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## **2014-16 DIRECTORY OF PROJECTS AND PEOPLE**

University of Wisconsin Sea Grant Institute



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Cover photo: A winter day in Two Rivers, Wis.

Credit: Titus Seilheimer / University of Wisconsin Sea Grant Institute

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PROJECTS AND PEOPLE**  
University of Wisconsin Sea Grant Institute

Sea Grant is a partnership with public and private sectors combining research, education, outreach and technology transfer for public service. Sea Grant is a national network of 33 university-based programs enhancing the practical use and conservation of coastal, ocean and Great Lakes resources to create a sustainable economy and environment.



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## From the Director

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The largest freshwater system on the planet faces challenges. Wisconsin Sea Grant is poised to address those challenges because it is in synch with coastal stakeholders up and down the shores of lakes Michigan and Superior. Those stakeholders shaped our 2014-17 strategic plan, which also aligns with the National Sea Grant College Program Strategic Plan and the University of Wisconsin-Madison Graduate School Strategic Plan. The graduate school is our home institution and reflects our commitment to linking research and education for the sustainable use of Great Lakes resources.


The projects detailed in this publication represent inspiration, insight and expertise all in support of building a healthy Great Lakes coastal ecosystem, a viable fishery, advancements in regional aquaculture, resilient and economically strong coastal communities, environmentally informed residents, and an expanded workforce literate in science, technology, engineering and mathematics.

In this research cycle we once again began with a call for proposals to bring out the best of innovation from scientists on Wisconsin's public and private campuses. Experts in physical and social sciences across the nation reviewed the 74 preproposals, which then winnowed down to 40 proposals that received even further scrutiny by technical panels. The result of all that scrutiny is on the following pages—22 new and continuing research projects, numerous supportive outreach activities and narratives on how we are focusing our efforts, along with strategies to achieve our goals.

Each two-year cycle brings the potential for breakthroughs on behalf of the Great Lakes and relies on stakeholder support, and strong local and regional partnerships. It's an exciting and iterative process that we will again undertake beginning in late 2014 when we release a request for preproposals for 2016-18.

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In the meantime, I am enthusiastic about what this next two years will bring to the benefit of our inland seas, a system thousands of years old and still sustaining life and industry along its shores. I know you share in my enthusiasm. I'd invite you to stay on top of what we accomplish as the years unfold. Our Web address is [seagrant.wisc.edu](http://seagrant.wisc.edu). At this site you can find rich resources, including video and audio updates, as well as links to our social media platforms through which we can engage with you in real time.



James P. Hurley, Director



# Participating Institutions and Agencies 2014-16

University of Wisconsin Sea Grant Institute

AmeriCorps	Lake Superior National Estuarine Research Reserve
Arizona State University	Loyola University
Bowling Green State University	Marine Biological Laboratory, Woods Hole, an affiliate of the University of Chicago
Central Michigan University	Marquette University
Cooperative Educational Service Agency 6	Medical College of Wisconsin
Cornell University	Michigan Coastal Management Program
East Central Wisconsin Regional Planning Commission	Michigan Department of Natural Resources
Federal Emergency Management Agency	Michigan State University
Fox-River Valley County Land Conservation Departments	Milwaukee Metropolitan Sewerage District
Great Lakes Dredging Team	Minnesota Department of Natural Resources
Great Lakes Indian Fish and Wildlife Commission	NEW Water
Illinois Coastal Management Program	NOAA Coastal Services Center
Illinois Natural History Survey	NOAA National Marine Sanctuary Program
Indiana Lake Michigan Coastal Management Program	NOAA National Weather Service
Julius Kühn-Institut, Federal Research Centre for Cultivated Plants	National Park Service

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Northland College  
Northwest Wisconsin Regional  
Planning Commission  
Ohio State University Extension  
Pennsylvania State University  
Purdue University  
St. Norbert College  
State University of New York-Stony  
Brook  
Southeastern Wisconsin Regional  
Planning Commission  
The Ohio State University  
U.S. Army Corps of Engineers  
U.S. Bureau of Indian Affairs  
U.S. Environmental Protection  
Agency  
U.S. Fish and Wildlife Service  
U.S. Forest Service  
U.S. Geological Survey  
University of Illinois  
University of Miami  
University of Michigan  
University of Minnesota-Duluth

University of Notre Dame  
University of Wisconsin-Extension  
University of Wisconsin-Green Bay  
University of Wisconsin-Madison  
University of Wisconsin-Manitowoc  
University of Wisconsin-Milwaukee  
University of Wisconsin-Oshkosh  
University of Wisconsin-Stevens Point  
University of Wisconsin-Superior  
Uppsala University  
Wisconsin Historical Society  
Wisconsin Coastal Management  
Program  
Wisconsin Department of Natural  
Resources  
Wisconsin Department of Public  
Instruction  
Wisconsin Department of Tourism  
Wisconsin Department of  
Transportation  
Yale University

## Healthy Great Lakes Coastal Ecosystems

Fifteen of Wisconsin's 72 counties border the Great Lakes of Superior and Michigan totaling over 800 miles of shoreline. On Lake Michigan, these ecosystems span from the state's southern border with Illinois north to the shared border with Michigan's Upper Peninsula. Wisconsin's Lake Superior habitats extend west from our shared border with Michigan's Upper Peninsula to the diverse ecosystem comprising the St. Louis Estuary at Superior. In Wisconsin, our healthy coastal ecosystems, sustained by their surrounding watersheds, are the foundation of life along the coast.

Keeping coastal ecosystems healthy is a challenge because of the diversity of stressors each system faces. This is further complicated because ecosystems do not adhere to political boundaries. Responsible management of these systems requires new kinds of thinking and actions, often termed ecosystem-based management. Ecosystem-based approaches require unprecedented levels of coordination among federal, state and local jurisdictions and the active engagement of the people who live, work and play along our coasts. They also require an understanding of the characteristics of species, landscapes and their interactions within each ecosystem.

In general, increasingly rapid coastal development, greater demands on fisheries resources, climate change and other human activities are leading to water-quality degradation, increased demands on water supplies, changes to fisheries stocks, wetlands loss, proliferation of aquatic invasive species and a host of other environmental impacts. It is essential for decision-makers and Great Lakes coastal residents to understand the interconnectedness and interactions of these systems in order to maintain vital habitats and inform restoration efforts within ecosystems and watersheds.

Sea Grant is a leader in regional approaches to understanding and maintaining healthy ecosystems, with planning efforts across the country to identify information gaps, implement research priorities and coordinate information and technology transfer to people who need it. Sea Grant recognizes the need to determine the value of myriad ecosystem

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services that maintain the conditions for life in and along the Great Lakes. Wisconsin Sea Grant and our partners are well-suited to clarifying and addressing ecosystem health at the appropriate management level.

### *National and Wisconsin Sea Grant Goals*

- Ecosystem services are improved by enhanced health, diversity and abundance of fish, wildlife and plants.
- Ecosystem-based approaches are used to manage land, water and living resources.
- Ecosystems and their habitats are protected, enhanced or restored.

### *Wisconsin Sea Grant Strategies*

- Support research that seeks to contribute to the understanding, management and improvement of Great Lakes ecosystem health.
- Engage researchers with the Sea Grant outreach and communications staff to effectively make available and deliver research-derived information and findings to resource managers, policy- and decision-makers and public stewards.
- Improve and enhance stakeholder access to and understanding of data, models and policy information in Wisconsin and the Great Lakes that support ecosystem-based planning, decision-making and management approaches.
- Help residents, resource managers, businesses and industries understand the effects of human activities and environmental changes on coastal resources.

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- Train and inform residents, resource managers and businesses so that they understand and can apply the policies that apply to coastal protected species and habitats.
  - Interpret data, train and inform residents, resource managers and businesses to help them understand threats to Great Lakes ecosystems and the importance of the benefits provided by preserving non-degraded ecosystems.
  - Support research to develop technologies and approaches for restoring degraded Great Lakes ecosystems.
  - Involve stakeholders in resource management decision-making processes and help resource managers incorporate public input in resource management decisions.

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## Projects

### **Changing Benthic Metabolism in the Great Lakes**

*J. Val Klump, UW-Milwaukee, (414) 382-1700, vklump@uwm.edu*

The Great Lakes have experienced arguably the largest short-term ecological shift in their history within the last decade and face a long-term climate shift in the decades to come. The invasion of Dreissenid mussels, the disappearance of Diporeia, and the predicted increasing temperatures and lengthening stratification have altered and will alter the role of benthic metabolism. The nearshore habitat is a complex of newly colonized cobble, gravel, hard clay and silty sands. Deepwater bottoms have been overrun with mussels. Production and respiration of oxygen are notoriously difficult to measure in such environments since many of the common methods—oxygen and pore water gradients, sediment or chamber incubations—all have limitations. The researchers propose to employ new, nondisruptive eddy correlation techniques to study oxygen exchange at the benthic boundary in a range of Great Lakes environments that have undergone or will undergo significant change. [R/HCE-12](#)

### **Assessment of Beach Remediation Efforts at Select Lake Michigan Beaches**

*Gregory Kleinbeinz, UW-Oshkosh, (920) 424-1100, kleinbei@uwosh.edu*

Water quality at more than 30 public beaches in Door County, Wis., has been monitored under the BEACH Act since 2003 using the fecal indicator bacterium (FIB) *Escherichia coli* (*E. coli*). Although sanitary survey analyses of these beaches have been performed and several beaches have been redesigned, assessment of the effects of beach redesign on water quality has not been included. This research will assess water-quality parameters (*E. coli* and Enterococci) during wet and dry weather at a newly redesigned Door County beach and a similar beach that has not yet been redesigned. A large historical database of FIB concentrations in beach water exists for these beaches and will be compared to post-redesign FIB concentrations. Since the U.S. EPA plans to implement

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rapid methods for beach water-quality measurements (qPCR for Enterococci), this study also will compare Enterococci concentrations with traditional culture and molecular methods. [R/HCE-13](#)

### **Climate Change Impacts on Anuran Ecotoxicology in Great Lakes Ecosystems**

*William Karasov, UW-Madison, (608) 263-9319, wkarasov@wisc.edu*

Generally, most contaminants become more toxic as temperature increases. However, the exact mechanism(s) underlying this relationship are not well understood. The focus of this project is temperature-dependent effects of chronic exposure to persistent organic pollutants (POPs)-polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs). The researchers hypothesize that increased temperature (as predicted with climate change in Great Lakes ecosystems) will increase food and hence toxicant intake rate, but may also increase the biotransformation and elimination rates that influence overall bioaccumulation; contaminant toxicity will also increase. The researchers seek to determine the temperature dependence of exposure kinetics (uptake, elimination and bioaccumulation) for POPs at environmentally relevant concentrations in northern leopard frogs and determine the temperature dependence of toxicity for POPs.

[R/HCE-14](#)

### **A Tale of Two Beaches: Bridging the Research and Policy Gap to Improve Urban Beach Ecosystem Health**

*Sandra McLellan, UW-Milwaukee, (414) 382-1700, mclellan@uwm.edu*

Milwaukee's South Shore Beach on Lake Michigan requires major investments (\$1-5 million) in order to improve water quality. The beach can serve as an excellent case study for understanding how communities can address severely degraded beaches by incorporating sound science and policy into coastal management. In this project, we will examine the barriers to this process and fill gaps in information needed to estimate water-quality improvement at South Shore Beach under different remediation scenarios. We will also work directly with stakeholders to transfer scientific information and policy

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recommendations to create a decision-making framework where costs can be weighed against benefits. Bradford Beach, which has benefitted from more than \$1 million in improvements, will serve as a comparison to quantify the economic value of a healthy beach ecosystem. The main outcome from this project will be development of guidance for decision-making when dealing with highly degraded urban beaches that need considerable investments to make them safe and enjoyable recreational swimming beaches. [R/HCE-15](#)

### **Role of Invasive Quagga Mussels in Regulating Organic Carbon Dynamics in Lake Michigan**

*Laodong Guo, UW-Milwaukee, (414) 382-1742, guol@uwm.edu*

The Great Lakes have experienced significant ecological changes due to increasing anthropogenic influences and the introduction of invasive species, resulting in the decline of fish biomass and changes in ecosystem function, food web structure and carbon/nutrient dynamics. However, the pathways/mechanisms and changes in nutrient/carbon dynamics remain elusive. Quantitative linkages between quagga mussels and changes in carbon/nutrient dynamics in Lake Michigan remain poorly known. Understanding the uptake pathways and interactions of quagga mussels with dissolved, colloidal and particulate organic matter in the water column is likely at the heart of this issue. Our working hypothesis is that ultra-fine colloidal or nanoparticulate organic matter is either retained or taken up by quagga mussels, consequently competing for food sources with zooplankton and altering carbon/energy flow in the water column. Our results from controlled laboratory experiments should provide new insights into biogeochemical consequences of invasive species in Lake Michigan. [R/HCE-16](#)

### **Constructing a Lake Michigan Nearshore Ecosystem Model**

*Harvey Bootsma, UW-Milwaukee, (414) 382-1717, hbootsma@uwm.edu*

As a result of fundamental changes in the functioning of Lake Michigan and the other Great Lakes in the past two decades, nearshore biogeochemical processes have become



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somewhat distinct from offshore processes. While pelagic waters have become oligotrophic to the point of negatively affecting fish populations, the nearshore zone, which in many parts is dominated by Dreissenid mussels, experiences excessive levels of nuisance algal growth on the lake bottom. In recognition of these changes, the revised Great Lakes Water Quality Agreement has stressed the need to update phosphorus targets for nearshore water. New targets require science-based models that can predict the response of nearshore biota and water quality to phosphorus loads and concentrations. We propose to address this need by integrating research findings and models of specific nearshore processes that we have developed over the past seven years into a linked physical-biogeochemical nearshore ecosystem model. The model will be calibrated with existing data and validated with new data collected during this study. [R/HCE-17](#)

### **Integrating Prior Vegetation Surveys to Test Spatial and Temporal Patterns of Wetland Floristic Quality in the St. Louis River Estuary**

*Nicholas Danz, UW-Superior, (715) 394-8161, ndanz@uwsuper.edu*

The St. Louis River widens into a 12,000-acre freshwater estuary near its entry into Lake Superior. The estuary has serious pollution issues resulting from a history of heavy industrial use, but high-quality wetlands are widely distributed throughout this system. These wetlands play many critical ecological roles, but there is very little available scientific information regarding plant composition and floristic quality throughout the estuary. This information would allow us to address several research questions of current management interest, including creating target species lists for restoration, identifying drivers of floristic quality and developing a vegetation baseline for judging future changes. Our goal in this project is to use existing data from a multitude of plant studies in the estuary over the past few decades to create an emergent synthesis of wetland vegetation in the St. Louis River estuary that will address these management questions. [R/HCE-18](#)

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## **Modeling the Chequamegon Bay Ecosystem to Facilitate Climate Adaptation**

*Randy Lehr, Northland College, (715) 682-1261, rlehr@northland.edu*

To manage the Lake Superior ecosystem effectively in the presence of changing climatic conditions, it is necessary to understand the relationship between increases in water temperature, changes in tributary runoff—particularly nutrient, sediment and organic matter loads—and nearshore water-quality conditions. Water temperatures and stream hydrology are anticipated to continue to shift in the coming decades. Given that water temperature and tributary runoff are both key drivers of the nearshore environment in Lake Superior, it is likely that water-quality in these ecosystems will also shift in response. However, it is unclear what the resulting water-quality conditions will be under future climatic scenarios. This project will estimate the potential impacts of climate change on water-quality conditions in the Chequamegon Bay, and results from this work will describe an integrated framework for assessing the individual and combined effects of climate stressors, providing valuable information to communities making decisions related to climate adaptation. [R/HCE-19](#)

## **Investigate the Proliferation of Antimicrobial Resistance in Lake Michigan Coastal Waters**

*Krassimira Hristova, Marquette University, (414) 288-5120, krassimira.hristova@marquette.edu*

The focus of this project is to investigate a novel role of the invasive Dreissenid mussels, zebra and quagga, on the dissemination of antibiotic resistance genes (ARGs) in the Great Lakes coastal ecosystem through horizontal gene transfer (HGT). We hypothesize that the primary source of ARG proliferation in Great Lakes coastal ecosystems is the gastrointestinal microbiome of humans and animals consuming antibiotics, and invasive Dreissenid mussels that concentrate bacteria in their gut. The project goal is to characterize the surface water resistome in Lake Michigan and an inland Wisconsin lake by characterizing ARG diversity, HGT rates and the impact of zebra and quagga mussels on the dissemination of ARGs. This project will provide novel information of how the

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interactions of many ecosystem factors, including treated wastewater, invasive species and the microbiome of coastal waters, interact to lead to potential reservoirs of antibiotic resistant bacteria. [R/HCE-20](#)

### **Measuring Iodine-131 in Coastal Lake Michigan: A Point Source Tracer for Wastewater**

*James Waples, UW-Milwaukee, (414) 382-1741, [jwaples@uwm.edu](mailto:jwaples@uwm.edu)*

Although great improvements have been made in sewage wastewater treatment, wastewater is still a major source of nutrient and contaminant loading to Lake Michigan. Of increasing concern are the many human pharmaceuticals that are ineffectively removed from the wastewater stream. Iodine-131 (I-131) is particularly suited for tracking sewage wastewater and sewage-sourced contaminants for several reasons: It is used as a radio-pharmaceutical (with few exceptions) and released in human waste to the municipal sewage treatment system. I-131 has a short half-life, making it ideally suited for measuring recent wastewater exposure. It is actively taken up (and concentrated) by aquatic organisms. It is relatively easy to measure by gamma spectroscopy. Milwaukee is the largest contributor of sewage wastewater to Lake Michigan, and the prevalence of I-131 here may indicate the extent of this tracer's usefulness throughout the North American Great Lakes. [R/HCE-21](#)

### **The Basis for Microbially Mediated Mercury Methylation in Oxygen-Depleted Zones of the Great Lakes**

*Katherine McMahon, UW-Madison, (608) 890-2836, [tcmahon@engr.wisc.edu](mailto:tcmahon@engr.wisc.edu)*

Elevated levels of the potent neurotoxin methylmercury (MeHg) are present in fish throughout the Great Lakes. An inability to balance sources and sinks of MeHg in aquatic ecosystems suggests that we are missing significant processes and/or locations of MeHg production. In this project, we will test hypotheses about the organisms and their genes expected to be responsible for Hg methylation in the Great Lakes. We will

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use molecular techniques to relate microbial community composition to MeHg and total Hg levels at depth-resolve intervals within the water column of all five Great Lakes, at stations known to have significant MeHg concentrations. We will also target recently identified genes known to be involved in methylation in pure cultures of anaerobic bacteria. Finally, we will evaluate the effect of thiols on methylation in lake microbial communities. This work will advance our understanding of the freshwater Hg cycle, providing evidence for the mechanisms at play in microbial communities mediating methylation. [R/HCE-22](#)

### **An In Situ Molecular Detection System for Microcystin Monitoring**

*Matthew Smith, UW-Milwaukee, (414) 382-1700, smith926@uwm.edu*

Human activities are increasingly causing eutrophication of water supplies, which has led to an increase in toxin-producing organisms such as cyanobacteria. Of these toxins, microcystins are a group of hepatotoxins that have been shown to cause adverse health effects in humans and animals even at low concentrations. There is a need for instruments capable of making autonomous, species-specific, microbiological measurements that can serve as early warning systems for toxic metabolites in freshwater systems. We propose to develop a field-portable autonomous instrument that can be deployed in water bodies for extended periods (~1 month) and provide near real-time detection of microcystin. The proposed instrument will decrease the labor requirements of routine monitoring, while increasing sampling resolution during dangerous or inconvenient times. [R/HCE-23](#)

### **A New Tool for Studying Food Web Change in the Great Lakes: Amino Acid-Specific Nitrogen Isotope Analysis**

*M. Jake Vander Zanden, UW-Madison, (608) 262-9464, mjvanderzand@wisc.edu*

Great Lakes ecosystems have undergone dramatic changes due to a suite of interacting anthropogenic stressors. For example, Dreissenid mussels have shunted productivity to the nearshore benthos and caused severe oligotrophication in the offshore zone. What

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are the underlying food web changes that both drive and respond to these remarkable ecological shifts? Amino acid-specific nitrogen isotope analysis is a novel approach for measuring food web change in freshwater systems. We will develop the basis for long-term retrospective food web analysis from preserved museum specimens and calcified tissues (fish scales and otoliths). Using this approach, we will test hypotheses about historical trophic niche partitioning among deepwater coregonids in the upper Great Lakes. In addition, we will test hypotheses about food web responses to Dreissenid-driven changes in nearshore and offshore habitats. This innovative approach has exciting potential to serve as an integrative ecological indicator of Great Lakes ecosystem health. [R/HCE-24](#)

### **An Ancient but Unrecognized Mechanism for Harvesting Light Energy in Great Lakes Bacterioplankton**

*Katherine McMahon, UW-Madison, (608) 890-2836, [tcmahon@engr.wisc.edu](mailto:tcmahon@engr.wisc.edu)*

Aquatic microorganisms play a critical role in the Great Lakes. They mediate nearly all biogeochemical cycling of carbon and nutrients. Recent findings suggest a previously unrecognized mode of light harvesting to support microbial biomass, with broad implications for our understanding of the microbial loop and the underpinnings of Great Lakes food webs. Some very abundant and prevalent freshwater bacteria carry genes that seem to encode proton-pumping rhodopsins, which allow for energy generation independent from conventional phytopigments, such as chlorophyll in algae and phycocyanin in cyanobacteria. Similar genes have been found in marine bacteria, and a recent study identified genes encoding novel rhodopsin-like proteins in Actinobacteria, by targeting single cells recovered from inland lakes. We know almost nothing about how and when these enzymes work, but we now have preliminary data that allow us to tackle this knowledge gap. Our overarching research goal is to functionally characterize these freshwater actinorhodopsin proteins. [R/HCE-25](#)

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## Outreach

**Total Maximum Daily Load and Area of Concern (Noordyk)** – Through the work of the Total Maximum Daily Load (TMDL) Outreach Committee, which consists of multiple partners, Sea Grant will support implementation efforts of the Lower Fox River TMDL plan. The efforts will focus on the three primary stakeholder groups impacted by the TMDL targets: (1) stormwater permit holders, (2) agricultural producers and farmers and (3) point source dischargers. The committee will work with NEW Water, the Green Bay sewerage district, to foster collaboration throughout the watershed using an adaptive management strategy. Related work is chairing the Area of Concern–Citizen Advisory Committee Outreach and Education Subcommittee that will identify and coordinate outreach and education activities to improve water quality in the watershed. [A/AS-01](#)

**Climate Change and Green Bay Hypoxia Decision Support Tool (Noordyk)** – This project, for which Sea Grant provides supportive outreach activities for two partner campuses, will create a decision-support tool for use within the Lower Fox River watershed to support ecosystem-based management using alternative sediment and phosphorous loading and climate trend scenarios. Funding source: University of Michigan Water Center. [A/AS-01](#)

**Wisconsin Clean Marina Program (Noordyk)** – Collaborating with the Wisconsin Marina Association, Sea Grant will work with state marinas voluntarily adopting measures to reduce pollution from marinas, boatyards and recreational boats. Activities include business training, marina inspector training, a website, and committee participation in statewide and regional clean marina planning and guidance efforts. [A/AS-01](#)

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**Wisconsin Department of Natural Resources and Sea Grant Partnership for AIS Prevention (Moy/Seilheimer)** – This project continues aquatic invasive species watercraft inspections using nine people stationed at Great Lakes boating access sites. It's a partnership of Sea Grant, the Wisconsin Department of Natural Resources and University of Wisconsin-Extension. Funding source: Great Lakes Restoration Initiative, [NMC00000897](#).

**Watercraft Decontamination for Wisconsin Communities and Organizations (Campbell)** – Interest in watercraft decontamination has grown as localities and states adopt strategies for aquatic invasive species prevention. The goal of this project and Sea Grant's two partners is to develop standard decontamination recommendations for Wisconsin, provide guidance to stakeholders interested in decontamination and provide decontamination educational materials. [A/AS-01](#)

**Great Lakes Charter Captains Aquatic Invasive Species Network (Campbell)** – Charter captains are opinion leaders in the field of fishing and may speak with clients daily about aquatic invasive species (AIS) issues. However, captains may not know all the facts about AIS and may not have time to seek them out. This project, carried out with two partners, will determine the information needs of charter captains and provide that information in the form of a toolkit. The toolkit will contain a standard mechanism for reporting an unknown or possible new AIS. This standard reporting process will increase the likelihood of reporting new sightings and is designed to increase communication between charter captains and AIS professionals. [A/AS-01](#)

**Wakeboard Boat Ballast Study (Campbell/Seilheimer)** – Some recreational boats have onboard ballast systems that are used to increase wake height to augment the enjoyment of water sports such as wake boarding and water skiing. These systems can contain more than 100 gallons of ballast and have the potential to transport invasive species.

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Initial observations from working with a wakeboard boat dealer determined that significant volumes of ballast water remains in the tanks even after the system has been “fully drained.” Transporting water from lake to lake is in violation of Wisconsin law. Although this rule is not currently being enforced on recreational boats with ballast systems, helping boaters comply will reduce the risk of transporting aquatic invasive species (AIS). The goals of this project, which involves two partners, are to assess the potential of recreational boat ballast to transport AIS, assess the risk of the boating behaviors of this boating group and ultimately develop a process to reduce the risk of recreational boat ballast transporting AIS. [A/AS-01](#)

**Organisms in Trade Symposium (Moy/Campbell)** – Nursery plants, exotic pets, study specimens, live bait and live food (also called “organisms in trade”) are all part of trade pathways that could introduce a species to a new ecosystem. In partnership with the Great Lakes Sea Grant Network, Wisconsin Sea Grant is hosting a regional conference to learn more about what has been done to address these specific pathways and develop a cooperative relationship between industry, regulators, educators and consumers so that OIT issues can be better addressed in the future. Other activities involving regulatory and business partners for this project include consumer outreach at trade shows and the continued promotion of the Habitattitude campaign. Funding source: Minnesota Sea grant, [DOO31491051](#).

**Characterizing Usage of Great Lakes Boating Access Through Launch Passes (Campbell)** – As aquatic invasive species (AIS) awareness increases, more targeted efforts will be required to reach high-risk boaters efficiently through this project that will involve partners. Understanding the usage of water access points can help target outreach and prevention activities. Knowing where boaters are from and where they access the water throughout the boating season can help direct prevention activities. Launch passes from coastal communities will be used to obtain data such as the number of nonlocal



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users and users per week. This information can then be compared across communities to determine where prevention resources would be best used throughout the boating season. [A/AS-01](#)

**AIS Prevention at Fishing Tournaments (Moy/Campbell)** – Fishing tournaments have the potential to spread aquatic invasive species (AIS) through the movement of participants' boats among water bodies and the equipment used by tournament organizers. Judge and release boats and weigh-in equipment may be transported hundreds of miles between events with little time to dry. By educating tournament organizers, and in turn tournament participants, about AIS prevention, Sea Grant and its national and regional partners can slow the spread of AIS between waters, maintain the fishing tournament industry and engage tournament anglers in youth education. Funding source: Great Lakes Restoration Initiative, [GL-OOF01138-0](#).

**Asian Carp Research (Seilheimer)** – This will be a literature review of current research on the control of the spread of Asian carp throughout the Great Lakes and Mississippi River basin to also include input from the more than 25 partner organizations involved in control measures. These efforts will create a document on the current status of research that will be directed toward interested members of the public, resource managers and policymakers. Finally, Sea Grant will identify knowledge and information gaps in the current understanding of Asian carp in North America. The identified gaps can then be used to guide future research and management activities for better control of the species and more efficient use of funds. Funding source: Asian Carp Regional Coordinating Committee through Ohio Sea Grant, [6003744 RFO1305214](#).

## Sustainable Fisheries and Aquaculture in the Great Lakes Region

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The nation has witnessed the decline of many of its major fisheries while seafood consumption has increased and continues to be encouraged because of its health benefits. To fill the gap between seafood demand and domestic harvests, the United States imports 86 percent of what is consumed leading to a seafood trade deficit of over \$10 billion per year. With global wild fisheries harvests at a plateau of around 185 metric tonnes, some 50 seafood species are now produced from aquaculture. There are no projected increases in wild capture fisheries, but global aquaculture is predicted to increase by 33 percent over the next decade. These projections create opportunities for an expanded Great Lakes basin aquaculture industry and for innovative marketing strategies and value-added products for the wild fisheries industry.

The overall economic impact of the commercial, recreational, for-hire fisheries and aquaculture industries in the region is \$7 billion annually. In Wisconsin, 1.4 million fishing licenses are issued each year, and fishers and the fishing industry deliver \$2.75 billion in economic impact and 30,000 jobs every 12 months. There are 70 commercial fishers in Wisconsin who rely on fewer than 10 species, and have a combined harvest of \$5 million annually.

Wisconsin's aquaculture industry contributes \$21 million in annual economic activity and more than 400 jobs to the state. There is definitely room for growth — additional opportunities for job creation, and contributing to meeting the demand for finfish. The Midwest consumes more than a billion pounds of seafood products per year but less than 4 percent comes from aquaculture operations in the region.

Sea Grant continues to play a leadership role in developing innovative technologies for all sectors of the seafood industry, including fishing, aquaculture, seafood processing and consumer safety, to ensure a safe and sustainable supply of seafood products now and for future generations. Seafood safety will continue to be a concern for consumers as foreign imports, some of which are associated with seafood contamination, continue to increase.

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Sea Grant's partnership with NOAA Fisheries, state fisheries managers, seafood processors, fishing associations, the aquaculture industry and consumer groups will ensure safe, secure and sustainable supplies of domestic seafood and decrease our reliance on seafood imports.

### *National and Wisconsin Sea Grant Goals*

- A safe, secure and sustainable supply of seafood to meet public demand.
- Informed consumers who understand the health benefits of seafood consumption and how to evaluate the safety and sustainability of the seafood they buy.

### *Wisconsin Sea Grant Strategies*

- Support research to develop and improve aquaculture practices and techniques, including aquaponics, nutritional value of feeds and disease and pathogen prevention and diagnosis.
- Develop outreach products to make wild fish harvesters and aquaculture operations aware of advancements in product handling, packaging and marketing strategies.
- Support research that leads to a better understanding of the risks and benefits of consuming Wisconsin-produced fish.
- Develop outreach products for Wisconsin consumers about Wisconsin origin fish and fisheries products and other seafood choices, including nutrition benefits, risks, seafood safety and environmental impacts.

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## Projects

### **Genetic Analysis of Virulence Factors of the Fish Pathogen *Flavobacterium Columnare***

*Mark McBride, UW-Milwaukee, (414) 229-5844, mcbride@uwm.edu*

*David Hunnicutt, St. Norbert College, (920) 403-3200, david.hunnicutt@snc.edu*

*Flavobacterium columnare* is a common fish pathogen that causes columnaris disease in wild and farmed freshwater fishes and results in devastating losses in the aquaculture industry. The disease has been recognized for nearly 100 years, but a lack of genetic tools to manipulate the bacterium has hampered identification of the mechanisms of pathogenesis. The researchers developed robust genetic tools and procedures for *Flavobacterium johnsoniae* and recently demonstrated that some of these function in *F. columnare*; they propose to adapt additional genetic tools for use in *F. columnare*. *F. johnsoniae* GldN is a component of a novel protein secretion system. The researchers suspect that *F. columnare* GldN is involved in secretion of the chondroitinase CslA, and that GldN and CslA are needed for virulence. To test these hypotheses, wild-type, gldN mutants and CslA mutants will be examined for ability to cause disease in the model zebrafish system and in yellow perch. [R/SFA-08](#)

### **Quantifying Coastal Wetland – Nearshore Linkages in Lake Michigan for Sustaining Sport Fishes**

*Patrick Forsythe, UW-Green Bay, (920) 465-2524, forsythp@uwgb.edu*

Coastal wetlands support rich and diverse faunal communities, providing habitat for 90 percent of Great Lake fish species. Estimates of the linkages between coastal wetlands and other lake habitats will fill a major data gap concerning how wetland degradation and restoration of previously degraded wetlands affect the Lake Michigan nearshore food web. Otolith microchemistry analysis will provide an estimate of fish use of wetland-nearshore habitats. Isotope mixing models will be used to construct cross-habitat food webs and provide estimates of wetland and nearshore energy sources for piscivorous fish.

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These results will determine both how and when nearshore sport fish use wetland habitats and accumulate wetland energy. By understanding wetland-nearshore linkages, we can incorporate coastal wetlands into long-term management of Great Lakes food webs and the Lake Michigan fishery, and set appropriate protection and restoration priorities for the Lake Michigan coastal zone. [R/SFA-09](#)

## Outreach

**Aquaponics Manual (Binkowski)** – This project will produce a comprehensive, region-specific aquaponics manual covering all aspects of fin fish and plant production from initial concept and system design to the final phase of marketing and processing of fin fish, plants and vegetables. This new-age aquaponics concept will be used on a regional and national level. [A/AS-01](#)

**Aquaculture and Aquaponics Curriculum and Training (Binkowski/Fischer/Hartleb/Rogge)** – This project of Sea Grant, partner individual school districts, the Wisconsin Department of Public Instruction and other groups will develop aquaculture and aquaponics curriculum and training programs specifically directed to science and agricultural educators within Wisconsin's and First Nation school systems. This education program will expand Sea Grant involvement to more than 30 schools. [A/AS-01](#)

**Cool- and Cold-Water Aquaculture (Binkowski/Fischer/Hartleb/Rogge)** – Through this project, Wisconsin's existing and prospective aquaculturists will gain increased access to University of Wisconsin- Stevens Point Northern Aquaculture Demonstration Facility technology and information regarding fish biology, engineering and water chemistry related to the health and growth potential for fish species such as hybrid walleye and sauger (known as saugeye), lake trout, lake herring, Arctic char, yellow perch and Atlantic salmon. [A/AS-01](#)

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**Urban Aquaculture (Binkowski)** – UW-Milwaukee School of Freshwater Sciences personnel, supported by Wisconsin Sea Grant, will provide technical assistance in all aspects of urban aquaculture with expertise in biological, chemical, physical and economic parameters. Sea Grant will use this opportunity to involve new people and potential investors in the urban setting, which has the advantage of product availability near consumer demand, which also reduces transportation costs and can create jobs in central cities. [A/AS-01](#)

**Workforce Training on Aquaculture (Binkowski/Hartleb/Moy/Wawronowicz)** – This project recognizes the varied levels of expertise for those in Wisconsin’s aquaculture industry and responds with a series of teaching modules based on a three-tiered system of progressive advancement using online lectures and in-person workshops. Overall, the focus is on cold- and cool-water fish production Tier one encompasses a business plan, permitting and regulations, and marketing. Tier two involves nutrition, fish health and pond culture. Tier three will provide training on recirculating aquaculture systems, principles of biofiltration and aquaponics. This project aligns with NOAA’s 2013 strategic plan that calls for the need to create a skilled workforce and effective technology transfer. [A/SFA-01](#)

**Great Lakes Commercial Trap Nets Location (Seilheimer)** – In order to diminish life-threatening entanglement events involving sport anglers’ equipment and commercial fishing nets, Sea Grant works with the Lake Michigan commercial whitefish fleet to make the GPS coordinates of commercial trap nets available to anglers on its website and in printed maps in some locations. In previous years, the project included areas from Sheboygan to the Two Rivers/Manitowoc area. [A/AS-01](#)

**Salmon Ambassadors Wisconsin (Seilheimer)** – This project will engage Wisconsin anglers in the management of Lake Michigan Chinook salmon and also involves partner state and federal regulatory agencies. Anglers will be recruited from Wisconsin ports

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to collect information about the fish they catch. Fish size and fin clip (an indicator of stocked versus wild) data will be collected by anglers to increase the knowledge of seasonal change in the abundance of wild salmon in Wisconsin waters. This program will also allow for increased and more targeted collection of Chinook salmon heads for retrieval of coded wire tags, which will offer information on the movement of stocked and wild salmon. [A/AS-01](#)

**Safe and Sustainable Seafood Consumer Education (Kline/Harrison/Gen/T. Dellinger)**

– Many people are interested in purchasing more of their food from local sources, but when it comes to local fish, consumers often have questions about nutrition benefits and risk, as well as environmental sustainability. Sea Grant will continue its Eat Wisconsin Fish campaign to educate consumers about the benefits and risks of eating wild Great Lakes fish and Wisconsin farm-raised fish, as well as the environmental impacts associated with them. Sea Grant is partnering with one local store to pilot communications products with its customers. Following the pilot, these products will be revised and distributed to grocery stores, fish markets and distributors statewide to provide the information consumers need to make healthy choices for their families and support Wisconsin fishermen and fish farmers. [A/AS-01](#)

## Resilient Great Lakes Communities and Economies

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Coastal communities provide vital economic, social and recreational opportunities for millions of people within the Great Lakes basin. A 2011 study completed by the University of Michigan reported that more than 1.5 million jobs, generating \$62 billion in wages are tied to the inland seas. The job breakdown is: 994,879 in manufacturing; 217,635 in tourism; 118,550 in shipping; 118,430 in agriculture, fishing and food production; 38,085 in science and engineering; 10,980 in utilities; and 10,003 in mining. In Wisconsin, 173,969 jobs can be linked to the Great Lakes. Population migration has also transformed many natural coastal habitats into urban landscapes and intensified the use of finite coastal resources. From 2000 to 2010, the population in the 15 counties bordering Wisconsin's Great Lakes grew by 57,500. This population increase and developmental pressure has resulted in greater vulnerability of coastal communities and environments to natural and technological hazards. To accommodate more people and activity while balancing demands on coastal resources, Wisconsin must develop innovative policies, institutional capacities and management approaches to increase community resilience.

Sea Grant will continue to support cutting-edge research in the areas of marine-related energy sources, climate change, coastal processes, energy efficiency, hazards, stormwater management and tourism. In Wisconsin, Sea Grant will engage our diverse and growing coastal populations in applying the best-available scientific knowledge to address increased resource demands and vulnerability. Ultimately, Wisconsin Sea Grant will bring its unique research and engagement capabilities to support the development of resilient coastal communities that sustain diverse and vibrant economies, effectively respond to and mitigate natural and technological hazards and function within the limits of their ecosystems.



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### *National and Wisconsin Sea Grant Goals*

- Development of vibrant and resilient coastal economies.
- Communities use comprehensive planning to make informed strategic decisions.
- Improvements in coastal water resources sustain human health and ecosystem services.
- Resilient coastal communities adapt to the impacts of hazards and climate change.

### *Wisconsin Sea Grant Strategies*

- Support research to document the socioeconomic values of open water and coastal businesses and other water-dependent industries and research that addresses natural resource valuation along Wisconsin's Great Lakes.
- Utilize Web-based technologies, publications, displays and communication dissemination using traditional and new media to make available, and distribute, information about the value of waterfront, tourism-related economic activities and other socioeconomic impacts.
- Support research to develop or enhance community planning and visualization tools that demonstrate the benefits, risks and consequences of urbanization on the coastal environment.
- Support research that assesses the economic and social well-being of Wisconsin coastal communities to document improvements in quality of life related to coastal development plan implementation.

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- Work with Wisconsin's coastal communities, community leaders and businesses to help them develop and adopt plans for responsible development.
  - Support research to assess the impacts of human activities on Great Lakes watersheds, water quality and supply.
  - Communicate alternative actions to conserve water, protect water quality and protect water supply.
  - Help communities understand the reasons and restrictions on Great Lakes water use particularly in areas peripheral to the Great Lakes basin.
  - Support research that evaluates the impacts of increased climate variability and change, including intensity and frequency of rainfall and storm events on coastal community infrastructure.
  - Develop outreach and communications tools so that communities can understand the consequences of alternative development and stormwater mitigation scenarios.
  - Work with regulatory agencies, tribal entities and communities to help them understand the vulnerability of coastal properties to storm impacts.

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## Projects

### **Building Blocks of the Heartland: Underwater Investigations of Wisconsin's Stone Industry**

*John Broihahn, Wisconsin Historical Society, (608) 264-6496, john.broihahn@wisconsinhistory.org*

Nineteenth-century stone quarrying had a lasting effect on the Great Lakes coastline, and today quarries that closed a century ago are readily identifiable. Stone from these quarries often reached market aboard Great Lakes vessels. This project will document two components of the historic stone trade—the S.C. Baldwin, a vessel that served in the stone trade, and the stone quarry piers on Basswood, Hermit and Stockton Islands in the Apostle Islands where such vessels were loaded. Data gathered during the Basswood Island survey will be used to update the current entry on the National Register of Historic Places, and data collected on the S. C. Baldwin, Hermit and Stockton Island sites will be used to evaluate these sites for listing on the register. Collected data will be distributed to professional and public audiences via professional papers, reports, public programs, websites, dive guides, news media and National Park Service publications.

C/RCE-01

### **Estimating the Economic Benefits of the Wisconsin Great Lakes Sport Fishery**

*Daniel Phaneuf, UW-Madison, (608) 262-4908, dphaneuf@wisc.edu*

This project will develop models describing the behavior of users of the recreation fishery, focusing on developing predictions that are conditional on the range of ecological and management regimes that may exist in the future. This will allow prospective analysis of how economic benefits may change in response to changes in stocking rates, invasive species control, pollution levels, and other management and environmental conditions. Researchers will conduct surveys of private anglers and charter boat captains and combine the results with existing data to develop spatially explicit models of anglers' participation and destination decisions and charter operators' profit-maximizing deci-

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sions. Once in place the models can be used to understand how use of the fishery will evolve if, for example, stocking rates are reduced. Predictions of the changes in behavior will then be used to simulate how the economic benefits to individuals and coastal communities may be affected by these types of external shocks. [R/RCE-01](#)

### **Development of Geo-Indicators for Assessment of Coastal Bluff Ecosystem in Lake Michigan for Regional Integrated Bluff Management (IBM)**

*Chin Wu, UW-Madison, (608) 263-3078, chinwu@engr.wisc.edu*

Coastal bluffs along the Great Lakes are a sensitive landscape feature, often containing both vital shoreline habitat at the bluff toe and urbanized development at the crest. Sediments in the coastal bluff environment (CBE) play an important role in ecosystem function. Movements of sediment are constantly altered by natural climate factors and anthropogenic coastal development, making a sediment budget accounting for sources, sinks and pathways of sediment transport critical. In this project we will develop three sets of geo-indicators to parameterize the CBE, quantify coastal processes on a regional sediment budget and characterize the health or function services of the CBE. The resilience of geo-indicators in response to stressors like coastal development and climate change would be examined on three sites of varying urbanization along the Wisconsin coast of Lake Michigan. The geo-indicators would help coastal managers effectively assess the health of the coastal bluff ecosystem for regional integrated bluff management along Lake Michigan. [R/RCE-02](#)

### **Algal Bioremediation of Wastewater Inputs to Great Lakes Ecosystems**

*Erica Young, UW-Milwaukee, (414) 229-3257, ebyoung@uwm.edu*

Future sustainability of coastal communities demands a reduction of nutrients in effluents from wastewater treatment plants, and population growth is increasing pressure on communities' infrastructure to manage and treat wastewater. Algal species like *Cladophora* can tolerate and take up high concentrations of nutrients, and this can be exploited for nutrient remediation of wastewater. The researchers have already shown

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in laboratory tests that *Cladophora* can deplete sewerage effluent of soluble reactive phosphorus to  $<5$  ug/L and also provide a good biomass feedstock for biofuels production, offering combined sustainability benefits for use in remediation of wastewater. This project aims to develop algal nutrient remediation of wastewater that will provide cost savings to coastal communities and offer more sustainable options to improve lake ecosystem health. [R/SCD-06](#)

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## Outreach

**Great Lakes Coastal Storms Program (Noordyk)** – The NOAA Coastal Storms Program is a nationwide effort now focused on the Great Lakes, administered by Wisconsin Sea Grant along with Minnesota Sea Grant and involving multiple partners. Its goal is to make coastal communities safer by reducing the loss of life and the negative impacts of coastal storms. The program provides an array of tools and services, including improved observing systems, forecast models, decision-support tools, risk assessments, best-management practices, socioeconomic information, and outreach and extension activities to enhance community resilience. Funding source: NOAA Coastal Storms Program, [NA12OAR4170111](#).

**Identifying Land Use Indicators and Ecosystem Tipping Points in the Great Lakes Basin – Wisconsin Outreach (Hart/Noordyk)** – This project identifies land-use indicators and tipping points in Great Lakes nearshore areas that can be used to develop the policies, ordinances and restoration priorities needed to sustain Great Lakes ecosystems. Sea Grant specialists helped define the outreach approach for the project, attended train-the-trainer workshops to learn how to apply the tipping points indicators and will work with the Bay-Lake Regional Planning Commission to apply the indicators in Wisconsin. Funding source: Illinois-Indiana Sea Grant with CILER, [2013-03729-05 AA943](#).

**Design and Development Recommendations for Great Lakes Water Level Visualization Tools (Hart)** – This research supports existing work at NOAA to translate the Sea Level Rise and Coastal Flooding Impacts Viewer to visualize changing water levels on the Great Lakes. It includes development of (1) a functional and technological comparison of map-based water level spatial decision support and geographic visualization tools currently available to the public, (2) a description of the type of target users and use-case scenarios for the planned NOAA Lake Level Viewer, with an emphasis on new or revised scenarios for visualizing lake levels rather than sea levels and (3) a recom-

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mended set of functional and technological design requirements for the NOAA Lake Level Viewer as well as a recommended process for continued user-centered design of the tool. Funding source: Great Lakes Restoration Initiative, [NA13OAR4170213](#).

**Promote Coastal Heritage Tourism (Hart)** – Sea Grant has collaborated with multiple governmental and academic partners on several projects that promote a better understanding of Wisconsin’s Great Lakes coastal heritage. Projects include a website that features stories about Wisconsin shipwrecks, development of geocaching sites that provide education about Great Lakes maritime heritage and a Web-mapping site that promotes exploration of the Great Lakes Circle Tour. This project will enhance those efforts and integrate them with partner activities to create a more holistic approach to promote coastal heritage tourism both in Wisconsin and neighboring states. [A/AS-01](#)

**Geospatial Technologies for Great Lakes Coastal Management (Hart)** – This activity with numerous governmental, academic and private partners will expand the content and use of the Wisconsin Coastal Atlas and develop decision-support tools that promote adaptive management, ecosystem-based management, sustainable coastal development and resilience to coastal hazards. [A/AS-01](#)

**Climate Change Adaptation and Wisconsin’s Coastal Communities: Connecting With Users (Moy/Hart/Clark)** – Sea Grant staff works with coastal communities to inform planners and decision-makers about the current science on climate adaptation. Moy, Hart and Clark serve as co-chairs of the Coastal Communities Working Group of the Wisconsin Initiative on Climate Change Impacts and collaborate with coastal communities, non-governmental organizations, and university, state and federal agencies to conduct a comprehensive needs analysis to determine climate impacts, vulnerabilities and possible adaptation plans. Funding source: Supplemental grant from the NOAA Sea Grant Office.

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**Ports, Harbors and Marinas Initiative (Clark)** – Sea Grant will continue to assist Great Lakes ports, harbors and marina managers and owners with all aspects of port, harbor and marina infrastructure maintenance and repair, facility management, dredging technology and dredged material disposal. A single non-advocacy source for reliable, up-to-date information to help managers and owners is critical to the operation and maintenance of ports, harbors and marinas. New techniques need to be verified and information disseminated to assist managers with their project investigation studies and repairs. Sea Grant will partner with the Great Lakes port, harbor and marina managers, in addition to other regional and national entities, to establish a direct link between managers experiencing operational problems and valuable resources for technical information and engineering assistance. [A/AS-01](#)

**Coastal Processes Manual, Third Edition (Clark)** – The Wisconsin Sea Grant Coastal Processes Manual was first written in 1987 by the coastal engineering specialist and was extremely successful. This manual quickly became an essential resource for Great Lakes coastal engineering information that was easily understandable to property owners, coastal communities, regulators, and regional and statewide coastal resource agencies. A second edition followed in 1998. Since that edition was prepared, there have been significant advances in several of the manual's topics and information sources as well as several completely new topics such as Web-based coastal engineering tools and data sources, Federal Emergency Management Agency flood mapping results, climate change issues, coastal construction set-back guidance, and coastal structure and processes interactions understanding. A third edition will address those topics and will involve the collaboration of governmental and trade industry partners. [A/AS-01](#)

**Beneficial Use of Dredged Material Outreach and Project Assistance (Clark)** – The maritime industry relies on adequate water depth in harbors and connecting channels for navigation. Maintaining that depth where there is natural accumulation of sediments requires periodic dredging. Slightly more than half of the dredged sediment is typically



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disposed of in specifically designed confined disposal facilities (CDF). Sea Grant and its private sector and governmental partners will work to raise awareness about the value of dredged material as a sustainable resource that can be beneficially used and not deposited in a CDF. [A/AS-01](#)

**Freshwater Harbor Corrosion Study Results Outreach (Clark)** – Sea Grant, along with governmental partners and the Wisconsin Commercial Ports Association, will continue to provide education, research and outreach concerning the accelerated freshwater corrosion seen in Lake Superior port, harbor and marina structures. This will include hosting the research and outreach steering committee’s website and production of communications products detailing research, studies and field investigations, along with mitigation strategies. [A/AS-01](#)

**Coastal Engineering Project, Grant Proposal Review and Permit Assistance (Clark)** – Great Lakes shoreline and coastal regions continue to receive increasing levels of pressure from both the occasional weekend vacationer, and especially new, year-round property owners and developments. Record levels of waterfront activities as well as the high demand for coastal property have created increased levels of human pressure on the fragile shoreline areas. Sea Grant and state and federal governmental partners will meet the critical need to provide Great Lakes property owners, resource managers, lenders, insurers, engineers, realtors, and local, regional and statewide agencies with natural coastal hazard awareness, permit review assistance, grant proposal reviews, coastal engineering guidance, education opportunities and shoreline management tools. [A/AS-01](#)

**Wisconsin Department of Natural Resources Permit Review Policy for Timber Crib Piers (Clark)** – The number of timber crib structures along the Madeline Island shoreline in Lake Superior now exceeds 100. Over the years, these perpendicular shoreline structures have been routinely issued permits by the Wisconsin Department of Natural Resources (DNR). Recently, there have been a number of legal issues amongst adjacent

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shoreline property owners concerning the detrimental effects on Great Lakes shoreline properties due to these structures trapping littoral transport of sand, which would normally move along the shoreline if these structures were not in place. Additionally, new timber crib permits are being requested. DNR staff do not have the training in coastal engineering to understand these situations, and they have asked for and begun to use Sea Grant's coastal engineering knowledge. Collaborative partners include the Civil and Environmental Engineering Department, University of Wisconsin-Madison, and state and federal agencies. [A/AS-01](#)

**Weather-Ready Nation Evaluation of the National Weather Service Impact Based Warning Tool (Harrison)** – This project, involving fellow Sea Grant program partners, the National Weather Service and the NOAA Coastal Services Center, will accomplish two objectives: (1) improve public response to extreme weather events, including thunderstorms and tornadoes and (2) evaluate a new National Weather Service communication tool known as Impact Based Warning, in the Weather Service's central region. Interviews, focus groups and surveys with weather forecasters, emergency managers and broadcast meteorologist will be used. Funding source: CILER, [3002702331](#).

**Sheboygan Area of Concern Economic Study (Harrison)** – This study, in collaboration with the University of Wisconsin-Extension, local governments and the Wisconsin Department of Natural Resources, will estimate the economic activity related to completed remediation and restoration of the Sheboygan U.S. EPA-designated area of concern. It will help determine whether and how cleanup activities have encouraged entrepreneurs and established businesses to undertake additional economic activities. It will also estimate economic activity related to sport fishing, a key tourism draw for Sheboygan. The project includes three years of data gathering and analysis: 2013, 2015 and 2017. Funding source: Wisconsin Department of Natural Resources.

# Environmental Literacy and Workforce Development in the Great Lakes Region

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Wisconsin provides a crucible to meet the literacy-building and workforce development demands posed by a state, region and nation transitioning to a new era of sustainability and job creation.

We will build on a renowned K-12 public education system that consistently produces students who, taken together, best the national average ACT composite score, and rank among the top three states in well-performing students. Wisconsin also has a wealth of institutions of higher learning—33 public and private four-year colleges and 29 two-year colleges. Included in that group is the University of Wisconsin-Madison, one of the top five research schools in the country. The school also holds, as a critical tenet, the Wisconsin Idea. The Wisconsin Idea is a public-service concept that the boundaries of the university extend to the boundaries of the state and beyond. This principle is also the heart of Wisconsin Sea Grant's efforts.

Building a workforce literate in science, technology, engineering and mathematics is crucial to maintaining America's competitiveness in a rapidly changing global economy. These skills are also necessary to advance cutting-edge research and to promote enhanced resource management. In recognition of these needs, the America COMPETES Act mandates that NOAA build on its historic role in stimulating excellence in the advancement of ocean and atmospheric science and engineering disciplines. The Act also mandates that NOAA provide opportunities and incentives for the pursuit of academic studies in science, technology, engineering and mathematics. Workforce needs are reflected in the broader science and technology communities of both the private and public sectors with whom Sea Grant works to fulfill its mission.

An environmentally literate person is someone who has a fundamental understanding of the systems of the natural world, the relationships and interactions between the living and non-living environment, and the ability to understand and utilize scientific evidence to make informed decisions regarding environmental issues. Once again, Wisconsin

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is a crucible for these concepts. It is the home state and the epicenter of much of the research, writing and innovation of such environmental giants as John Muir, Aldo Leopold and Sen. Gaylord Nelson, the founder of Earth Day. Wisconsin Sea Grant carries on the traditions of its environmental forebears when providing stakeholders with the decision-making tools to synthesize economic, aesthetic, cultural and ethical values.

### *National and Wisconsin Sea Grant Goals*

- An environmentally literate public supported and informed by a continuum of lifelong formal and informal engagement opportunities.
- A future workforce reflecting the diversity of Sea Grant programs, skilled in science, technology, engineering, mathematics and other disciplines critical to local, regional and national needs.

### *Wisconsin Sea Grant Strategies*

- Work with education partners to develop K-12 curricula that address the Great Lakes Literacy Principles and adhere to science and environmental education standards, approved by the Wisconsin Department of Public Instruction.
- Engage Sea Grant-supported graduate students, scientists and informal educators to help develop educational demonstrations for Great Lakes issues and topics to promote Great Lakes literacy.

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- Establish a Wisconsin Sea Grant graduate student fellows program to help make Sea Grant-supported graduate students aware of the full range of Sea Grant activities and Great Lakes-related employment opportunities.
  - Support research projects that engage and train graduate and undergraduate students about Great Lakes coastal resources.

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## Project

### **Great Lakes Multicultural Earth Partnership**

*Cheryl Bauer-Armstrong, UW-Madison, (608) 262-5264, cherylbauer@uwarb.wisc.edu*

Wisconsin Sea Grant launched Great Lakes Earth Partnership (GL-EPS) in three Wisconsin basins—Lake Superior, Green Bay and Milwaukee in 2010. Funding from the U.S. EPA-Great Lakes Restoration Initiative (U.S. EPA-GLRI), the Morgridge Center for Public Service, and the Elementary and Secondary Education Act extended GL-EPS to six Great Lakes states involving 100 school communities and 60 partner organizations. Teachers, students and citizen volunteers are engaged in learning and action focusing on water quality, ecological restoration, climate change, pollution prevention, ecological literacy and environmental justice. Regional lead teams will be trained in 2014 and will conduct five-day local school/community institutes in 2015. In north-west Wisconsin, our focus is indigenous coastal education. In southeast Wisconsin, Colaboración Ambiental (Latino Earth Partnership) will build partnerships and capacity in Latino communities, schools and organizations. Our program will allow students and citizens learn about how their choices affect coastal ecosystem health and how to take positive stewardship actions. [E/ELWD-01](#)

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## Outreach

**Grandparents University (Kline/Moser)** – This Wisconsin Alumni Association two-day summer program offers coursework in a number of subject areas for children ages 7-14 and their grandparents. Sea Grant and the University of Wisconsin Center for Limnology collaborate to offer a popular course on the study of lakes that includes water sampling aboard a research vessel, hands-on operation of underwater robotic technology and aquatic invasive species activities. [A/AS-01](#)

**Center for Great Lakes Literacy (Kline)** – The Center for Great Lakes Literacy is a collaborative effort led by Sea Grant educators throughout the Great Lakes watershed. The center fosters informed and responsible decisions that advance basin-wide stewardship by providing hands-on experiences, educational resources and networking opportunities that promote Great Lakes literacy among an engaged community of educators, scientists and citizens. [A/AS-01](#)

**Understanding the Changing Lake Michigan Food Web (Seilheimer)** – The Lake Michigan food web is in a constant state of flux due to invasive species, pollution and the changing climate. Providing the most current information on the science of Great Lakes food webs and ecosystems is necessary for creating informed policy makers and citizenry. This project, in partnership with the Wisconsin Maritime Museum, will develop an outreach and education program to inform angler groups, conservation groups and students about food web ecology, the structure of Lake Michigan's food web and how it has been changed by invasive species. [A/AS-01](#)

**College for Kids (Kline/Moser)** – The UW-Madison School of Education sponsors this three-week active learning summer program for highly motivated students entering sixth grade. The program also provides professional development opportunities for teachers, counselors, pre-service teachers, graduate students and administrators to gain experience

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in working with diverse, motivated and high-achieving learners. Sea Grant coordinates a course on limnology that provides students with experience using water sampling equipment aboard a research vessel and classroom activities that support the Great Lakes Literacy Principles. [A/AS-01](#)



# Sea Grant Fellowships / Scholarship

## **Dean John A. Knauss Marine Policy Fellowship**

[seagrant.noaa.gov/fundingfellowships](http://seagrant.noaa.gov/fundingfellowships)

*Contact: James P. Hurley, director, University of Wisconsin Sea Grant Institute, (608) 262-0905*

This competitive program provides an opportunity for one-year expenses-paid internships with a federal legislator or an agency in the Washington, D.C., area. Twenty-two Wisconsin students have been among those selected for Knauss fellowships since 1982. Funding source: NOAA Sea Grant Office.

## **Sea Grant/NOAA Fisheries Graduate Fellowship**

[seagrant.noaa.gov/fundingfellowships](http://seagrant.noaa.gov/fundingfellowships)

This program in population dynamics and marine resource economics was established by NOAA Sea Grant and NOAA Fisheries for Ph.D. candidates who are interested in either of these two disciplines. Funding source: Sea Grant Office and National Marine Fisheries Service, NOAA.

## **Great Lakes Commission/Sea Grant Fellowship**

[glc.org/about/scholarships-fellowships](http://glc.org/about/scholarships-fellowships)

*Contact: James P. Hurley, director, University of Wisconsin Sea Grant Institute, (608) 262-0905* A successful fellow will work with members of the Great Lakes' science, policy and information/education communities to advance the environmental quality and sustainable development goals of the Great Lakes states. Funding source: Great Lakes Commission.

## **Carl J. Weston Memorial Scholarship**

*Contact: Terri Liebmann, administrative manager, University of Wisconsin Sea Grant Institute, (608) 262-0905, [terri@aquawisc.edu](mailto:terri@aquawisc.edu)*

The Carl J. Weston Memorial Scholarship was established in 1995 to aid undergraduate students working on Wisconsin Sea Grant-supported projects. Funding source: Dr. and Mrs. Carl B. Weston.

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## Useful Websites

### **University of Wisconsin Sea Grant Institute**

[seagrant.wisc.edu](http://seagrant.wisc.edu)

### **Funding Opportunities**

[seagrant.wisc.edu/projects](http://seagrant.wisc.edu/projects)

### **Current and Past Projects**

[seagrant.wisc.edu/projects](http://seagrant.wisc.edu/projects)

### **NOAA National Sea Grant**

[seagrant.noaa.gov](http://seagrant.noaa.gov)

## Special Program Resources

### **Aquatic Sciences Chronicle**

[aqua.wisc.edu/chronicle](http://aqua.wisc.edu/chronicle)

Published four times a year, this newsletter reports on the activities of Sea Grant and its complementary program, the University of Wisconsin Water Resources Institute. Visit the website to review current and past issues, and sign up for free delivery, either in print or electronically.

### **Sea Grant Publications**

[aqua.wisc.edu/publications](http://aqua.wisc.edu/publications)

This well-stocked virtual publications center offers dozens of items for free download or at a reasonable cost to cover their production and shipping. Find fact sheets, posters, books and maps.

### **Social Media Channels**

[seagrant.wisc.edu](http://seagrant.wisc.edu)

Visit the Sea Grant home page and look for the links to many social media channels, including Twitter, Flickr, Facebook, YouTube and the blog Great Lakes Takes. It's a convenient way to connect, get program information or access information in alternate formats like video or audio podcasts.

### **Wisconsin's Water Library**

[aqua.wisc.edu/library](http://aqua.wisc.edu/library)

This library contains more than 30,000 volumes of water-related information, with particular emphasis on Wisconsin and Great Lakes issues. Any state resident can access and benefit from the collection. The library also maintains [aqualog2.blogspot.com](http://aqualog2.blogspot.com), a lively and engaging blog.

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## **National Sea Grant Library**

[nsgd.gso.uri.edu](http://nsgd.gso.uri.edu)

The National Sea Grant Library is the official archive of a wide variety of Sea Grant documents. The 40,000-plus-record database is easily searchable and is a comprehensive source on coastal issues.

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