It was a great idea. Trouble was, the dashboard was programmed using Flash, a closed-source platform/plugin that's largely fallen out of use. A few years after the students created it, the original dashboard was both broken ship of the Great Lakes." —ARC and challenging to update.

End of story? Not quite. Enter Erin Hamilton, a 26-yearold graduate student with the UW-Madison's department of geography. Hamilton spent much of the last year recreating the dashboard in Javascript, an open-source code that can be updated easily on multiple platforms, especially mobile platforms. Thanks to Hamilton's efforts, the dashboard's now back to full functionality—and you can view it here: maps.aqua.wisc.edu/fwhd/hydrologic. html.

"The main idea of the dashboard is to give users the opportunity to view a storm event from start to finish," explained Hamilton. "We wanted to let people see what kinds of effects the storm has on streams as the water moves through the watershed."

Hart and Hamilton are hoping to add more features to the dashboard, including the ability to animate storm events-currently, users can click

## **Playing the Changes at NOAA**

UW Sea Grant's 2013 Knauss Fellow, Jenn Phillips, is sending us updates about her year-long placement in Washington, D.C. This update is from April. To see more, go to uwiscseagrant.tumblr.com.

week where I see NOAA leaders acting gracefully and positively considering the many ways they are stretched and ence and allowed me to see the span of decisions that are made across the agency and how they are delivered and received.

Even in these challenging economic times, I've done very rewarding things. For example, I've written high-level

I sit in on several high-level meetings a capabilities for the future as well as for a series of education-related events lots of other writing (some about our in May, which includes logistical planoutgoing NOAA administrator, Dr. ning and coordinating with key players Lubchenco). I've spent a Saturday at inside and outside NOAA while also strained. It's been a humbling experi- the Chesapeake Bay Bowl, one of the helping with speech writing. regional competitions of the National Ocean Sciences Bowl, with Dr. Sullivan portive and fun group of coworkers, (acting NOAA administrator). I have who have made it clear that no matter spent an evening in the Smithsonian what happens in the next few weeks, National Museum of Natural History months or even year, taking this position listening to Sen. Begich and Dr. John will surely be one of the most rewarding Walsh speak about the changing Arctic. things I've ever done. —JP climate documents outlining NOAA's And now I am preparing Dr. Sullivan

The dashboard's target audience is water resource managers, who could potentially use it as a tool to help them make better decisions on planning and allocating resources to prepare for future storm events. Hart sees it as a key part of a much more expansive toolbox.

"When you put this in touch with other geotools we're developing, we're really building a narrative in Green Bay," said Hart. "It could become part of a solution that would allow people to be much more engaged in steward-



Above all, I have an amazingly sup-

**UGA** 



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## **Aquatic Sciences Chronicle**

a joint newsletter from UW Sea Grant and UW Water Resources



#### **CALENDAR** OF EVENTS

#### AUG. 7, 2013

Sea Grant and Water Resources at the State Fair West Allis, Wis. *wistatefair.com/wp* 

#### AUG. 7-9, 2013

**Wisconsin Association of Environmental Educators Conference** Stevens Point, Wis. *bit.ly/LmnUM8* 

#### AUG. 8-12, 2013

143rd Annual Meeting of the American Fisheries Society Little Rock, Ark. *afs2013.com* 

#### SEPT. 10-12, 2013

**9th Annual Great Lakes Restoration Conference** Milwaukee *conference.healthylakes.org* 



#### **Pick a Fish**

We will soon be reprinting our popular Great Lakes Fishes Poster **seagrant.wisc.edu/fishposter**, and we're taking suggestions for changes. Is your favorite fish included? Any you'd rather not see? Send your suggestions to our Fisheries Outreach Specialist Titus Seilheimer at **tseilheimer@aqua**. **wisc.edu**. The deadline for suggestions is Sept. 20, 2013. All responses will be included in a drawing for five winners of a free poster, so please include a way to contact you.

