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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:


Helen Mandalopoulos

WATER RESOURCES INSTITUTE RESEARCH

TRACKING MERCURY

POLLUTANT QUICKLY FINDS ITS WAY INTO FISH

Morning breaks over the south basin of Lake 658. The north basin and wetland are around the bend at the center of this view as seen from the boat launch and staging area near Lake Winnange.

They took to the remote lake in Canada under the cover of dusk, dripping pollution into the water via the boat's prop wash. Were these culprits improperly disposing of industrial waste? No. They were researchers, and their actions were in the name of science.

The setting was a unique area in Ontario, about 40 miles east of Kenora on the Trans-Canada Highway and then due south another 10 miles. The Experimental Lakes Area (ELA) is one of the only place in the world where researchers can practice experimental limnology; in other words, instead of relying on computer models or other simulated conditions, they can study a real lake and see what happens.

The water body in question is Lake 658, a smallish 19-acre lake in the ELA surrounded by wetlands and an upland habitat. Water Resources Institute-funded scientists wanted to observe how the lake and surrounding environment reacted when mercury was added to the system, with the ultimate goal of seeing how it recovered once the mercury addition was discontinued.

The project was part of a larger study called METAALICUS (Mercury Experiment to Assess Atmospheric Loadings in Canada and the United States), designed to discover how a watershed and its lake would respond to changes in mercury loading.

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Aquatic Sciences Chronicle

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FEATURED SOCIAL MEDIA + WEB

Aquaculture and You—the Podcast

seagrant.wisc.edu/aquacultureandyou

Amazed by aquaculture?

If you aren't already, you will be by the end of Wisconsin Sea Grant's "Aquaculture and You," a 14-episode podcast series that traces the origins of aquaculture, examines its historical and modern advantages and challenges, and even provides some ideas for setting up your own aquaculture operation.

Freshwater aquaculture is one of the fastest-growing food trends of the modern era and is a process that should provide jobs, sustainable food and biosecurity for the U. S. in the 21st century.

To put it all in perspective, Chris Bocast, ASC's audio specialist, has produced a story that begins in imperial China and medieval Europe. The series traces the development of aquaculture through the Industrial Revolution and into the 20th century. Later episodes take the listener behind the scenes of today's industrial-scale aquaculture operations, such as Indiana's Bell Aquaculture.

Download the series for free in the podcast section of Wisconsin Sea Grant's website, **aqua.wisc.edu/channel/38**.

FERTILIZER

Producing Perfect Plankton for Picky Perch

Among fish farmers, it's known as "the bottleneck," the six-week period between the point when a fish fry is released into a pond and the point when it's grown large enough to become feed-trained. For many fish farmers, it's the make-or-break phase of the operation—will enough fish survive for me to turn a profit? Chris Hartleb, professor of fisheries biology at the UW-Stevens Point, recalls a conversation he had with a yellow perch farmer a few years ago.

"I asked him, 'How many fish do you put in your pond?'" recalled Hartleb. "He told me, 'I put half a million in, and I expect that after six weeks I'll only get 10,000.' These farmers are massively overstocking their ponds just so they'll meet their quota. That's such an inefficient way to operate."

The problem stems from the fact that yellow perch, the delicious staple of the Midwest's Friday night fish fry, aren't as domesticated a fish species as catfish or rainbow trout. In other words, perch fry first have to learn to feed on tiny zooplankton produced by specific types of algae. If the zooplankton aren't present or develop too late, the perch will die. Often in disturbingly large numbers.

"Getting the first feed is a very tricky proposition," said Hartleb. "Yellow perch are extremely finicky and are gape limited; that is, they have a very small mouth for a predator."

Fueled by funding from Wisconsin Sea Grant, Hartleb set out to determine whether organic or inorganic fertilizer would promote the particular type of algae and zooplankton fledgling perch need to survive.

Over a two-year period, Hartleb and his research team used 34 ponds, located at the Lake Mills State Hatchery and Coolwater Farms in Deerfield, Wisconsin, to compare the results of organic fertilization, a process that involves allowing manure to decay in the pond, and inorganic fertilization, a process that involves mixing nitrogen, phosphorous and carbon and spraying the pond water.

The results may surprise those who've come to believe that "organic" always equals "better."

"What we found is that inorganic fertilization resulted in the proper type of algal blooms, and, as a result, a far greater survival rate for the perch larvae," said Hartleb.

The difference boils down to timing and type of algae. It takes far longer—around 8-10 weeks—for the organic fertilizer to break down, enrich the pond water and produce algae blooms. By that

Capturing feed-trained yellow perch fingerlings (above). Getting the first feed is a very tricky proposition. Yellow perch are extremely finicky.

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wisconsin's**water**library

Read All About Aquaculture

Aquaculture in Wisconsin is a diverse industry that includes raising freshwater bait fish, stocker fish, aquatic plants, crayfish and more. As a food trend, the freshwater aquaculture industry is growing quickly and has the potential to provide jobs and sustainable food for the U. S. in the 21st century. Check out some books about this exciting trend.

AQUACULTURE ENGINEERING

By Odd-Ivar Lekang. Ames, Iowa: Blackwell Pub., 2007.

The author of this comprehensive book introduces many aspects of engineering that are applied to aquaculture systems including material technology, building design and construction, mechanical engineering and environmental engineering.

ENVIRONMENTAL IMPACTS OF AQUACULTURE

By Kenneth D. Black. Boca Raton, Fla.: CRC Press, 2001.

This text examines the relationships between the activities of aquaculture and the environment through examination of topics including tank culture and recirculating systems, genetic impacts, modeling ecological effects, aquaculture as a component of integrated coastal zone management, and sustainability of aquaculture.

ENVIRONMENTAL BEST MANAGEMENT PRACTICES FOR AQUACULTURE

Edited by Craig S. Tucker and John A. Hargreaves. Ames, Iowa: Wiley-Blackwell, 2008.

This book provides technical guidance to best management practices (BMPs) for the mitigation of environmental impacts of aquaculture in the United States. Topics covered development and implementation of BMPs, BMPs for specific aquaculture production systems, and the economics of implementing best management practices.

MANAGING WISCONSIN FISH PONDS

By William Swenson, et al. Madison, WI: University of Wisconsin Extension, 2000.

UW Extension provides up-to-date, reliable information for those interested in building or managing existing fish ponds. Processes and principles are explained and offered as examples from which to choose based on your specific situation.

MOLECULAR RESEARCH IN AQUACULTURE

By Ken Overturf. Ames, Iowa: Wiley-Blackwell, 2009.

Context to provide an understanding of molecular research and its applications to the aquaculture industry are presented in this volume in a format that allows individuals without prior experience in this area to learn about and understand this important topic.

If you wish to see more books on this topic, visit our recommended reading list at **aqua.wisc.edu/channel/39.**

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

OUTREACH

Narayan Mahon

Vicky Harris assisted the Wisconsin Department of Natural Resources in evaluating waterfowl populations of Green Bay.

Green Bay Waterfowl Populations Just Ducky

Aerial and ground waterfowl surveys of Green Bay conducted by the Wisconsin Department of Natural Resources (WDNR) in October yielded surprising results, and Wisconsin Sea Grant's Vicky Harris was on hand to help.

On Harris's first survey, team members saw an estimated 48,000 ducks, an unusually high number. Canvasback and redhead ducks were the most common types. Aerial surveyors count the ducks via voice recorder; then someone else listens to the recorder and gets a number estimate. Harris was involved in what's called "ground-truthing," using binoculars and spotting scopes to verify counts.

WDNR wardens use the counts to determine "duck-use days" for the bay as part of the effort to get it delisted as an area of concern. The wildlife population target is 2 million duck-use days. Back in the 1970s, the number of duck-use days was less than 1 million. According to Harris, the 2 million goal was first met in the 1990s, but an official duck survey hasn't been done since 1997-99.

Given that other wildlife population targets haven't been met, WDNR wardens needed an updated survey to ensure that duck numbers are still strong. (Apparently, they are.) They're also interested in seeing how declining water levels and changes in food availability have affected duck species in the bay area. —MEZ


Kristina Kostuk

Titus Seilheimer, Fisheries Outreach Specialist

But for a few twists of fate, University of Wisconsin Sea Grant Institute's new fisheries outreach specialist could have ended up a beekeeper instead.

Growing up in the small town of New Auburn, Wisconsin, **Titus Seilheimer**'s family owned more than 5,000 hives, the largest operation in the state at that time. "We used them for pollination, and honey production too," he said. "Cherry and apple trees in the spring. Cranberries in the summer. I spent a lot of time in Door County."

In his new role, which began in December, Seilheimer is poised to oversee a very different sort of pollination—pollinating the state's environmental groups and recreational and commercial fishermen with Wisconsin Sea Grant research findings.

"My biggest role will be to bridge the gap between the research and the people who can use the research," said Seilheimer. "Sometimes there's a disconnect between the two groups, and I want to help solve that."

Seilheimer, 34, is no stranger to the world of Great Lakes research. He holds a Ph.D. in biology from McMaster University in Hamilton, Ontario, where he studied fish habitat in Great Lakes coastal wetlands. He's also done research in New York and Oklahoma. For the last several years, Seilheimer has been working as a research ecologist for the U.S. Forest Service's Northern Research Station in St. Paul, Minn., developing water quality models for the western Great Lakes. In previous jobs, he's headed research that looked at how fish habitat responded to changes in environmental flows in streams and rivers.

> "My biggest role will be to bridge the gap between the research and the people who can use the research."
> TITUS SEILHEIMER

Phil Moy, Wisconsin Sea Grant's assistant director for research, served as the organization's fisheries outreach specialist from 1999 to the present. Moy said Seilheimer will have no shortage of issues to sink his teeth into, from aquatic invasive species' effects —including the ever-looming threat of the Asian carp— to trap net safety and questions about the effects of changing climate on fish and Great Lakes' food webs.

Seilheimer will be based in Wisconsin Sea Grant's Manitowoc Office, on the UW-Manitowoc campus.

For now, he's trying to facilitate moving his wife, Amy Fettes, and their two young sons (Tor and Leif) from Minnesota to Manitowoc. Coincidentally, Fettes' UW-Green Bay graduate research on zebra mussels in Green Bay was funded by Wisconsin Sea Grant.

"My oldest will start kindergarten next year, and it'll be nice to be in one place and not have to think about moving every few years," he said. "Mostly, I'm excited to do some great work in the Great Lakes."

Seilheimer's already become active on Twitter. You can follow him at **@DrFishSG**.

—ARC

Christopher Babiarz/Water Resources Institute

WATER RESOURCES INSTITUTE RESEARCH

TRACKING MERCURY

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Above left, Jim Hurley and and Todd Kuiken, Canada Department of Fisheries and Oceans, homogenize the mercury isotope solution to ensure the carboys on each boat have the same concentration. Above right, the group prepares the boats before the first addition of mercury isotopes to Lake 658, June 19, 2001. Left to right: John Rudd, Jim Hurley, Tara Trinko, Mike Tate, Ken Sandilands and Todd Kuiken.

For this study, researchers added enriched stable (non-radioactive) isotopes of mercury to Lake 658 and the surrounding watershed. They used different isotopes for the lake, the upland and the adjoining wetland so they could trace which contributed more to the eventual mercury pollution of the plankton and fish. They also wanted to see how quickly this "new" mercury reacted with the "old" mercury already stored in the environment.

The mercury was added to the lake at night because sunlight can vaporize it. The amount added was not excessive — only about two to three times what would typically occur in background levels. The lake was dosed with a colorless mixture of mercury premixed with a batch of lake water once every two weeks from ice-on to ice-off over the course of seven years (three years for this particular study). Mercury was applied to the watershed with the help of a crop duster plane once per year.

Researchers found that this new mercury, as opposed to the old mercury, got assimilated into the environment very quickly and that the new lake-deposited mercury made up the bulk of the mercury in fish. They also discovered that it took much longer for mercury added to the watershed to be taken up by plants and animals in the lake food chain. Their findings were published online in "Science of the Total Environment" in an article titled "Importance of Hypolimnetic Cycling in Aging of 'New' mercury in a northern Temperate Lake" **aqua.wisc.edu/channel/40.**

"It was amazing how fast the mercury got into fish," said James Hurley, project researcher and director of the Water Resources Institute (WRI). "In order to get to that point, the mercury has to get to parts of the lake where it is transformed by microbial processes into methyl mercury. Then it has to get through the food web to accumulate in fish. We started seeing the isotope we added in June accumulate in yellow perch by early fall. By the start of the second year, we were clearly seeing it even in predatory fish."

"Before this study and the other METAALICUS work, we really didn't really have any idea about how long it took for mercury to move through the environment," said David Krabbenhoft, a lead investigator for METAALICUS and a research hydrologist with the U.S. Geological Survey's Wisconsin Water Science Center. "This study has been very useful for that."

"The other amazing thing was that after we stopped adding the mercury isotope, we quickly started to see the mercury concentration in predatory fish drop," Hurley said. These findings were discovered in follow-up studies.

Results from the study of Lake 658 are already being used by environmental regulators to protect lakes on a nationwide basis. Hurley and Krabbenhoft said the Environmental Protection Agency used them to help justify rules for decreasing mercury emissions from power plants through the Mercury and Air Toxics Standards passed in 2011.

A basic part of the scientific method is replication. It may be very challenging for other scientists to try to replicate these results or attempt further whole-lake manipulations because funding for the ELA has been cut by the Canadian government and the scientific area may be closed if other funding sources or operators can't be found.

According to Kevin Hill, communications manager for the Central and Arctic Region for Fisheries and Oceans Canada, discussions about the fate of the ELA are ongoing and "for reasons of confidentiality, we cannot provide additional information at this time."

For more information about mercury and the METAALICUS study, listen to this WRI-produced podcast **aqua.wisc.edu/channel/41**. —MEZ

Education Evolution

KATHY KLINE'S LATEST UW SEA GRANT GIG IS EDUCATION OUTREACH

Her name's certainly familiar to longtime Wisconsin Sea Grant followers—Kathy Kline has been with the program since 2004, as a science writer, co-author of the popular book "People of the Sturgeon" and, for the last few years, a general outreach specialist. Now she's moving into a new outreach education specialist position.

"We are very pleased that Kathy has taken on this new role with Wisconsin Sea Grant," said Phil Moy, UW Sea Grant's assistant director for research. "She brings with her a new perspective and energy that will work well with our current and new program initiatives."

New national guidelines for science, technology, engineering and math (STEM) education in grades K-12 are expected to be approved by the state of Wisconsin by early next year, and those will likely serve as a framework for Kline's efforts. Kline will also be front and center in implementing UW Sea Grant Director Jim Hurley's plans to enhance the experience of UW Sea Grant-supported graduate students.

Kline is actually a former Sea Grant graduate student herself. In 2000, she was a student writer for the popular Earthwatch Radio series, an experience that led her to apply for a position with New Hampshire's Sea Grant program, where she worked prior to returning to Wisconsin.

"I didn't know anything about Sea Grant before I started working here as a graduate student, and I didn't know much about the Great Lakes, either," said Kline. "As I wrote for Earthwatch and learned more about Sea Grant, I realized what a powerful mission it has—research, outreach and education all working together to sustain our Great Lakes resources. It was my grad student experience that introduced me to Sea Grant, and I feel so fortunate to have been involved with it ever since." — ARC

"Kathy brings a new perspective and energy."
PHIL MOY

EDUCATION

SEA GRANT INSTITUTE RESEARCH

FERTILIZER

Producing Perfect Plankton for Picky Perch

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time, large chunks of the perch fry population have starved and died. Inorganic fertilizer (top) moves more quickly to produce a particular type of cladoceran plankton called Bosmina. Bosmina is the right-sized zooplankton perch fry need to thrive. Organic fertilizer (bottom) favored a different type of plankton called Copepod that's far less desirable to the perch and resulted in lower survival.

"Using inorganic fertilizer yields a twofold benefit: it produces quickly and it produces the appropriate type of algae," said Hartleb.

Hartleb's original research proposal aimed at calculating the proper ratio of nitrogen, phosphorous and carbon to create a successful inorganic fertilizer formula. He hoped that a process used by fish farmers in the South would also work in Wisconsin, but it wasn't to be. Wisconsin's colder water disrupts the absorption process.

"There are rough guidelines for the ratio," said Hartleb. "But a lot of it is still trial and error. Due to a variety of factors, each farmer's pond behaves differently." —ARC

Application of inorganic fertilizer resulted in a type of algal bloom that produced more of the zooplankton perch fry need to survive (top) than organic fertilizer, which resulted in algal blooms that produced more of a less-desired type (bottom). Photos by Chris Hartleb.

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Aquatic Sciences Chronicle

a joint newsletter from UW Sea Grant and UW Water Resources

CALENDAR OF EVENTS

MARCH 7 AND 8, 2013
American Water Resources Association
— Wisconsin Section Meeting
Brookfield, Wis.
state.awra.org/wisconsin/2013meeting.html

MARCH 25 – 27, 2013
American Water Resources Association
Spring Specialty Conference
St. Louis
awra.org/meetings/Spring2013/special-session-call.html

APRIL 18 – 21, 2013
National Ocean Sciences Bowl
Milwaukee
nosb.org

JUNE 9 - 14, 2013
Association of State Floodplain Managers 56th Annual Conference
Hartford, Conn.
floods.org/index.asp?menuID=223

We're Looking for Feedback About This Newsletter

As you are aware, Wisconsin's water resources are plentiful and valuable. The Aquatic Sciences Chronicle strives to share news of research, outreach and education efforts that foster sustainability of these resources. Please let us know what you think of the Chronicle. There is a self-addressed, postage-paid card in this issue for you to complete and return to us. Or visit **aqua.wisc.edu/chronicle/survey** and complete the brief survey online.

All respondents will be entered into a drawing for a **$50 gift certificate** from our online store; include your mailing address at the end of the survey. We'll give away three gift certificates, randomly selected from completed surveys.

Please respond to the survey no later than **April 25**.