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Biennial Report **2002-2004**

University of Wisconsin Sea Grant Institute



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Sea Grant is a unique partnership with public and private sectors combining research, education and technology transfer for public service. It is a national network of universities meeting the changing environmental and economic needs of people in our coastal, ocean and Great Lakes regions.





From the Director

Visualizing healthy coastal development. Illuminating the molecular mechanisms of dioxin's toxicity. Preventing an invasion of Asian carp. Advancing technology and training for a new Wisconsin industry. These are among the highlights of another successful biennium for the University of Wisconsin Sea Grant College Program, a statewide program of research, outreach and education for the protection and sustainable beneficial uses of our Great Lakes, coastal and ocean resources.

As described in the following pages, UW Sea Grant supports a highly effective, award-winning research, outreach and education program that employs a richly integrated, issue-oriented approach. This approach effectively cross-links and thereby augments the efforts of specialists in a wide range of disciplines, including biology, ecology, chemistry, medicine, engineering, geology, computer science and biotechnology.

Our program provides highly competitive, rigorously peer-reviewed awards totaling about \$3 million annually to principal investigators at Wisconsin's leading institutions of higher learning. During 2002-04, more than 100 Wisconsin faculty, staff and students in 60 departmental units participated in 37 Sea Grant projects involving seven UW System campuses, five out-of-state universities, three state agencies and two units of the U.S. Geological Survey.

Projects funded by UW Sea Grant are selected through an external screening process that takes into consideration carefully developed state and regional priorities that address national priorities in 10 broad thematic areas identified by NOAA Sea Grant officials, leaders of the national Sea Grant Association and members of the greater aquatic sciences community. This ensures that the Wisconsin Sea Grant program remains accountable to the needs of our nation as well as to those of our state and region.

The UW Sea Grant program thus continues to be a leading member of a distinguished national network of 30 university-based programs funded primarily through the National Sea Grant College Program, National Oceanic & Atmospheric Administration (NOAA), U.S. Department of Commerce, with matching contributions from participating coastal states and private sources.

We are proud to share with you our accomplishments during this biennium, and we invite you to visit our Web site at www.seagrant.wisc.edu to learn more about our program and its many activities.

Anders W. Andren
Director





producing **significant** impacts
University of Wisconsin Sea Grant Institute

UW–Madison graduate student Jane Remfert (left) and undergraduate student Meghan Olson (right) prepare algae for feeding zebra and quagga mussels for a Sea Grant-supported research project.

Bringing Charges against Invasive Species

For the last eight years, Wisconsin Sea Grant fisheries specialist **Philip Moy** has been working to prevent a catastrophe in the Great Lakes—an invasion of Asian carp.

These voracious fish escaped from southern fish farms more than 10 years ago and since then have made their way up the Mississippi and Illinois rivers.

They are now poised to enter the Great Lakes via the Chicago Sanitary and Ship Canal, a 28-mile manmade waterway that connects the Illinois River with Lake Michigan.

Blocking them are a temporary barrier and a very determined team of people. Moy co-chairs the 27-member, multiagency Aquatic Nuisance Species Advisory Panel that provides input and guidance to the U.S. Army Corps of Engineers in developing a way to keep the carp out of the Great Lakes. **Gerry Barnhart**, chair of the Great Lakes Fishery Commission, says the work of this advisory panel is absolutely critical.

“Based on the havoc these carp have wreaked in the Mississippi River, we have every reason to believe they would devastate the Great Lakes ecosystem as well,” he says.

Asian carp grow up to four feet long and weigh 100 pounds. One type—the silver carp—leaps out of the water when startled by engine noise, sometimes smacking into boaters and injuring them. Just as startling is that all of the carp eat enormous amounts of animal and plant plankton—the same diet needed by all young native fish as well as several popular adult sport species. A carp invasion of the Great Lakes system could jeopardize its \$4.5 billion fishery, says Barnhart.

To safeguard the Great Lakes, the National Invasive Species Act authorized the barrier project in 1996. Moy served as its first project manager as a fishery biologist for the U.S. Army Corps of Engineers, and he has continued to lend his expertise since joining UW Sea Grant in 1999.

Moy and his colleagues on the panel reviewed a wide range of options for securing the Chicago canal and finally recommended building an electric barrier to repel invasive species. The barrier would be effective, affordable and safe for the environment, the panel decided, and it wouldn’t interfere with water flow or navigation. The Corps followed the advice and installed a temporary barrier in 2002. Moy and the panel have since urged the Corps to build a more secure and permanent replacement.

Asian carp can grow four feet long and weigh 100 pounds.

They’re gobbling up large amounts of plankton in the Mississippi River, robbing native fish of food. The Great Lakes’ \$4.5 billion commercial and recreational fishery could be at stake if these foreign fish breach the electric barrier on the Chicago San-Ship Canal.





zeroinginon
zebra mussels

Moy's perseverance did not end there. He led a group that developed a "rapid response" plan to deal with any failure of the temporary barrier. The plan involves monthly monitoring and an eradication component to kill any Asian carp that approach the barrier. The panel hopes the response plan will no longer be necessary once the Corps installs the permanent barrier.

In March 2004, the Great Lakes Fishery Commission (GLFC) honored Moy for his years of service to the barrier project by awarding him the Jack Christie-Ken Loftus Award for Distinguished Contributions to Healthy Lakes Ecosystems.

"Phil Moy has been a strong and innovative leader by moving things forward, building the coalitions needed and cutting through bureaucratic hurdles," says Chris Goddard, GLFC executive secretary. "When Phil and his colleagues first started this process, the focus was on preventing the transmigration of any species. Today we are focusing our efforts on using the barrier to prevent Asian carp migration. Through Phil's efforts, a strong and robust process has been put into place to help us respond to new, emerging threats."



UW Sea Grant research into zebra mussel genotypes revealed that all zebra mussel invasions derived from the Black Sea population, suggesting it is a particularly invasive population.



A 4½-minute special and 30-second public service announcement on aquatic invasive species sponsored by UW Sea Grant were aired over six months on the nationally syndicated "**Babe Winkelman's** Good Fishing" television program, reaching nearly 50 million households. This project won the Great Lakes Sea Grant Network's 2003 Superior Program Award.



The Miller Brewing Company of Milwaukee featured UW Sea Grant invasive species prevention guidelines in 1.5 million copies of its *Spring 2003 Fishing Guide*.



Together with Illinois-Indiana Sea Grant, Wisconsin Sea Grant coordinates development of the Sea Grant Nonindigenous Species (SGNIS) Web site, which now contains more than 1,700 items related to aquatic invasive species and is visited by more than 3 million users annually, over 70 percent of whom are U.S. residents. (continued on page 10)



Zeroing in on Zebra Mussels *continued*

An estimated 150,000 readers of *Wisconsin Trails* magazine saw UW Sea Grant's annual "Zebra Mussel Watch" public service advertisements.



Nearly 32,000 of UW Sea Grant's "Zebra Mussel Watch" cards were provided free of charge to chambers of commerce, UW-Extension offices, libraries and state agencies statewide.



Fifty thousand copies of UW Sea Grant's popular *Protect Our Waters* brochure were reprinted in 2003 for regionwide distribution in partnership with the U.S. Fish & Wildlife Service, Minnesota and Wisconsin departments of natural resources, UW-Extension, and the Illinois-Indiana, Michigan and Minnesota Sea Grant programs.



A 45-minute appearance in 2003 by UW Sea Grant Invasive Species Specialist **Philip Moy** on Wisconsin Public Radio's popular "**Larry Meiller Show**" was heard by as many as 76,000 listeners statewide.



Forty-two Wisconsin baitfish and hatchery operators were trained in Hazard Analysis & Critical Control Point techniques to prevent the spread of aquatic nuisance species as part of a special Great Lakes Sea Grant Network project, winner of the network's Outstanding Program Award for 2003.



About 295,800 "Zebra Mussel Watch" cards were printed on behalf of clients in other states during 2002-03, bringing the total printed since 1991 to more than 2.2 million. In addition, nearly 200,000 other invasive species watch cards, bookmarks and brochures were distributed during the biennium.





COMPARING QUAGGA MUSSELS

The investigators on this Sea Grant project are discovering how the attachment dynamics and behavior of quagga mussels, an invasive relative of zebra mussels, enable it to successfully compete with its cousin for habitat. (Clockwise, from left) **Suzanne Peyer**, **Carol Lee** and **Gemma May** inspect quagga mussels collected from Lake Ontario. May works with quagga mussel DNA to determine its origin. **Meghan Olson** assesses quagga mussels' ability to adhere to substrate (in 2004, Olson was awarded a **Carl J. Weston** Memorial Scholarship, which supports undergraduate students interested in Great Lakes and ocean issues).





As
Seen
through
a
Fish

The risk is unknown and, so far, unknowable. Dioxin is so pervasive in the environment that it is almost certainly embedded in the bodies of every fish on the planet. And in the species studied to date, dioxin is so toxic that even small amounts in body tissues can wreak havoc with fishes' ability to reproduce, endangering entire populations. But the precise toxicity of dioxin varies from species to species. That makes it prohibitively labor-intensive and expensive to conduct separate laboratory studies on each of the estimated 20,000 species of freshwater fish to determine the risk dioxin poses to each.

But getting a grip on that risk may soon be possible. Two researchers at the University of Wisconsin-Madison are developing a means of predicting the risk of dioxin for any fish species without undertaking lengthy "dose-response" laboratory studies for each one. And they're making rapid advances using an approach they pioneered with support from UW Sea Grant.

Toxicologists **Warren Heideman** and **Richard Peterson** are revealing the intricate molecular mechanisms by which dioxin (and similar compounds like PCBs) derail normal processes in



“Today many other federal agencies are beginning to fund research in zebrafish toxicology. . . Sea Grant helped lead the way.”

—Heideman

the cells of developing fish. With a detailed understanding of these mechanisms, toxicologists will have a way to predict the danger a given species faces from dioxin: conduct a relatively simple analysis of that species’ cellular biochemistry, and then describe how dioxin will corrupt it.

Heideman and Peterson had made substantial progress toward this goal by 1995, working with lake trout, once the king of native species in the Great Lakes. But working with lake trout was slow. The eggs must be collected from the wild, and they’re available only once a year, providing few opportunities for experiments. Also, it takes fertilized lake trout eggs six months to develop to young adults—a long time to wait for the results of an experiment.

Heideman and Peterson were among the first toxicologists to see a way to accelerate this painstaking work: use zebrafish instead, and apply the results to lake trout and other fish.

The tiny, striped zebrafish recommends itself in many ways as a scientific stand-in for other fish. The eggs can be bred in the lab and thus are available any time, and they develop into recognizable fish within 24 hours after fertilization, greatly boosting the number of experiments that can be run in a year. The eggs are relatively small, allowing large numbers to be conveniently reared in the lab. And zebrafish embryos are transparent to light, so observing developing brains, hearts and other organs requires only a microscope.

For these reasons, the zebrafish was widely studied as a model organism in developmental biology and had become the “fruit fly of the vertebrate world,” as Heideman puts it. But they had yet to catch on in the toxicology community. Few funding sources were supporting research in zebrafish toxicology, so Heideman and Peterson turned to Wisconsin Sea Grant.

Supporting their vision has paid off handsomely. Heideman and Peterson first established that zebrafish serve as excellent models of toxicological processes in lake trout: both species responded to dioxin with exactly the same sequence of symptoms. This strongly suggested that dioxin alters the biochemistry in the cells of each fish in the same way—and maybe in other fish, too. Thus, revealing the details of its destructive workings in zebrafish would likely explain it in other fish as well.

Since Sea Grant first supported this work, Heideman and Peterson have made great strides. They have become recognized leaders in zebrafish toxicology, and their approach is widely emulated. It’s allowed the researchers to discover “details that would have been impossible using lake trout,” according to Peterson, and it’s brought them much closer to a principled model of dioxin toxicity in fish.

Heideman extends partial credit to Sea Grant for bringing that goal within reach: “Today many other federal agencies are beginning to fund research in zebrafish toxicology, but Sea Grant helped lead the way.”



SAFER SCUBA DIVING

Recent UW Sea Grant-sponsored research involving medical scientists at the University of Wisconsin, Harvard University, University of Puerto Rico and the Diver's Alert Network found high rates of debilitating decompression injuries among Puerto Rican scuba divers employed in harvesting seafood.

Led by **Charles Lehner**, **Michael Wilson** and **Tass Dueland** at UW-Madison, this work demonstrated a pressing need as well as a potent collaborative structure exists for developing an educational outreach program for lowering the risks of decompression sickness, dysbaric osteonecrosis (bone death) and disabling osteoarthritis among high-risk seafood and recreational scuba diving populations throughout the Caribbean region.

DIVING INTO HISTORY

For the past 16 years, UW Sea Grant has partnered with the Wisconsin Historical Society (WHS) to inventory and increase public awareness and appreciation of Wisconsin's maritime heritage. During 2002-04, this included collaborating with state underwater archaeologist **Russ Green** to convert the entire WHS shipwrecks database into a format for use in an online geographic information system, and completely redesigning and expanding the "Wisconsin's Great Lakes Shipwrecks" Web site (wisconsinshipwrecks.org).

UW Sea Grant Science Writer **John Karl** helped the WHS produce nine roadside markers of historically significant shipwrecks for the Door County and mid-Lake Michigan segments of Wisconsin's Maritime Trails project. He also helped create a Wisconsin's Maritime Trails Web site (maritimetrails.org), which features a database of nearly 700 Wisconsin shipwrecks as well as a database of statewide maritime-related cultural attractions. This project was recognized with the 2004 "Superior Program Award" from the Great Lakes Sea Grant Network.



FOCUSING ON FISHERIES

UW Sea Grant Fisheries Specialist **Philip Moy** chairs monthly meetings of the Lake Michigan Fisheries Forum, an advisory body formed by the Wisconsin Department of Natural Resources to address issues related to Lake Michigan fisheries, provide a forum for discussion of issues of concern and develop consensus among diverse fisheries interests on matters of common concern.



Two Great Lakes Fisheries Leadership Institutes were held during the biennium in Manitowoc and Ashland as part of a Great Lakes Sea Grant Network Fisheries Extension project. Twenty-seven attended the Lake Michigan workshop and 19 participated in the Lake Superior workshop.

Lake Michigan's yellow perch population underwent a dramatic decline in the early 1990s from which it still has not recovered. UW Sea Grant has supported several research projects on possible reasons for this, most recently a study that found larval perch in offshore regions of the lake, indicating young perch are rapidly pushed out of their nearshore spawning and nursery areas, causing high mortality due to predation or starvation, or a combination of both.

GLOBAL INTERNET ACCESS

UW Sea Grant's Web site (www.seagrants.wisc.edu) offers Internet users a wide range of Great Lakes-related information on aquaculture, native fish, invasive species, toxic chemical contaminants, coastal erosion, scuba diving and shipwrecks. Web logs indicate the UW Sea Grant Web site is averaging 10,000 page-views by 4,000 visitors every day. To measure the effectiveness of these Web sites, state-of-the-art WebTrends® tracking software was installed during the past biennium to determine which website topics and information are of the most useful to visitors.



Assistant Scientist Jon Manchester and colleagues found high levels of flame retardants in Lake Michigan fish.

IDENTIFYING NEW TOXINS

The discovery by UW Sea Grant researchers **William Sonzogni** and **Jon Manchester** of high levels of PBDEs (polybrominated diphenyl ethers), a common flame retardant, in Lake Michigan fish has greatly increased the level of awareness of PBDE contamination throughout the Great Lakes region and beyond. Sonzogni and Manchester also created a database of the concentrations of six major PBDE congeners in forage fish from Lake Michigan that showed increasing concentrations over time.

As a result of this work, PBDE is now considered a priority contaminant by the Wisconsin Department of Natural Resources, and the State Division of Health increased its monitoring of PBDEs. The report of this project's initial findings, published in *Environmental Science & Technology*, was six months later "one of the most cited" papers in the field by the Institute for Scientific Information.

MODELING LAKE TROUT

UW–Stevens Point researcher **Michael Hansen** used a statistical catch-at-age analysis of lake trout to estimate a sustainable harvest quota for lake trout in Wisconsin waters of Lake Superior that was used immediately by state and tribal managers to set 2002 harvest quotas for their respective fisheries. Another project on Lake Superior confirmed the hypothesis that the lean and siscowet (fat) lake trout are reproductively isolated, and that lake trout from different areas of the lake are separate assemblages—stocks that need to be managed separately.

HEALTHY FATTY ACIDS

The health benefits of fish oils are well known, and Sea Grant-supported research by **Charles Hill** at UW–Madison successfully produced acylglycerols from fish oil and conjugated linoleic acid that contain substantial concentrations of two omega-3 fatty acids. These essential fatty acids have significant dietary implications for individuals who are at risk for cardiovascular disease, certain forms of cancer and/or hypertension, and a U.S. corporation and a company in Barcelona, Spain, are interested in employing this technology.

INTERACTIVE FISH I.D.

A new, innovative teaching aid based on an annotated and illustrated means for identifying Wisconsin fishes—entitled "Interactive Fish Identification and Bioenergetics Lab"—is being developed in a collaborative project involving UW Sea Grant (**Elizabeth White**), the UW–Madison Center for Limnology (**Paul Hanson**) and the Wisconsin Department of Natural Resources (**John Lyons**). Led by center director **James Kitchell**, this project will provide students at UW–Madison and other UW System campuses the opportunity to study fish identification, ecology and physiology using the latest techniques and scientific information while minimizing the need for terminal experiments, travel to remote locations and dependence on fragile museum specimens.

WATCHING THE EARTH

Coproduced by **Rich Hoops** at UW Sea Grant and **Steve Pomplun** at the UW–Madison Gaylord Nelson Institute for Environmental Studies, "Earthwatch" is a 32-year-old weekly series of five two-minute public service programs distributed monthly on CD free of charge to interested commercial, public, school and community radio stations. During 2002–04, the program was carried by more than 140 radio stations in the United States and Canada, and America's global Armed Forces Radio & Television Services network. Subscriptions to an email distribution list for Earthwatch program scripts increased from 180 subscribers in 2002 to nearly 300 today, including academic and government personnel in the United States and Canada as well as subscribers as far away as the United Kingdom, South Africa and Russia.

The Earthwatch Web site was completely redesigned by Art Director **Tina Yao** during 2002–04 to enhance its usefulness and program marketability, and in 2002 the name "Earthwatch" became a federally protected trademark of the University of Wisconsin Board of Regents for use in radio programming. Listen to it online at ewradio.org!





connecting with people

University of Wisconsin Sea Grant Institute

Smart Maps

David Hart can create a picture worth a thousand words—and sometimes hundreds of thousands of dollars. His 3D images of Wisconsin shorelines help coastal managers see not only land and water, but also property values, water quality and the risk of flooding.

This is the world of geographic information systems (GIS), a technology that UW Sea Grant has been fostering in Wisconsin for more than two decades.

“GIS pulls everything together and shows you things you’ve never seen before,” says Hart, GIS specialist at UW Sea Grant. “Initially, the information might have been in a bunch of thick reports. But when you take all that information and lay it out on a single map, people can understand it immediately and see how it all fits together.”

Hart says local governments collect loads of valuable information about coastal property, such as who owns it, how much it’s worth and how it’s being used. For the last nine years, he has been demonstrating how GIS can integrate this information and transform it into powerful visual displays.

For example, he combined locations of property boundaries in Door County, Wis., with a tax assessment database. The resulting map shows in a glance where the county’s high-value prop-



visualizing healthy coastlines

erties are—it looks like someone took a magic marker and traced right along the coastline.

“That’s the power of GIS,” Hart says. “You can take these map layers, link them to a database and then start to ask all sorts of questions.”

One pressing question GIS can help answer is how to protect coastal resources from land development pressures. Five years ago, Wisconsin enacted a “Smart Growth” law requiring every city, village, county and town to adopt a comprehensive land use plan by 2010. To comply with the law, communities need access to current geospatial information, but that’s often scattered among different offices. Even when the data are available on the Internet, these “stand-alone” sites are often incompatible with each other.

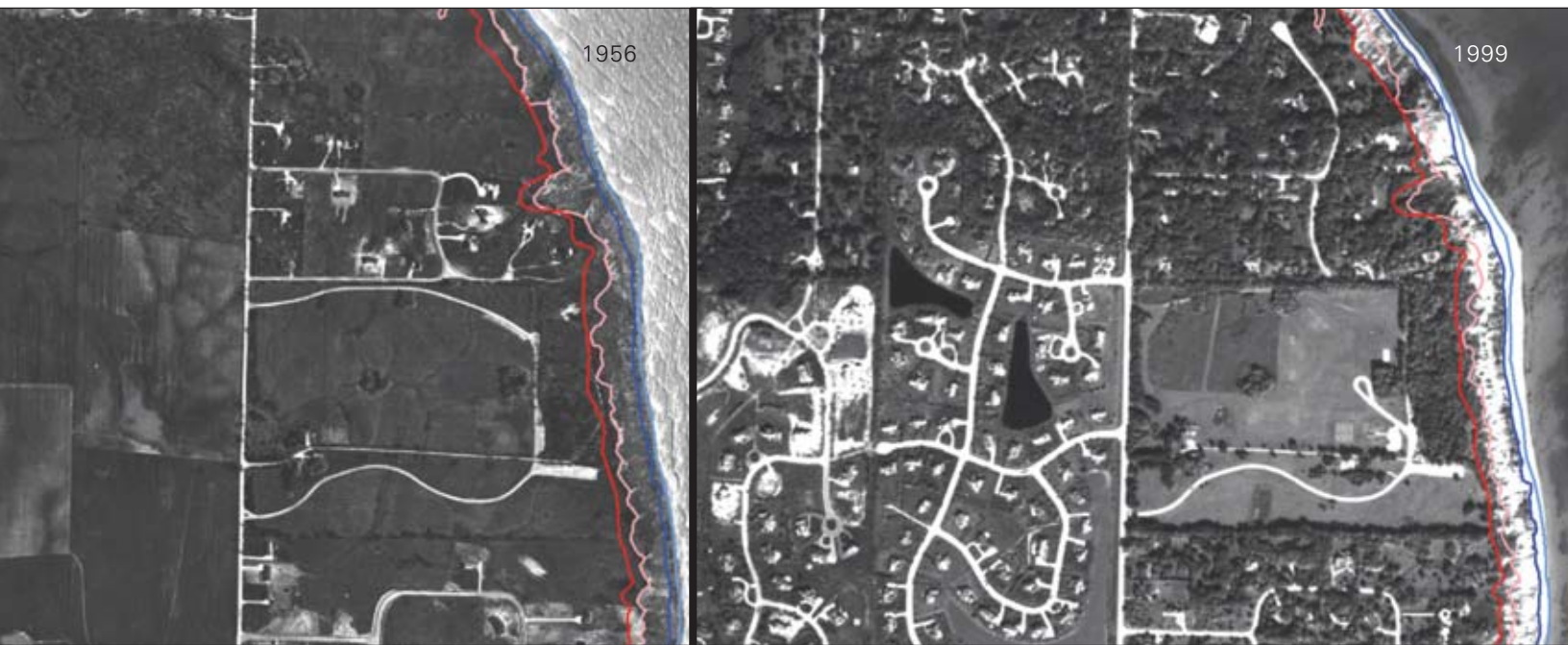
Hart is changing this by showing local governments how to link their sites to allow remote users to access and integrate data from multiple sources. One of his recent efforts involved the Bay-Lake Regional Planning Commission, a public agency that provides planning assistance to eight counties in eastern Wisconsin.

“We’re much farther along in the project than we anticipated, and most of that is due to David’s coordination efforts,” says

Mark Walter, the commission’s executive director. “He has provided my GIS staff with an incredible amount of technical assistance, knowledge and advice.”

Hart helped the commission find a way to integrate regional data sets with those of Kewaunee County on the shore of Lake Michigan. Walter hopes to repeat the process with each of the counties in the Bay-Lake area to create a comprehensive set of land information that anyone can access from a home computer.

“The success of this pilot project could lead to more funding for our program, and it really helps with our overall goals in terms of what we want to do with GIS in providing information to communities so that they can make better decisions,” Walter says.



As one of the few full-time Sea Grant GIS specialists in the country, David Hart has his sights set on integrating spatial data from all over Wisconsin to help communities make smart decisions about coastal resources.

Aerial photos reveal coastal erosion over time. These two photos of the Ozaukee County shoreline show bluff tops (red) and toes (blue) and the changes that occurred between 1956 (dotted lines) and 1999 (solid lines).

Nurturing Wisconsin's Aquaculture Industry

UW Sea Grant is spurring the development of aquaculture, the fastest-growing agricultural sector nation. Sea Grant outreach specialists buoy the industry with expertise and one-to-one advice. Providing on-site assistance and tailor-made workshops, they help everyone from successful business owners to casual inquirers and high school students better understand the technical, biological and economic realities of turning a profit while raising fish.

Dave LaBomascus says these resources are unique. LaBomascus is the operations manager at the St. Croix Waters Fishery in Danbury, Wis., the largest freshwater aquaculture

facility in the state. The operation is owned by the St. Croix Band of Lake Superior Chippewa, and UW Sea Grant provided advice throughout the planning and building of the \$25 million, 60,000-square-foot facility. Using intensive aquaculture technology developed in part by UW Sea Grant, it has been raising yellow perch and other fish for three years. LaBomascus says much credit for its success goes to UW Sea Grant Aquaculture Specialist **Fred Binkowski**.

Last year, Binkowski and Assistant Scientist **Steve Yeo** took aquaculture outreach to a new level when the St. Croix fishery sought guidance in raising a million yellow perch eggs. To provide critical, hour-by-hour input, Binkowski and Yeo raised a second batch of eggs from the same source under similar conditions in their laboratory at the UW-Milwaukee Aquaculture Institute, which Binkowski directs.

"That way, we could compare notes," Binkowski said. "If they had questions about egg incubation and water temperature or the timing for larval feeding, we could walk them through these critical events, and together we could resolve any problems immediately."

The arrangement delivered virtual on-site advice over the telephone, while fishery staff gained essential hands-on experience.

"There's no other place like Sea Grant we could turn to for this kind of help," LaBomascus said.

Binkowski is now helping the fishery develop a technology plan for year-round perch spawning and fingerling production.



UW Sea Grant Aquaculture Specialist Fred Binkowski (left) and Fisheries Specialist Philip Moy (center) inspect a fish-rearing tank with a St. Croix Waters Fishery employee.

Other constituents of Wisconsin Sea Grant's aquaculture outreach program may never run a commercial fish farm, but they do harvest rich rewards. High school students in Freedom, Wis., raise yellow perch, trout and salmon in a 3,500-gallon recirculating system. **Kevin Champeau**, one of the teachers who directs the program, says UW Sea Grant provided essential assistance with curriculum development, facilities design and water quality management. He says Sea Grant also supplied fingerlings and loaned water chillers, oxygen meters and other equipment that has supported the program for 12 years.

"If I hit a roadblock, Fred's there," Champeau says. "That's what keeps me going. Without Sea Grant's help, I wouldn't be anywhere near where I am."

Raising thousands of fish from fingerlings to market size, Champeau's students make life-and-death decisions on a daily basis. In the process, they learn math, science, language, business and real-world job skills. Champeau says the applied setting works well for many students.

"Some of them are not really interested in the academic world," he said. "But they find this fun to do. They even come in after school. That's pretty gratifying."

And, just maybe, UW Sea Grant will one day work shoulder-to-shoulder with one of these students when they're running their own successful aquaculture business.



UNDERGRADUATE LEARNING AT SEA

UW Sea Grant Education Coordinator **James Lubner** helped pilot a new Winterim course in Geosciences at UW–Milwaukee aboard the schooner *S/V Denis Sullivan*. Seven undergraduate students studied oceanography and nautical science in a hands-on setting as the vintage vessel sailed U.S. and Bahamian waters over a two-week period in January 2004. This successful pilot enabled Lubner to partner with the university's Department of Geosciences in formalizing this course as an approved laboratory course that will fulfill three general education credits in natural sciences.



BOWLING FOR KNOWLEDGE

A regional qualifier for the annual National Ocean Science Bowl (NOSB) high school competition, the Lake Sturgeon Bowl is intended to improve oceanographic and aquatic science literacy among students and reward academic excellence among students and their schools. Since the first Lake Sturgeon Bowl in 2001, the number of participating teams has been doubling annually.

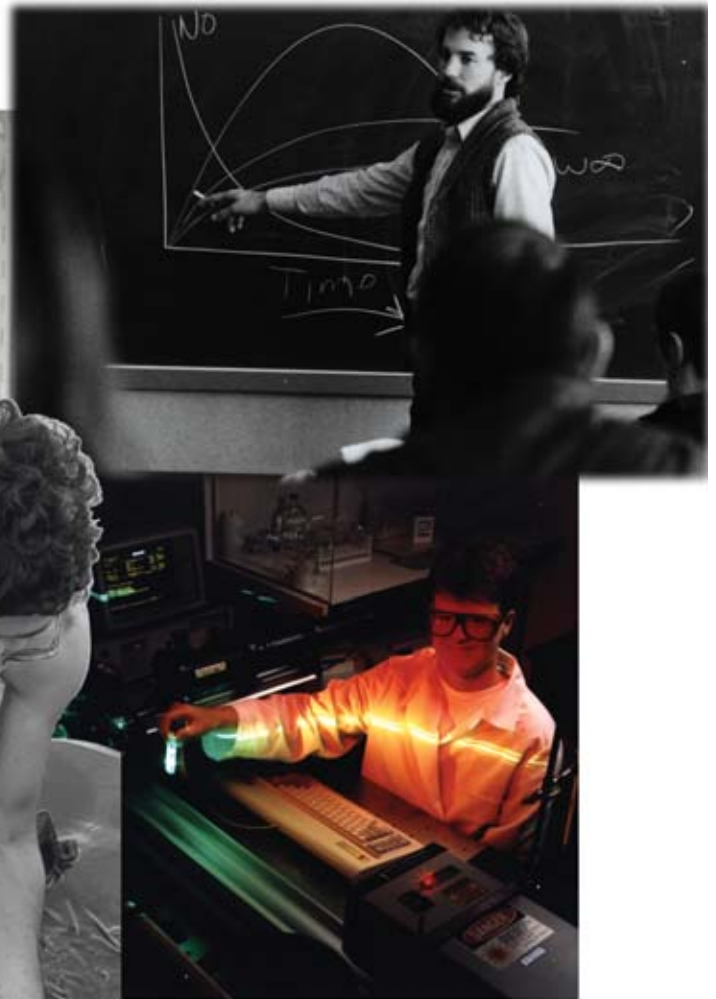
In 2002, NOSB Regional Coordinator **Barbara Duffy** brought together 10 teams of five students from eight high schools from across the state. The 2003 competition attracted 101 students forming 21 teams from 15 high schools, including three from the Milwaukee Public Schools system, which has a large proportion of under-represented students. The winner for the third straight year was Marshfield Senior High, which placed eighth among 24 teams in the 2004 NOSB competition held in April in Charleston, S.C.

UW-Milwaukee Outreach Specialist **Fran Luebke** and UW Sea Grant Education Coordinator **James Lubner** help Duffy organize and host the annual event, which is held in Milwaukee.



More than 5,000 people picked up nearly 4,000 pieces of invasive species information at UW Sea Grant exhibits on invasive species at Chicago's Shedd Aquarium, the Neville Public Museum in Green Bay, Milwaukee Public Museum and the Wisconsin State Fair (above) during 2002-03.

“Sea Grant financed our Problems in Oceanography class trip to Sapelo Island, Georgia, where I had my first research experience at sea. This experience was fundamental in my decision to continue a Ph.D. in Oceanography and Environmental Sciences.” Professor **José Manuel López**, University of Puerto Rico



MARINE FIELD EXPERIENCE

UW Sea Grant annually provides support for continuing the interdisciplinary “Problems in Oceanography” course at UW–Madison. Offered biennially since 1968, the course enables graduate students to obtain field research experience during a week-long field trip to an educational research station at Sapelo Island, Ga., where they learn firsthand about estuarine ecology. This popular course has been a turning point in the education of many students who later pursued careers in marine science as a result of the experience.

TRACKING SUCCESS

A survey of former UW Sea Grant-supported graduate students—almost 450 of them (196 Ph.D. and 278 master’s degrees)—revealed these “alumni” are working in 39 of the 50 states, a British commonwealth and nine foreign countries, and over 75 percent are employed in a field directly related to their degree(s). Thirty-five percent are working in the private sector, 24 percent in the public sector, and 41 percent in academia.

SUPPORTING STUDENTS

Established in 1995 with \$10,000 from **Dr. and Mrs. Carl B. Weston**, this UW Sea Grant Institute scholarship is periodically awarded to talented and needy undergraduate students expressing a strong interest in Great Lakes and ocean-related issues. In 2002, a \$300 Weston scholarship was awarded to **Joseph J. Weber**, a UW–Madison Medical Microbiology student working with **Dr. Charles Lehner** on his UW Sea Grant-supported scuba diving physiology and safety research. To date, six UW–Madison students have been awarded a total of \$1,400 in Weston scholarships.



LENDING WATER WISDOM

Established in 1964 by the UW Water Resources Institute, the Water Resources Library (WRL) is unique among UW-Madison's many libraries for its collection of almost 30,000 volumes of water-related information, including a curriculum collection, dozens of educational videos, and more than 60 journals and 100 newsletters. During 2003, UW Sea Grant partnered with librarian **JoAnn Savoy** to develop "Wisconsin's Water Library" (aqua.wisc.edu/waterlibrary), a special outreach project in celebration of Wisconsin's "Year of Water" observance. Through the "Wisconsin's Water Library" Web site, any resident of Wisconsin can check out the library's materials, which are sent free of charge to the user's local public library for pick up and return. This makes the WRL the only, if not the first, academic library in Wisconsin to make its collection directly available online to residents throughout the state. Savoy is now developing a kids section for "Wisconsin's Water Library" to support UW Sea Grant's Madison JASON Project as well as provide a resource to students and teachers statewide.

*In addition to sending publications all over the state, Wisconsin's Water Library reached out to a nearby community in Madison. Above, graduate student and library assistant **Stephanie Good** reads to children from the Allied Drive neighborhood during a "water critters" story hour. The program featured art projects, movies, snacks and live animals that all tied into a water-related theme.*



IMMERSED IN 'W.O.W.'

UW Sea Grant has been an active participant in the Wisconsin Academy of Sciences, Arts and Letters' "Waters of Wisconsin" (WOW) initiative, which resulted in the adoption of a "Waters of Wisconsin Declaration," a governor's proclamation of 2003 as "The Year of Water" in Wisconsin and the creation of a blue-ribbon panel to begin development of a comprehensive state water policy. UW Sea Grant actively played an active role in the 2003 "Year of Water" observance, the coordinating committee for which was chaired by UW Sea Grant Water Quality Specialist **Vicky Harris**.

Harris helped develop the WOW final report, released on Earth Day 2003, which summarizes the status of Wisconsin's surface and groundwater resources, defines current and future issues, and lays the groundwork for developing a comprehensive statewide water policy. As a first step toward a statewide policy, UW Sea Grant worked with the UW-Madison Department of Urban & Regional Planning to create "Wisconsin's Water Policies," a publicly accessible online database for initiating a review of all existing state policies and rules governing water management in Wisconsin (aqua.wisc.edu/waterpolicy).



WATER SCIENCE SEMINARS

UW Sea Grant supported seven lectures during 2002 on a variety of aquatic science topics held each Friday at the UW-Madison Water Science and Engineering Laboratory. Fifteen graduate students were enrolled in the course during the 2001-02 academic year, and each seminar attracted 25 to 30 students, faculty, staff and guests.



FELLOWS IN WASHINGTON

Named in honor of one of Sea Grant's founders, a former NOAA Administrator, the **John A. Knauss** Marine Policy Fellowship program provides a unique educational experience to students who have an interest in ocean, coastal and Great Lakes resources and the national policy decisions affecting them. Established in 1979, it matches highly qualified graduate students with "hosts" in the offices of federal administration or legislature in the Washington, D.C., area, for a one-year paid fellowship. To date, 14 Wisconsin students have been selected by NOAA Sea Grant for a fellowship, which are partly funded by UW Sea Grant. In 2002, UW-Madison Ph.D. graduate **Karl Gustavson** was awarded a Knauss fellowship, serving on the Subcommittee on Fisheries Conservation, Wildlife and Oceans of the U.S. House of Representatives' Committee on Resources. UW-Madison graduate **Colleen Corrigan** was among those selected for a 2004 Knauss fellowship and spent the year working on marine mammal conservation issues at the U.S. Fish & Wildlife Service's Branch of Resource Management Support. And in 2004 UW-Madison graduate **Diane Pansky** (above) was selected to receive a 2005 Knauss fellowship.

SHARING RECENT ADVANCES

Each year since 1973, UW Sea Grant has provided support for the "Recent Advances in Limnology and Oceanography" seminar series held Thursday evenings at UW-Milwaukee's Great Lakes WATER Institute. Open to the public, attendance at each lecture regularly ranges from 25 to 50 people. About 16 advanced undergraduate students and graduate students enroll in the courses each year, although more students attend than are registered for credit. The theme for the 2002 series was "Chemical Cues in the Aquatic Environment;" the theme for the 2003 series was "Biological Markers and Indicators in the Aquatic Environment." They included experts from Massachusetts' Woods Hole Oceanographic Institution, Georgia Institute of Technology, the Freshwater Institute in Winnipeg, Man., and Wageningen University in The Netherlands. Among the featured speakers in 2003 was former Wisconsin U.S. Sen. Gaylord Nelson, representing the Wilderness Society.

ENGAGING YOUNG STUDENTS

The international JASON Project—founded by **Bob Ballard**, discoverer of the wreck of *HMS Titanic*—is designed to excite and engage middle school students and their teachers in science and technology, and to provide professional development for their teachers. UW Sea Grant has been annually hosting JASON in the Madison area since 1995 www.seagrant.wisc.edu/madisonjason. Fifteen teachers and 482 students from 14 schools participated in the 2002 Madison JASON; 19 teachers and 800 students from 12 schools participated in 2003. Participants came from Abbotsford, Beaver Dam, Blair, Columbus, DeForest, Fort Atkinson, Janesville, Madison, Marshall, Middleton, Platteville, Portage, Stoughton, Sun Prairie and Windsor. Eight public, private and nonprofit organizations in the Madison area helped enhance both events by providing an exhibit, presentation or tour.

In 2004, **Sue Sewell**, a Madison JASON 6th-grade teacher, was selected from thousands of applicants worldwide to be one of the eight JASON Teacher Argonauts to work directly with a select team of internationally distinguished scientists to study California's Channel Islands, a unique interconnected ecosystem of the Pacific Coast. She has since become the principal at Columbus Elementary School.



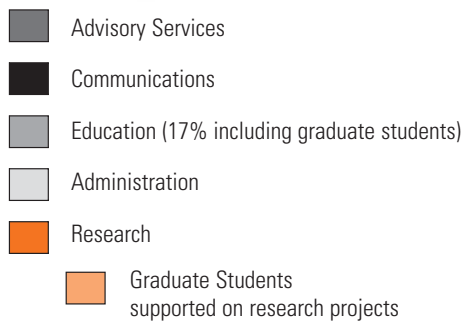
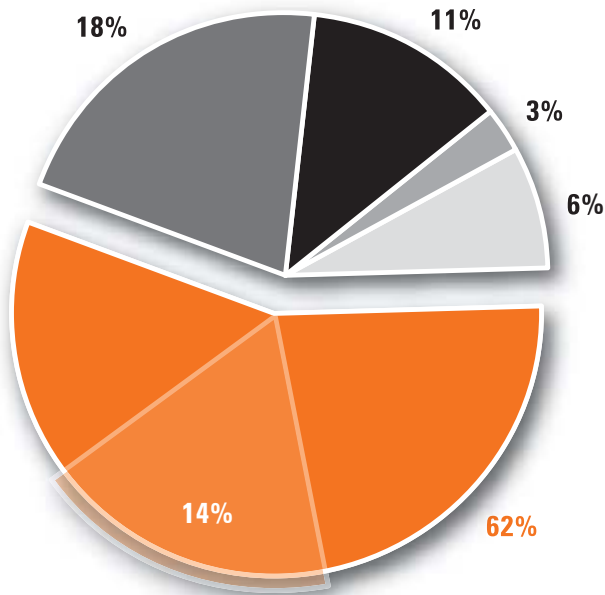
Titanic discoverer Bob Ballard with Madison JASON Argonaut Sue Sewell.



University of Wisconsin Sea Grant Institute managing for success

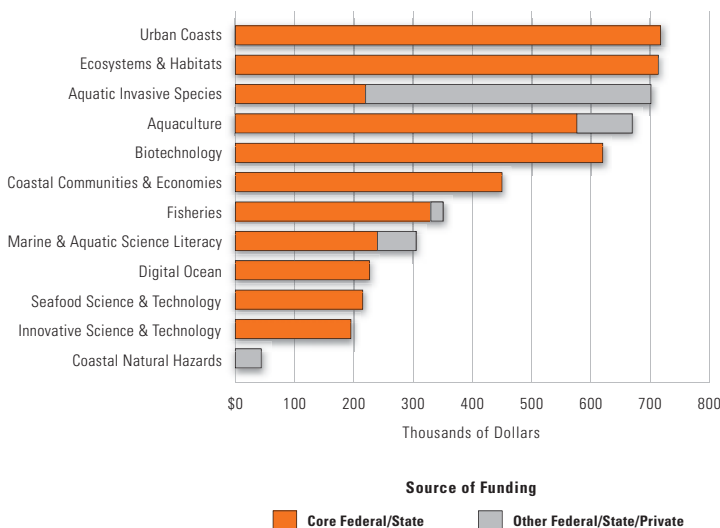
BUDGET OVERVIEW

Program Components 2002–2004



Thematic area funding FY 2002–2004

NOTE: Some projects address more than one theme.



ORGANIZING EFFICIENCY

After consulting with the UW–Madison Office of Quality Improvement and external advisory groups, the UW Sea Grant management team was restructured in 2002 to better integrate and coordinate program activities. With the retirement of Assistant Director for Advisory Services **Allen Miller**, Assistant Director for Research **James Hurley** became Assistant Director for Research & Outreach. Similarly, the responsibilities of Assistant Director for Administration & Information Technology **Mary Lou Reeb** were expanded to include supervision of Communications and Water Resources Library activities, and she became Assistant Director for Administration & Information. In addition, three administrative positions were eliminated in response to state budget cuts.

PROJECT REPORTING ONLINE

The interactive Project Reporting Online (iPRO) system provides an easy, efficient way for Wisconsin Sea Grant principal investigators to manage their projects via an interactive Web interface. It facilitates continuous information exchange between investigators and program administration, education and outreach staff on project-related activity even after a project ends, thus creating a more complete, up-to-date record of project results. Programmed by UW Sea Grant Web and Database Developer **Rich Dellinger**, iPRO was selected for “Best Management Practice” recognition by the National Sea Grant Office’s Program Assessment Team.

MARKETING ONLINE

The UW Aquatic Science Center’s Publications Store (www.aqua.wisc.edu/publications) is a state-of-the-art, interactive online site for marketing and distributing Sea Grant information. Managed by Publications Sales and Distribution Coordinator **Linda Campbell**, it is a full-featured e-commerce application featuring an electronic shopping cart, secure credit card payment, dynamic calculation of taxes based on zip code, and inventory tracking and management. Launched in February of 2003, the system increased the distribution rate of UW Sea Grant publications by more than 50 percent in its first year of operation.

MEETING ONGOING NEEDS

UW Sea Grant's Coastal Engineering Outreach Specialist **Philip Keillor**—the only Sea Grant coastal engineer in the region—retired in 2002 after 28 years with the program. At the recommendation of the program's Committee on Advisory Services, UW Sea Grant continued to fill this niche by hiring **Gene Clark** as its new coastal engineering specialist. Previously employed as a lakeshore engineer with the Minnesota Board of Water and Soil Resources, Clark was located at the UW–Superior campus to help expand UW Sea Grant's outreach capabilities on Wisconsin's Lake Superior coast.

ADDING NEW CAPABILITY

Wisconsin is a national leader in modernizing its land information offices through the use of computer-based Geographic Information Systems (GIS). UW Sea Grant-supported development and training projects have helped accelerate the use of GIS in Wisconsin for coastal zone management, including shoreline zoning, nonpoint-source pollution control, and mapping coastal erosion and recession rates. Following the retirement of UW Sea Grant's Business Management Outreach Specialist **Harvey Hoven**, UW Sea Grant strengthened its commitment to the development and application of this powerful emerging technology by adding a full-time GIS Outreach Specialist **David Hart** to its Advisory Services staff. Previously employed at the UW–Madison Land Information & Computer Graphics Facility, Hart has continued to develop our GIS capabilities and among his activities, he is developing a system for local officials (county, city, town officials) to access several GIS databases simultaneously to aid in coastal planning.

STRATEGIC PLANNING

As recommended by the last federal Program Assessment Team, UW Sea Grant strategic planning process was modified in 2002 to rely more extensively on input from external advisory groups, research faculty, program outreach staff, and various local, state and regional constituencies. Approved by the UW Sea Grant Advisory Council, the program's existing strategic plan was first restructured in accordance with the National Sea Grant College Program's 10 research, outreach and education themes, and UW–Madison's institutional strategic plan.

This revised draft was then distributed to more than 450 individuals, including state and regional constituent groups; local, state and federal government officials, and university scientists and administrators for comment. These comments and other feedback were used to update the program's state and regional strategic priorities in each of the 10 national Sea Grant themes, which then became the focus of the UW Sea Grant 2004–06 Request for Proposals. These strategic priorities also were a major criterion used by members of an external review panel in recommending which project proposals to fund during the 2004–06 biennium. The 2002–06 UW Sea Grant Strategic Plan is online at www.seagrant.wisc.edu/aboutus/stratplan02.pdf



ADVANCING TECHNOLOGY

Technological advancement is a UW Sea Grant priority, and the program places an emphasis on using the Internet and Web-based database applications. During 2002–03, a major upgrade of computer network capabilities was completed by Information Systems Engineer **James Grandt**, and the UW Sea Grant network now includes a suite of eight servers, uninterruptible power supplies, a high-capacity tape library backup system, virus and spam protection, 25+ high-speed Pentium 4-based client computers running the Windows XP Professional operating system, and Macintosh systems for design work and audio/video editing. The network is protected by a hardware firewall. The network supports a UW Sea Grant intranet site that enables staff to post announcements, obtain computer support, access campus-wide information and share schedules. An online financial statement application was developed by Finance and Grants Administrator **Dan Marklein** to enable campus administrators, funded project investigators and staff to view financial status of individual projects. These advances have provided Sea Grant staff with the latest in hardware and software technology. A Campus 21st Century network infrastructure upgrade also increased our network bandwidth tenfold, so Web users now access Sea Grant audio/visual components faster than ever before.



Appendices

Participating Institutions (18)

Madison Metropolitan School District
Purdue University
State University of New York–Buffalo
University of Illinois–Urbana/Champaign
University of Michigan
University of Notre Dame
University of Wisconsin–Green Bay
University of Wisconsin–La Crosse
University of Wisconsin–Madison
University of Wisconsin–Manitowoc
University of Wisconsin–Milwaukee
University of Wisconsin–Stevens Point
University of Wisconsin–Superior
University of Wisconsin System
U.S. Geological Survey
Wisconsin Coastal Management Program
Wisconsin Department of Natural Resources
Wisconsin Historical Society

Students Supported

2002–03: 14 graduate students, 21 undergraduate students
2003–04: 20 graduate students, 45 undergraduate students

Students Earning Master’s Degrees (11)

Dana Barton, UW–Madison
Lee Clippard, UW–Madison
Scott DeLaruelle, UW–Madison
Jennifer Devine, UW–Stevens Point
Paul Drevnick, UW–La Crosse
Amanda Goeble, UW–Madison
Kevin Kapuscinski, UW–Stevens Point
Brian Linton, UW–Stevens Point
Kathleen Schmitt, UW–Madison
Benjamin Vail, UW–Madison
Ann Weiben, UW–Madison

Students Earning Doctorate Degrees (7)

Ken Baerenklau, UW–Madison
Stephen Hoffmann, UW–Madison
Jerry Kavouras, Marquette University
Stephen Lemos, UW–Madison
Ragan Petrie, UW–Madison
Antony Scott, UW–Madison
Chester Wilson, UW–Madison

Staff Professional Awards

OUTSTANDING PROGRAM AWARD (Great Lakes Sea Grant Extension Program Leaders)—Aquatic Invasive Species Specialist **Philip Moy** in recognition of his role in a multi-state, multi-institutional project using Hazard Analysis Critical Control Point techniques to prevent the spread of aquatic-nuisance species by aquaculture and baitfish operations.

SUPERIOR PROGRAM AWARD (Great Lakes Sea Grant Extension Program Leaders)— Aquatic Invasive Species Specialist **Philip Moy**, Communications Manager **Stephen Wittman** and Science Editor **Jill Ladwig** in recognition of the exceptional success of the “Using Mass Media to Inform Anglers about Invasive Species” project.

WILLIAM Q. WICK AWARD (National Assembly of Sea Grant Extension Program Leaders)—Assistant Director for Advisory Services **Allen H. Miller** in recognition of visionary career leadership through outreach programming.

BEST WEB SITE ON GREAT LAKES REGIONAL CULTURE (Center for Great Lakes Culture, Michigan State University)—Science Writer **John Karl**, Designer **Tina Yao**, Web Developer **Rich Dellinger** for Wisconsin's Great Lakes Shipwrecks as the best Web site in 2002 devoted to the history and culture of the Great Lakes region “... noteworthy for its cultural importance, exceptional quality and effective design.”

PRESIDENT’S AWARD (Sea Grant Association)—Communications Manager **Stephen Wittman** “in recognition for meritorious service to the national Sea Grant network.”

APPRECIATION AWARD (Sea Grant Association)—Director **Anders W. Andren** “in appreciation and gratitude for outstanding contribution, commitment and service as chair of the Program Mission Committee.”

Publications

New titles—*44* (research journal reprints/Sea Grant publications)

Publications distributed—*385,719*

Publication sales—*\$39,486.55*

Workshops, Courses & Exhibits

Events—*171*

Total attendance—*29,341*

Principal Program Partners (*26*)

Partnerships—*608* (in *290* activities)

University

Illinois-Indiana Sea Grant College Program

Michigan Sea Grant College Program

Minnesota Sea Grant College Program

UW–Extension

UW Great Lakes WATER Institute

UW–Madison Center for Limnology

UW–Madison Gaylord Nelson Institute for Environmental Studies

Wisconsin Public Radio

State

Wisconsin Coastal Management Program

Wisconsin Coastal Management Council

Wisconsin Department of Natural Resources

Wisconsin Historical Society

Wisconsin Public Radio

Regional

Great Lakes Commission

Great Lakes Fishery Commission

Federal

NOAA Coastal Services Center

NOAA Great Lakes Environmental Research Laboratory

U.S. Army Corps of Engineers–Detroit District

U.S. Coast Guard

USDA North Central Regional Aquaculture Center

U.S. Environmental Protection Agency–Great Lakes National
Program Office

U.S. Fish & Wildlife Service–Green Bay Ecological Services Office

U.S. Geological Survey

Private

JASON Foundation for Education

Winkelman Productions, Inc.

Wisconsin Academy of Sciences, Arts & Letters

Wisconsin Aquaculture Association

Advisory Council

Anders W. Andren (*ex officio*)

Director, Aquatic Sciences Center
Professor, Environmental
Chemistry & Technology Program
UW–Madison

Richard R. Burgess

Professor, Oncology
UW–Madison

Beverly A. French

Partner, Orde Advertising, Inc.
West DePere, Wis.

Frances C. Garb

Senior Academic Planner
Office of Academic Affairs
UW System

Hallett J. (“Bud”) Harris (*chair*)

Professor Emeritus,
Natural & Applied Sciences
UW–Green Bay

Reinhold Hutz

Interim Associate Dean for Research
Research Services & Administration
UW–Milwaukee

Lee Kernen

Citizen representative
Madison, Wis.

Dea Larsen Converse

Chief, Wisconsin Coastal
Management Program
Madison, Wis.

Reuben H. Lorenz

Citizen representative
Madison, Wis.

Larry J. MacDonald

Owner, Apostle Islands Outfitters
& General Store
Mayor of Bayfield, Wis.

John J. Magnuson

Professor Emeritus, Zoology
UW–Madison

Kevin McSweeney

Professor, Soil Science
& Environmental Studies
Director, School of Natural Resources
UW–Madison

David T. Michaud

Principal Environmental Scientist
Wisconsin Electric Power Co.
Milwaukee, Wis.

Nathaniel E. Robinson

Sea Grant National Review Panel
Executive Assistant to the State Director
Wisconsin Technical College System

Daniel O. Trainer

Professor Emeritus, Wildlife
Dean Emeritus, College of Natural Resources
UW–Stevens Point

Linda L. Weimer

Vice President for University Relations
UW System



15 Wisconsin Great Lakes Facts



15 Wisconsin Great Lakes Facts

- 1 Just 3 percent of the world's water exists as fresh water—2 percent is locked in the polar ice caps; less than 1 percent resides in freshwater lakes and streams.*
- 2 The Great Lakes contain an estimated 5,500 cubic miles (22,700 cubic kilometers) of water—a fifth of all the liquid surface fresh water on Earth.*
- 3 The United States draws more than 40 billion gallons (151 million liters) of water from the Great Lakes every day—half of which is used for electrical power production.*
- 4 About 6.4 million acres (2.6 million hectares) of Lakes Michigan and Superior lie within Wisconsin's state boundaries.*
- 5 Wisconsin's 15 coastal counties contain more than 1.2 million acres of wetlands (486,000 hectares)—nearly a fourth of all of the state's remaining wetlands.*
- 6 Wisconsin has more than 800 miles (1,300 kilometers) of Great Lakes coastline.*
- 7 More than a third of Wisconsin's population lives in the 11 counties forming its Lake Michigan coast; 24 percent live in the three southeast coastal counties of Milwaukee, Racine and Kenosha alone.*
- 8 About 13 million salmon and trout are stocked in Lake Michigan each year by the Wisconsin Department of Natural Resources.*



- 9** *Anglers net about more than 500,000 trout and salmon in Wisconsin waters of Lakes Michigan and Superior. Great Lakes trout and salmon fishing stamp fees alone bring in nearly \$1.7 million a year to state coffers.*
- 10** *The Great Lakes have been colonized by 161 known nonindigenous aquatic species—over half of them since the opening of the St. Lawrence Seaway in 1959.*
- 11** *Wisconsin's power and water utilities spend an estimated \$5 million annually trying to protect water intakes from zebra mussels.*
- 12** *The assessed value of Lake Michigan lakeshore property in just one Wisconsin county—Door County—is almost \$2 billion.*
- 13** *Each year, Wisconsin's 12 active harbors on Lakes Michigan and Superior handle a total of more than 40 million tons (40 billion kilograms) of commodities valued at more than \$7 billion.*
- 14** *More than 800 toxic contaminants have been identified in Great Lakes water and sediment.*
- 15** *Five of the 43 Great Lakes "Areas of Concern" identified by the U.S.-Canadian International Joint Commission are in Wisconsin—Superior bay, Menominee River, Green Bay, Sheboygan River and Milwaukee estuary.*

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Bob Rashid, *pg. 6*

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Bob Rashid, *pg. 10-11*

Richard Peterson, *pg. 12*

OAR/National Undersea Research Program, *pg. 14*

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Philip Moy, *pg. 14*

Robert Queen, *pg. 15*

James Lubner, *pg. 17*

David Hart, *pg. 19*

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Melissa Hase; Jim Lubner, *pg. 22*

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John Karl; Jill Ladwig, *pg. 24*

JASON Project, *pg. 25*

Karen Rodriguez, *pg. 27*

Photodisc, *pg. 29*

Michigan Travel Bureau, *pg. 30*

Karen Rodriguez, *pg. 35, 37*

Jerry Bielicki; Dave Hansen, *pg. 36*

Editor: **Stephen Wittman**

Writers: **John Karl, Kathleen Schmitt, Stephen Wittman**

Art Director/Designer: **Tina Yao**

Design and Production: **Amy Kittleson**

Proofreader: **Gloria Gardner**

Key Contacts

Administration

Director
Anders W. Andren, (608) 262-0905

Assistant Director for
Research & Outreach
James Hurley, (608) 262-1136
hurley@aqu.wisc.edu

Assistant Director for
Administration & Information
Mary Lou Reeb, (608) 263-3296
mlreeb@aqu.wisc.edu

Finance and Grants Administrator
Daniel Marklein, (608) 263-3252,
marklein@aqu.wisc.edu

Communications Manager
Stephen Wittman, (608) 263-5371,
swittman@aqu.wisc.edu

Advisory Services Specialists

Aquaculture
Fred Binkowski, UW–Milwaukee,
(414) 382-1723, sturgeon@uwm.edu

Coastal Engineering
Gene Clark, UW–Superior,
(715) 394-8472, grclark@aqu.wisc.edu

Fisheries & Aquatic Invasive Species
Philip Moy, UW–Manitowoc,
(920) 683-4697, pmoy@aqu.wisc.edu

Geographic Information Systems
David Hart, UW–Madison,
(608) 262-6515, dhart@aqu.wisc.edu

Marine Safety & Education
James Lubner, UW–Milwaukee,
(414) 227-3291, jflubner@aqu.wisc.edu

Water Quality & Habitat Restoration
Victoria Harris, UW–Green Bay,
(920) 465-2795, harrisv@aqu.wisc.edu

Communications

Communications Office
(608) 263-3259

Earthwatch Radio
Richard Hoops, (608) 263-3149
earthwatch.radio@aqu.wisc.edu

News Media Contact
Stephen Wittman, (608) 263-5371
swittman@aqu.wisc.edu

Publications Requests
Linda Campbell, (608) 263-3259
publications@aqu.wisc.edu

Water Resources Library
JoAnn Savoy, (608) 262-3069
askwater@aqu.wisc.edu

University of Wisconsin Sea Grant Institute

Aquatic Sciences Center
Goodnight Hall, 2nd Floor
1975 Willow Drive
Madison, WI 53706-1177

Phone: (608) 262-0905
Fax: (608) 262-0591
Email: info@seagrant.wisc.edu
Web: www.seagrant.wisc.edu

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