SG

2010-12 DIRECTORY OF PROJECTS AND PEOPLE

University of Wisconsin Sea Grant Institute

cover photo: Asian carp in the Spoon River, Illinois. Wisconsin Sea Grant is engaged in multiple efforts to prevent the spread of invasive species in Great Lakes watersheds, including the carp that are nearing the lakes. Credit: Nerissa Michaels/Illinois River Biological Station.

2010-12 DIRECTORY OF PROJECTS AND PEOPLE

University of Wisconsin Sea Grant Institute

Sea Grant is a unique partnership with public and private sectors combining research, education, outreach and technology transfer for public service. Sea Grant is a national network of 32 university-based programs of research, outreach and education enhancing the practical use and conservation of coastal, ocean, and Great Lakes resources to create a sustainable economy and environment.

This publication was funded by the University of Wisconsin Sea Grant Institute under a grant from the National Sea Grant College Program, National Oceanic & Atmospheric Administration, U.S. Department of Commerce and the state of Wisconsin, federal grant no. NA06OAR4170011, project C/C-1.

Publication No. **WISCU-Q-10-002**

Additional copies of this free publication are available from:
Publications Office
UW Aquatic Sciences Center
226 Goodnight Hall
1975 Willow Drive
Madison, WI 53706-1177
USA

Phone: (608) 263-3259
E-mail: *publications@aqua.wisc.edu*
Web: *aqua.wisc.edu/publications*

Editor: Elizabeth White; *Writers:* Carolyn Rumery Betz, Moira Harrington, and Kathleen Schmitt Kline
Design: Tina Yao

First Printing: 2010
Printed in the USA

INSIDE:

5 From the Director

7 Participating Institutions and Agencies

Program Focus Areas

9 . . . . . **Improve Great Lakes Ecosystem Health**

21 . . . . . **Enhance Coastal Community Sustainability and Resilience**

29 . . . . . **Support Sustainable Fisheries and Aquaculture**

37 Cross Cutting Goals–Education

43 Sea Grant Fellowships/Scholarships

44 Useful Wisconsin Sea Grant Websites for Investigators, Staff and Students

45 Special Program Resources

47 Index of Project Principal Investigators

INSIDE BACK COVER Key Contacts

We believe the projects in this *2010-12 University of Wisconsin Sea Grant College Program Projects and People Directory* will serve as the foundation for the implementation of a new national policy for the stewardship of the ocean, our coasts and Great Lakes as laid out by the Interagency Ocean Policy Taskforce and adopted by presidential executive order in July 2010.

The taskforce provided an inspiring vision: "An America whose stewardship ensures that the ocean, our coasts, and the Great Lakes are healthy and resilient, safe and productive, and understood and treasured so as to promote the well-being, prosperity, and security of present and future generations."

This vision follows on the work of the U.S. Commission on Ocean Policy that in 2004 issued a rallying cry—fully realize the value of the nation's oceans and coasts, and act to halt continuing degradation of those resources. Using that report, the National Sea Grant College Program shaped three cross-cutting goals and four focus areas reflecting the most urgent needs in the coastal, ocean and Great Lakes arenas.

In turn, the University of Wisconsin Sea Grant College Program used the NOAA National Sea Grant plan as a basis to determine its own strategic plan. In crafting that plan, Wisconsin Sea Grant consulted with its Advisory Council and its Committee on Outreach and Education, conducted a needs assessment, checked in with key user groups and stakeholders, and solicited public comment. We believe the result satisfies the national program's charge: harness energy, diversity and creativity to achieve national goals, while also responding to Wisconsin's unique challenges and needs.

The Wisconsin plan embraces the three national cross-cutting goals presented in the National Sea Grant Strategic Plan and has fashioned the four national focus areas into

three (streamlining the Hazard Resiliency in Coastal Communities focus area because, for example, hurricanes are not relevant to Wisconsin and the Great Lakes). Wisconsin Sea Grant's three strategic focus areas are:

Improve Great Lakes Ecosystem Health

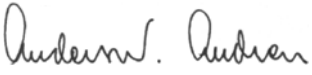
Enhance Coastal Community Sustainability and Resilience

Support Sustainable Fisheries and Aquaculture

The projects on the following pages demonstrate the ways in which the strategic plan comes alive. There are 54 research, outreach and education projects receiving UW Sea Grant support for the 2010-12 cycle.

In sum, the projects involve more than 100 faculty, staff and students at six UW System campuses in addition to UW-Extension and Northland College, five state agencies, two out-of-state agencies, 14 out-of-state institutions of higher education and six federal agencies. In the tradition of "the Wisconsin Idea," UW Sea Grant advisory services and communications staff will also partner with more than 200 public agencies, businesses, nongovernmental organizations, and individuals to accomplish outreach and education goals in the coming two years.

Log on to the website, *seagrant.wisc.edu*, to review the full Wisconsin Sea Grant strategic plan and to discover further information on this, the oldest Sea Grant Program in the Great Lakes.



Anders W. Andren, Director

Participating Institutions and Agencies 2010–12

University of Wisconsin Sea Grant Institute

Bemidji State University

Michigan State University

Minnesota Department of Natural Resources

NOAA-Cooperative Institute for Limnology and Ecosystems Research

NOAA-Great Lakes Environmental Research Laboratory

NOAA-National Climate Service

Northland College

Oregon Coastal Management Program

Oregon State University

Pennsylvania State University

Purdue University

State University of New York-Brockport

State University of New York-Oswego

State University of New York-Plattsburgh

The Ohio State University

U. S. Department of the Interior-National Park Service

U. S. Environmental Protection Agency

U. S. Geological Survey

University of Illinois at Urbana-Champaign

University of Michigan

University of Minnesota-Duluth

University of South Florida

University of Wisconsin-Extension

University of Wisconsin-Green Bay

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

Wisconsin Coastal Management Program

Wisconsin Department of Natural Resources

Wisconsin Department of Tourism

Wisconsin Historical Society

Wisconsin State Laboratory of Hygiene

Woods Hole Oceanographic Institution

Improve Great Lakes Ecosystem Health

National Sea Grant Goals:

- *Sound scientific information to support ecosystem-based approaches to managing the coastal environment.*
- *Widespread use of ecosystem-based approaches to managing land, water and living resources on our Great Lakes coasts.*
- *Restored function and productivity of degraded ecosystems.*

Healthy ecosystems are the foundation for life along the coast. However, increasingly rapid coastal development and other human activities are causing water quality degradation, declining fisheries, wetlands loss, the proliferation of invasive species, and a host of other challenges that need to be understood in order to restore and maintain these ecosystems. Ecosystem functioning does not respect traditional political boundaries, and responsible management of ecosystems requires new kinds of thinking and actions.

Sea Grant is a leader in multidisciplinary, regional approaches to understanding and maintaining healthy ecosystems, identifying information gaps, setting research priorities, and coordinating information and technology transfer to those who need it. Wisconsin Sea Grant has fostered efforts to address statewide problems such as invasive species and water quality issues and has staff specialists dedicated to tackling these problems. Sea Grant's regional consortia and networks and international contacts are particularly well-suited to helping Wisconsin address ecosystem health at the state and regional level.

Nowhere is an understanding of the linkages between terrestrial and aquatic environments more critical to resource quality, sustainability and management than in the Great Lakes region. With nearly 9,500 miles of shoreline, the Great Lakes are aquatic systems dominated by their coastal watersheds. Ensuring the health of the ecosystems of the Great Lakes and their watersheds is vital to ensuring the health of the residents of these basins.

Projects

Cercopagis Invasion of Lake Michigan: Predictable Responses or 'Invasional Meltdown' of the Planktonic Food Web?

Craig Sandgren, UW-Milwaukee, (414) 229-4279, sandgren@uwm.edu
John Berges, UW-Milwaukee, (414) 229-3258, berges@uwm.edu

Like the spiny waterflea(*Bythotrephes cederstroemii*) before it, the invasion of Lake Michigan by the fishhook waterflea(*Cercopagi spengoi*) is of great concern because it is a predatory zooplankton that competes with larval yellow perch and alewives for food. This new invasion offers an important opportunity to test the predictability of how Great Lakes ecosystems respond to repeated invasions by ecologically similar planktonic species. This continuing project examines Lake Michigan's ability to absorb this new invader by documenting the dynamics of competing predatory zooplankton populations. R/AI-2

Reciprocal Spread of Invasive Species in Lake Michigan Coastal Habitats

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

Coastal areas and ports of the Great Lakes have been a major focal point of research and monitoring for aquatic invasive species (AIS). The spread of AIS is generally through human-assisted means (boat trailers, bait buckets, etc.), but one often-overlooked pathway is through tributaries in the Great Lakes watershed. This continuing project is studying the distribution and invasion processes of round goby from the Great Lakes and of rusty crayfish to the Great Lakes. Monitoring and modeling this movement with various management scenarios (e.g., dam removal, stream restoration, etc.) will help better understand options for future control in light of cross-habitat invasions between inland waters and the Great Lakes. R/AI-3

Parallel Toxicogenomic Resources for Zebrafish and Rainbow Trout: Identifying Conserved Molecular Biomarkers of Toxicant Exposure

Michael Carvan, UW-Milwaukee, (414) 382-1706, carvanmj@uwm.edu

This continuing project will use genomic tools to identify toxicant-response molecular biomarkers in zebrafish and rainbow trout for use in assays evaluating the potential effects of exposure to persistant, bioaccumulative toxicants on fish. The investigators will combine DNA microarray work with quantitative reverse transcription-polymerase chain reaction methodologies to identify embryonic and larval genes responsive to dioxin (TCDD), polychlorinated biphenyls (PCBs) and methylmercury (MeHg) exposure. They plan to sequence about 20,000 toxicant-response transcripts for zebrafish and rainbow trout and create publicly accessible, functionally annotated, expressed sequence tag databases–a biomarker library that can be used as reference for examining toxicant responses among Great Lakes wild fish species. R/BT-21

Genomic Approach to Understanding TCDD Toxicity in Zebrafish

Warren Heideman, UW-Madison, (608) 262-1795, wheidema@facstaff.wisc.edu
Richard Peterson, UW-Madison, (608) 263-5453, repeterson@pharmacy.wisc.edu

This continuing project will address gene expression changes in zebrafish associated with TCDD exposures. Besides being nearly transparent, the zebrafish is the first fish to have had its genome mapped, which makes it ideal for research on the genetic effects of exposure to toxic contaminants. The goal of the project is to determine whether different TCDD responses in tissues correspond to a distinct gene expression pattern. Using DNA microarrays, the investigators hope to determine whether gene expression patterns can be used to predict sublethal toxicity; if successful, the microarray approach may be used as a screening tool to predict responses in wild fishes. This work directly addresses the strategic priority of developing gene microarrays in fish for identifying alterations in gene expression associated with chemical and physical stresses. R/BT-22

Utilizing Molecular Genetic Markers to Develop Wild Rice Restoration and Management Guidelines for Great Lakes Coastal Habitats

Anthony Kern, Northland College, (715) 682-1335, akern@northland.edu

American wild rice, a native, emergent aquatic grass, once served important ecological, cultural, historical and economic roles in the Lakes Superior and Michigan basins. Habitat loss and degradation have led to a dramatic change in wild rice populations. Because inbreeding has compromised genetic diversity and fitness, restoration efforts have failed. In this continuing project, researchers are working to describe the genetic effects of fragmentation on threatened populations of wild rice, perform genetic diversity studies on remnant populations and quantify the effects of inbreeding. R/BT-23

An Autonomous Microbial Genosensor for Detection of Gene Expression in Toxic Cyanobacteria

Katherine McMahon, UW-Madison, (608) 263-3137, tmcmahon@engr.wisc.edu

This continuing project has set out to specifically and quantitatively detect Microcystin (mcyB) biosynthesis gene expression that can lead to harmful toxin-releasing algal blooms. Researchers are developing a new assay to detect the expression of genes responsible for cyanotoxin biosynthesis in mcyB species. The assay will then be adapted for use in an existing in situ autonomous microbial genosenor. That genosenor will be deployed in several inland Wisconsin lakes with a history of blooms accompanied by high mcyB concentrations, in a Florida lake used as a drinking water source, and finally, in Lake Erie. The genosensors hold promise as both research tools and potential early-warning systems for water resource managers dealing with the blooms. R/BT-24

Target Organ Toxicity and Blue Sac Syndrome

Richard Peterson, UW-Madison, (608) 263-5453, repeterson@pharmacy.wisc.edu
Warren Heideman, UW-Madison, (608) 262-1795, wheidema@wisc.edu

Exposure of fish larvae to various chemicals causes blue sac syndrome, a cause of mortality in fish larvae in the lab and in the wild. This research will test the hypothesis that a birth defect involving the heart called "hypoplastic heart failure" causes the syndrome. This research project will test AhR2 agonists and non-AhR2 agonists for their ability to cause hypoplastic heart failure in zebrafish larvae. Results will help us understand the underlying cause of chemical-induced blue sac syndrome and recruitment failure in Great Lakes lake trout. Hatchery managers who encounter blue sac disease in hatchery stocks and aquatic toxicologists will find the results useful to better understand and evaluate the impacts of chemical exposure on feral populations. Ultimately, chemicals determined to cause hypoplastic heart failure in zebrafish may be useful in identifying heart teratogens that women may be exposed to during pregnancy that threaten the life of a fetus. R/BT-25

Lake Superior Food Web Dynamics: Modeling at Multiple Scales

James Kitchell, UW-Madison, (608) 262-3014, kitchell@wisc.edu

Trophic interactions occur at multiple scales, ranging from predator-prey interactions that govern population dynamics and community structure to daytime-nighttime vertical and horizontal migrations that regulate the daily feeding activity and growth rates of individual aquatic species. This continuing project will develop a model to assess diel changes in predator-prey encounters as a function of time of day, depth and nearshore versus offshore habitats. Complementing a Minnesota Sea Grant study, this work is novel in developing the first simulation model of diel changes in predator-prey relationships specific to the Lake Superior food web. R/EH-1

Ecological Immunology and Pathogen Resistance of Amphibians in Stressed Great Lakes Ecosystems

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

This multi-institutional, multidisciplinary continuing research program hypothesizes that contaminants will depress immunocompetence and pathogen resistance of Great Lakes amphibians. Developing leopard frogs are being exposed to two congeners of PCB(126, 70), one heavy metal (Cd) and a mix of polybrominated diphenyl ethers (PBDEs).The resistance of contaminant- and non-contaminant-exposed frogs to three types of pathogens common in microbially contaminated habitats in the Great Lakes will then be evaluated. The research is developing biomarkers for immunocompetence in amphibians to aid natural resource managers in diagnostic and remediation efforts in the region, and it will facilitate prediction of toxicological effects on amphibians at other times and/or in other regions. R/EH-2

Application of Molecular Based Methods for Investigation Sources of Fecal Pollution at Great Lakes Beaches

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

Beach closings are a major environmental and public health issue throughout coastal regions of the United States, including the Great Lakes. The overall goal of this project is to develop better assessment tools for contaminated beaches and partner with beach managers to reduce beach closings on the Great Lakes. The investigators will use a promising new sequencing technology to identify alternative indicators that may relate more accurately to human health risk. Rather than trying to identify a single human or animal waste-specific organism, they are using a completely different strategy and using the 454 Life Sciences sequencing platform to generate a comprehensive inventory of microbial communities in sewage and contaminated waters. R/HCE-1

Influence of Regional Mercury Sources on Lake Michigan Tributaries: A 15-Year Comparison

Christopher Babiarz, UW-Madison, (608) 265-5085, babiarz@cae.wisc.edu

Fifteen years have passed since the completion of the first Lake Michigan Mass Balance Study by the U. S. Environmental Protection Agency (USEPA), and during that period both industrial use and atmospheric emissions of mercury have been reduced in the Great Lakes Basin. Given the magnitude of these reductions, and new information on the residence time of mercury in aquatic ecosystems, the investigator believes a similar decrease in mercury loading has occurred in the tributaries of Lake Michigan. This project will coordinate with the 2010 USEPA lakewide sampling of Lake Michigan as well as a proposed intensive on-lake mercury sampling by the U.S. Geological Survey through its proposed Great Lakes Restoration Initiative Project. R/HCE-2

Physical and Biological Processes Associated With Resuspension of Contaminated Sediments in the Sheboygan River Estuary

Qian Liao, UW-Milwaukee, (414) 229-4228, liao@uwm.edu
Chin Wu, UW-Madison, (608) 263-3078, chinwu@engr.wisc.edu

Many persistent contaminants, such as PCBs, are strongly associated with smaller, fine sediments in the Great Lakes. This is particularly important in the lakes, rivers and estuaries, where sediments are subjected to resuspension, scouring and effects associated with varying water levels. This project will involve conducting field experiments at the estuary of the Sheboygan River, one of the "areas of concern" identified by the U.S. Environmental Protection Agency and the Wisconsin Department of Natural Resources, to quantify and compare several important forcing terms for sediment resuspension, including episodic storms, high-frequency lake seiches and snow-melt discharge. Using state-of-the-art imaging techniques, researchers will observe the response of mussels to suspended sediments through the measurement of particle fluxes both in the laboratory and in situ. Researchers will also evaluate to what extent the mussel filtration can alter the redistribution of contaminated sediments. R/HCE-3

Constructing the Nearshore Lake Michigan Food Web Using Multiple Trophic Indicators (with Illinois/Indiana Sea Grant)

Harvey Bootsma, UW-Milwaukee, (414) 382-1717, hbootsma@uwm.edu
John Janssen, UW-Milwaukee, 414-382-1733, jjanssen@uwm.edu

Food web studies in Lake Michigan have focused primarily on the pelagic food web, due to the significant role of pelagic fishes in both commercial and sport fisheries. The trophic ecology of several nearshore species, particularly yellow perch, has received attention, but the nearshore food web as a whole is not well studied. In many parts of the lake, the nearshore fish community has changed from one composed of a mixture of species with moderate numbers to one dominated by high densities of the round goby, whose trophic role is not well understood. This project will use a combination of three methods – stomach content analysis, fatty acid analysis and stable isotope analysis – to construct the nearshore food web and assess how it varies with substratum and location. Results will be used to determine how individual species have responded to change in community structure and energy flow. R/RegHCE-4

Modeling the Interactive Effects of Dreissenid Invasion and Nutrient Loading on Autotrophic and Food Web Structure in Green Bay, Lake Michigan

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

The introduction of zebra and quagga mussels has had a dramatic economic and ecological impact on lake ecosystems due to their remarkable ability to change primary productivity. Most research has focused on the open-water system, but this new research project will examine the impacts of mussels on primary production in bottom- and open-waters across the variable nutrient-enriched gradient of Green Bay and study the impacts across the aquatic food web. The researcher will measure primary productivity across the trophic gradient of the mussel-invaded Green Bay; use productivity models to estimate the impact on primary productivity, including the nuisance alga *Cladophora glomerata*; examine how changes in nutrient and sediment loading will affect autotrophic structure; and use stable isotopes to examine the trophic pathways supporting fish. R/HCE-5

Stressor Gradients and Spatial Narratives of the St. Louis River Estuary (with Minnesota Sea Grant)

Janet Silbernagel, UW-Madison, (608) 265-8093, jmsilber@wisc.edu

The Wisconsin portion of this project will develop communication and education tools, including an open geospatial archive, a "deep map" that incorporates vignettes of local communities, augmented reality games and geo-tours of the estuary, ship-based activities and a diverse array of complementary online resources. Results of this project coupled with the monitoring and spatial narratives constructed from Minnesota research will guide implementation of the St. Louis River Habitat Plan; help prioritize monitoring, restoration and remediation activities; and enhance public awareness and understanding of estuaries in coordination with the development of the Lake Superior National Estuarine Research Reserve. R/RegHCE-8-10

Understanding Biological Impacts of Metals in Coastal and Urban Waters of the Great Lakes: Ligand-Interactions, Novel Biochemical Endpoints, and Model Development

Martin M. Shafer, UW-Madison, (608) 262-0140, mmshafer@facstaff.wisc.edu

The objective of this continuing project is to measure and model the bioconcentration of methylmercury and the toxicity of copper and cadmium to phytoplankton in coastal regions of the upper Great Lakes. Field studies have been selected to provide key geochemical parameters and a range of both urban and rural influences on the phytoplankter *Chlamydomonas reinhardtii*. Comparisons between observed and predicted bioconcentration or toxicity are being used to test the adequacy of the predicted biotic ligand models and to identify possible modifications needed to achieve targeted accuracy in the predicted values. The results will ultimately provide the tools needed to assess the sensitivity of coastal regions to metal toxicity and methylmercury bioaccumulation. R/UC-3

Outreach

Green Marina Outreach and Education (Harris/Clark) – This three-year project is in partnership with Michigan Sea Grant and Clean Marina Program managers in other Great Lakes states. Specialists Harris and Clark will develop online curriculum, deliver training through seminars and other public events, and formulate program evaluation tools. Funding source: Great Lakes Restoration Initiative. A/GLRI-1

Beach Information Communication System (Clark) – This three-year project is in partnership with Minnesota and Michigan Sea Grant. Specialist Clark will develop a beach information system where Great Lakes beach users will have immediate access to an unprecedented amount of data about beaches, including bacteria monitoring, harmful algal blooms, wave heights, water temperature, weather data and rip current forecasts. All of these pieces of information can help beach users decide if today's the right day to go to the beach, but nowhere is all of this information synthesized in one place. This project will bring these disparate sources of information together into a single "Beach Report" that users can sign up to receive in any of a multiple of formats. Examples of potential formats include Twitter notices, RSS feeds, e-mail alerts and Facebook notices. Funding source: Great Lakes Restoration Initiative. A/GLRI-2

Wisconsin Clean Marina Training and Certification (Harris/Clark) – The Clean Marina Initiative is a voluntary, incentive-based program promoted by the National Oceanic and Atmospheric Association and others that encourages marina operators and recreational boaters to protect coastal water quality by engaging in environmentally sound operating and maintenance procedures. Participating marinas will voluntarily adopt pollution prevention strategies, environmental risk reduction, and fish and wildlife habitat enhancement in the context of good business practice. Specialists will promote best management practices to marina operators and certify those that meet rigorous criteria. Funding source: Wisconsin Marina Association using funding from the Wisconsin Coastal Management Program. A/WMA-1

Climate Change Outreach (Cross-cutting: all outreach/IT staff) – Wisconsin Sea Grant has already laid the groundwork for climate change outreach with funding from the Wisconsin Coastal Management Program that supported the seminar series and corresponding publication *Climate Change in the Great Lakes Region: Starting a Public Discussion.* Now, Wisconsin Sea Grant is expanding climate change outreach by participating in state (Wisconsin Initiative on Climate Change Impacts), regional (NOAA Sectoral Applications Research Program [SARP] grant as part of the Great Lakes Sea Grant Network: Preparing Coastal Communities for Climate Change) and national projects (NOAA SARP grant with the University Corporation for Atmospheric Research's Cooperative Program for Operational Meteorology, Education and Training: Enhancing Sea Grant Extension Capabilities through Training and Increased Interaction with NOAA Scientists).

Enhance Coastal Community Sustainability/Resilience

National Sea Grant Goals:

- *Healthy coastal economies that include working waterfronts, an abundance of recreation and tourism opportunities, and coastal access for all citizens.*
- *Coastal communities that make efficient use of land, energy and water resources and protect the resources needed to sustain coastal ecosystems and quality of life.*
- *Coastal citizens, community leaders, and industries that recognize the complex interrelationships between social, economic and environmental values in coastal areas and work together to balance multiple uses and optimize environmental sustainability.*
- *Widespread understanding of the risks associated with living, working, and doing business along the nation's coasts.*
- *Community capacity to prepare for and respond to hazardous events.*
- *Effective response to coastal catastrophes.*

Wisconsin's coastal communities provide economic, social and recreational opportunities for millions of Americans, but decades of population growth have transformed our coastal landscapes and intensified demand on finite coastal resources. The increase in population has resulted in new housing developments and recreation facilities, a new generation of energy development activities, port expansions and a growth in business activities.

These changes are placing tremendous pressure on coastal lands, water supplies and traditional ways of life. To accommodate more people and activity, and to balance growing demands on coastal resources, we must develop new policies, institutional capacities and management approaches to guide the preservation and use of Great Lakes resources. Wisconsin Sea Grant helps our diverse and growing coastal population apply the best available scientific knowledge and uses its extension and education capabilities to support the development of healthy coastal communities that are economically and socially

inclusive, are supported by diverse and vibrant economies, and function within the carrying capacity of their ecosystems.

Economic growth since 1950 has increased the urbanization of Great Lakes coastal areas—with corresponding increases in pollution and environmental degradation. Great Lakes urban shorelines have significant appeal, as evidenced by the demand for recreational, business and residential developments near the water. Communities and the state must balance economic and environmental values, manage the impacts of stormwater runoff and waste disposal, and consider needs for transportation, recreation and commerce—all while maintaining the integrity of coastal ecosystems that provide critical habitat and nursery areas for native aquatic species.

Protecting the water quality of the Great Lakes is essential to the region and the nation. Millions of Americans depend on the Great Lakes for drinking water, and the lakes support multibillion-dollar fisheries, shipping/boating and tourism/recreational industries. Population growth and development pose an increasing threat to water quality from chemical contaminants and nutrient loading as well as increasing demand for Great Lakes water. We urgently need to develop and support management programs designed to protect and enhance the quality of this vital ecosystem.

Wisconsin Sea Grant is developing new observational technologies and interpretive geospatial technology to help foster development of the Great Lakes Observing System (GLOS). Our overarching goal is to help the Great Lakes region maximize its environmental remote sensing capabilities to provide critical, real-time data for a broad suite of users, including resource managers, researchers, homeland security interests, the commercial shipping industry and the recreational boating community.

Projects

Assessment and Evaluation of the NOAA Climate Services Portal

Margaret Mooney, UW-Madison, (608) 265-2123,margaret.mooney@ssec.wisc.edu
Jean Phillips, UW-Madison, (608) 262-8164, jeanp@ssec.wisc.edu

Scientists, educators, decision makers and the general public turn to various sources for climate information. Investigators will conduct a literature review to determine the types of information sources. Guided by those findings, researchers will then design an evaluation tool and apply it to plumb the perceptions of the NOAA Climate Services Portal. Funding source: supplemental grant from the National Sea Grant Office. A/AS-65

Diving Deeper: Deepwater Archaeology, Geocaching, and Traveling Exhibits Supporting Wisconsin's Maritime Heritage

John Broihahn, Wisconsin Historical Society, (608) 264-6496, john.broihahn@wisconsinhistory.org
John Karl, UW-Madison, (608) 263-8621, jkarl@aqua.wisc.edu

The Great Lakes hold one of the world's best-preserved repositories of historic shipwrecks. More than 750 shipwrecks lie in Wisconsin waters alone, representing a remarkable range of vessel types, genres and histories. The archaeological, historical and recreational value of these resources is enormous. However, continuing threats of looting by recreational divers, coupled with advancing depths of recreational dives, renders these resources vulnerable to exploitation and degradation. This project will mitigate those threats with a sustained program of outreach and education to increase divers' and the public's appreciation of these resources' value and the need to protect them. In addition, this project will work closely with NOAA's National Marine Sanctuary Program, which is assessing factors for a possible shipwreck sanctuary in Wisconsin. C/SCD-1

An Economic Spatial-Dynamic Model of Great Lakes Coastal Development

R. William Provencher, UW-Madison, (608) 262-9494, rwproven@wisc.edu
Volker Radeloff, UW-Madison, (608) 263-4349, radeloff@wisc.edu

This continuing project is focused on two land development issues. First, it is looking at the effects of coastal (shoreline and nearshore) land use policies and management tools on the spatial dynamics of private subdivision. Second, researchers hope to provide local Great Lakes governments and planning agencies with GIS tools that can be combined with econometric models of the subdivision decisions of private landowners to create a dynamic, spatial forecast of the effect of various landscape policies and management options. R/CC-1

The Wisconsin Coastal Atlas: Building a Coastal Spatial Data Infrastructure for Wisconsin

Stephen Ventura, UW–Madison, (608) 262-6416, sventura@facstaff.wisc.edu

Coastal web atlases (CWAs) have emerged as an important resource to help organize and present maps and data about coasts and make them more relevant to decision-making about coastal management. The Wisconsin Coastal Atlas (WCA) will serve as the primary portal to geospatial data about the Lake Michigan and Lake Superior coasts of Wisconsin. It will be organized into four sections—maps, tools, learn and search. The primary Web-mapping interface will provide an overview of the Wisconsin coastal zone. A gallery of additional mapping interfaces will provide customized perspectives related to specific coastal issues. The atlas will allow users to search a catalog of coastal geospatial data. The catalog for the atlas will connect to distributed catalogs maintained by other data custodians, allowing discovery, assessment and download of a network of coastal geospatial data. In addition, the WCA will serve as a gateway to spatial decision support tools relevant to the Great Lakes and as a site to learn more about coastal issues and places. The research undertaken as part of this project will frame the WCA as an important building block of an eventual Great Lakes coastal atlas and will promote adaptive management of the Great Lakes at an ecosystem scale. R/SCD-1

Determining and Mitigating the Effects of Climate Change on Stormwater Hydrology and Management for Great Lakes Coastal Communities

Kenneth Potter, UW-Madison, (608) 262-0040, kwpotter@wisc.edu
David Liebl, UW-Madison, (608) 265-2360, liebl@epd.engr.wisc.edu

This project will use the current scientific knowledge about the potential increase in magnitude and frequency of large rainfalls in a changing climate to update the methods used to design and evaluate stormwater-related infrastructure in the Great Lakes region. These updated methods will be made available to local decision makers in Wisconsin's coastal communities for proactive design of stormwater management systems. R/SCD-2

Characterization of the Water Environment at the Apostle Islands, Lake Superior

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

The Apostle Islands National Lakeshore on Lake Superior is a treasured landscape, popular recreation area and a sensitive ecosystem. The 21 islands constitute a complex and poorly understood water environment.The investigator plans to observe and model the water environment at the Apostle Islands 1) to better understand the processes by which dangerous extreme (freak) waves are generated in popular areas of the park, 2) to identify at three spawning sites in the region a turbulence threshold that facilitates egg development, and 3) to develop"nowcasting" and forecasting models to aid park managers and visitors in wisely using this resource. This limnological research study has also received tremendous support from the National Park Service at Apostle Islands National Lakeshore and various citizen groups. R/SCD-3

Outreach

Preparing Coastal Communities for Climate Change: Translating Model Results to Prepare Ports, Harbors and Stormwater Management Facilities in an Era of Climate Variability and Scientific Uncertainty (Clark/Hart) – This Great Lakes Sea Grant Network project involves two tasks: 1) the creation of economic tools or scalable models for evaluating the potential Great Lake economic impacts to navigation and port, harbor and marina infrastructure due to climate-induced variations and 2) the visualization of shoreline and water level change for three Great Lakes harbors based on updated climate change and lake level scenarios. Funding source: NOAA, Climate Program Office. A/AS-62

Climate Change Adaptation and Wisconsin's Coastal Communities: Connecting With Users (Moy/Hart/Clark) – Advisory Specialists Moy, Hart and Clark will work with coastal communities to inform planners and decision makers about the current science on climate adaptation. Moy, Hart and Clark are co-chairs of the Coastal Communities Working Group of the Wisconsin Initiative on Climate Change Impacts, and they will collaborate with coastal communities, NGOs, 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 National Sea Grant Office.

Great Lakes Mapping Mashups: Training to Leverage GLOS Products and Distributed Web Services (Hart) – This project supports holding one-day workshops on each of the Great Lakes to: 1) showcase existing Great Lakes mapping and decision-support tools, 2) help Great Lakes constituencies assess their needs for new Great Lakes mapping and decision-support tools, 3) identify existing sources of Great Lakes maps and data and, 4) provide hands-on training to show how participants can develop their own Great Lakes mapping mashups. Funding source: Great Lakes Observing System. A/GLOS-1

Enhancing Sea Grant Climate Extension Capabilities Through Training and Increased Interaction With NOAA Scientists (Hurley) – Sea Grant extension agents and specialists are constantly responding to stakeholders with concerns about potential impacts of climate change in coastal areas. However, at this time, there is no centralized training available for them, nor is there a convenient way for NOAA and Sea Grant climate research scientists to interact in a way that brings current science to coastal stakeholders. The co-principal investigators plan to form an advisory committee consisting of selected NOAA climate scientists and Sea Grant extension personnel to develop an online training course for coastal extension agents as well as a climate-based wiki to increase interaction between key NOAA scientists and coastal stakeholders. Public access to the site will allow coastal stakeholders access to all wiki content and the ability to locate key Sea Grant and NOAA climate personnel. Funding source: NOAA, Climate Program Office Sectoral Applications Research Program. A/SARP-1

Enhancement of the Wisconsin Coastal Guide (Hart) – The project enhances the Wisconsin Coastal Guide by completing a comprehensive inventory and classification of public access sites, enhancing panorama photos, partnering with Portal Wisconsin to map the calendar of cultural events in coastal communities, developing a map interface for "stories" that communicate the special nature of the Great Lakes, and adding several new map features to include nature centers, museums, marinas, geocaches, state natural areas and wildlife refuges. Funding source: Wisconsin Coastal Management Program. A/WCMP-4

Ports, Harbors and Marinas Initiative (Clark/Harris) – Wisconsin Sea Grant will assist Great Lakes ports, harbors and marina managers and owners with all aspects of port, harbor and marina infrastructure maintenance and repair, dredging technology and dredged material disposal, and facility management. A single non-advocacy source for reliable, up-to-date information to help managers and owners is critical to the operation and maintenance of our ports, harbors and marinas. New techniques need to be verified and

information disseminated to assist managers with their project investigation studies and repairs. Wisconsin 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.

In addition, Wisconsin Sea Grant will initiate a coordinated outreach and education campaign for Wisconsin's coastal ports, harbors and marinas. Working with the newly formed Wisconsin Marina Association, Wisconsin Sea Grant will help establish and promote a Clean Marina Program in the state. Central to this effort will be a Sea Grant-created website for timely information on port and harbor infrastructure, beneficial uses of dredged materials, guidance for adaptive response to changing lake levels in the face of climate change, and best management practices for a variety of operational and environmental issues.

Coastal Hazards Workshops (Clark/Hart) – This project is in partnership with the Wisconsin Department of Natural Resources (WDNR) Office of the Great Lakes and the Wisconsin Coastal Management Hazards Team to conduct a series of coastal hazard workshops for two specific audiences. The first audience will include WDNR water regulations and zoning management specialists and basin supervisors while the second audience will include regional and county zoning administrators, building inspectors, and land and water conservation staff. These workshops will educate these specific specialists to assist them in reviewing and permitting projects along the Great Lakes shorelines and to consider the impacts of future development projects. The goal of these workshops is to convey knowledge gained through experience, education and work of the Wisconsin Coastal Hazards Workgroup team.

Support Sustainable Fisheries and Aquaculture

National Sea Grant Goals:

- *A sustainable supply of safe seafood to meet public demand.*
- *A healthy domestic seafood industry that harvests, produces, processes, and markets seafood responsibly and efficiently.*
- *Informed consumers who understand the importance of ecosystem health and sustainable harvesting practices to the future of our domestic fisheries, who appreciate the health benefits of seafood consumption, and who understand how to evaluate the safety of the seafood products they buy.*

Many major U.S. fisheries are in decline, while seafood consumption and demand are rising. The consequence is an $8 billion seafood trade deficit. Through its research, extension and education activities and work with partners, Sea Grant has produced important discoveries that have aided the stabilization and recovery of many endangered fisheries. According to the NOAA Aquaculture Program, fish farming is in its infancy in the U.S., amounting to just over $1 billion of a $70 billion worldwide industry. In Wisconsin, aquaculture sales in 2005 totaled $7 million. Aquaculture creates important new opportunities to meet the increased demand for seafood, but a number of questions need to be addressed for its full potential to be realized.

Seafood safety is a growing concern as international trade increases and fish diseases and toxic contamination become bigger problems. Sea Grant has several key roles to play in advancing public understanding of the nature of these problems and opportunities. Through the use of its research, extension and education capacities, Wisconsin Sea Grant supports the kind of informed public and private decision making that can lead to a sustainable supply of safe seafood long into the future.

Wisconsin has a diverse, moderately sized aquaculture industry for the production of food fish, baitfish and fish for stocking. The industry has good growth potential, particularly in the area of food fish production, because of the availability of new technology,

ample supplies of high-quality water, land, labor and markets. The most likely candidates for expansion in Wisconsin are cool-climate, freshwater fish species. To achieve the state's aquaculture potential, within the framework of biosecurity standards, additional research needs to focus on intensive culturing techniques, such as developing genetically defined domesticated broodstocks and controlling reproduction, advancing early life stage finfish culture technology, improving nutritional requirements as a function of growth, and managing fish health. Practical, cost-effective production parameters are needed, along with the development of environmentally sound recirculating aquaculture systems focused on reducing water usage and managing effluents.

The sustainability of Wisconsin's commercial fishery is threatened by changes in fish communities caused by invasive and introduced species, a changing climate, and economic pressures deriving from higher fuel costs for its fishing fleet. The fisheries of the Great Lakes have been strongly influenced by ecological changes brought about by deliberate as well as unintentional introductions of exotic species. Sea lampreys contributed to the collapse of native fish populations. New invaders—such as zebra mussels, round goby, ruffe and white perch—pose significant challenges.

Key research challenges include developing ways to control the spread of exotics, creative methods for reducing their adverse effects on native fish populations, and the combination of conceptual and analytical tools required to evaluate fishery sustainability and restoration efforts, particularly with regard to how all of these might be affected by climate change. Improvement in the fuel efficiency of charter and commercial fishing boats is another important need.

Projects

Urban Aquaculture Initiative

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

UW-Milwaukee WATER Institute 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. Wisconsin 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 reduces transportation costs. Sea Grant and the WATER Institute are in a unique position to act as advisors for aquaculturists working in a number of settings because both organizations have extensive experience in establishing and maintaining many types of fish-rearing systems. Investors who have questions on the marketability of urban aquaculture systems will come to appreciate the benefit of growing food locally, the creation of jobs in an urban environment and the balance of risks associated with starting a new business. In addition, Wisconsin Sea Grant's communications staff will produce outreach products to further support and promote urban aquaculture. (This project also fits within the "Enhance Coastal Community Sustainability and Resilience" focus area.) Also supported by the NOAA Sea Grant Aquaculture Extension and Technology Transfer 2010 competition. A/AQ-2

Increasing the Efficiency of Yellow Perch Fingerling Production by Optimizing Pond Trophic Dynamics and Feed-Training Strategies

Christopher Hartleb, UW-Stevens Point, (715) 346-3228, chartleb@uwsp.edu
Jeffrey Malison, UW-Madison, (608) 263-1242, jmalison@wisc.edu

In this ongoing project, researchers are looking at the food chain dynamics and feed training methods used in the yellow perch aquaculture industry. The growth of the yellow perch aquaculture industry is constrained by the high cost of feed-trained fingerlings. Using eight ponds at two locations, this project is using selected fertilizer regimes to identify and quantify plankton and benthic communities in pond culture systems; examining larval and post-larval prey selection and prey availability; and comparing photo-periods, temperatures and dietary regimes—krill and a moist diet versus a conven-

tional dry diet – during the weaning period. At harvest, fish survival and net fish yield for each pond is measured. R/AQ-42

Evaluation of Sources and Uptake of Methylmercury in Farm-Raised Rainbow Trout *(Oncorhynchuss mykiss)* and Yellow Perch *(Perca flavescens)*

Christopher Babiarz, UW-Madison, (608) 265-5085, babiarz@cae.wisc.edu

Elevated methylmercury (MeHg) levels in fish are known to slow their growth rates, disrupt their reproductive success, and increase their rates of infectious disease; MeHg may also result in fish consumption advisories for humans, but little is known about MeHg levels in the most popular farm-raised fish in the Midwest. The goal of this research project is to determine the critical factors controlling MeHg concentrations in farm-raised rainbow trout (*Oncorhynchuss mykiss*) and yellow perch (*Perca flavescens*) by tracking the quantity and quality of the feed, the growth stage of the fish, and the anaerobic conditions of the ponds. The resulting field- and laboratory-generated data will be used to calibrate a contaminant-accumulation model across species and method of aquaculture. Improved best management practices will be developed to minimize potential inputs of MeHg to farm-raised fish and to reduce the impact of mercury from aquaculture waste to the surrounding environment. R/AQ-43

Development of Yellow Perch Broodstocks for Selective Breeding

Rick Goetz, UW–Milwaukee, (414) 382-1700, rick@uwm.edu
Fred Binkowski, UW–Milwaukee, (414) 382-1723, sturgeon@uwm.edu

The recent decline of the yellow perch fishery in Lake Michigan has led to a shift toward aquaculture to replace this lost food resource, yet many unknowns add risk to developing a viable yellow perch aquaculture business. One is the need for a dependable supply of broodstocks with the ability to produce offspring at multiple times during the year. The investigators of this ongoing project are evaluating broodstocks from wild perch derived from several geographic regions in the United States. They are then determining genetic variation and phylogenetic relatedness of perch and their crossbred offspring using DNA microsatellite markers. This project is testing the viability of this genetic marker approach for developing aquaculture broodstock capable of out-of-season spawning. R/AQ 44

Lake-Wide Sustainability of Lake Trout Stocks in Lake Superior

Michael Hansen, UW-Stevens Point, (715) 346-3420, mhansen@uwsp.edu

A meta-population model is being developed to evaluate lake-wide sustainability of recently restored lake trout stocks across Lake Superior, building on a stochastic, age-structured population model that was developed under a previous Sea Grant-funded project. The hypothesis with this continuing project is that long-term sustainability of individual stocks within Lake Superior is enhanced by the presence of other stocks in the lake through immigration. Movement among stocks and effects of environmental factors are being modeled. It is also mimicking combinations of recreational and commercial fishery harvest by simulating probability distributions for key population parameters, such as population abundance and recruitment. R/FI-2

Climate Change Increases Sea Lamprey Impact in Lake Superior

James Kitchell, UW–Madison, (608) 262-7259, kitchell@wisc.edu

The average summer surface water temperature of Lake Superior has increased by about 3.5°C over the past three decades. Warmer water temperatures have increased the duration of thermal stratification and lengthened the period of lake trout's preferred thermal habitat (9-11°C) by up to twofold. Because lake trout are the preferred host of sea lamprey, changes to their thermal habitats alter the feeding and growth of sea lamprey, among the greatest threats to Lake Superior fisheries. While control efforts have been tremendously successful at reducing lamprey abundance, climate change raises questions about how increasing water temperatures in Lake Superior will change the parasitic behavior of remaining lamprey. This project will develop bioenergetic models that estimate effects of climate warming on sea lamprey growth in multiple regions of Lake Superior. Combining these results with information about host abundance and stable isotope-based estimates of lamprey diet in Lake Superior, the project will determine how increased lamprey growth may influence mortality of native lake trout. R/SFA-2

Novel Epidemiologic and Diagnostic Approaches for Reducing the Impact of Viral Hemorrhagic Septicemia Virus on Aquatic Ecosystems in Wisconsin

Tony Goldberg, UW–Madison, (608) 890-2618, tgoldberg@svm.vetmed.wisc.edu

Viral hemorrhagic septicemia virus (VHSV) is an invasive pathogen that threatens the health and sustainability of Wisconsin's aquatic ecosystems. In Wisconsin, the virus has been found in the Lake Michigan and Lake Winnebago watersheds. Despite the potential economic and ecological damage that could ensue if VHSV spreads to other areas of Wisconsin, adequate tools for predicting and managing the emergence of the virus are lacking. This project seeks to develop and distribute novel epidemiological and diagnostic tools for predicting the emergence and spread of VHSV. Specifically, it will develop non-lethal laboratory diagnostics to detect VHSV antibodies and use them to construct and validate a predictive model of VHSV transmission. This effort will allow the future course of VHSV transmission to be forecast from current measures of fish demographics and infection status, thus improving our ability to monitor and manage the disease in Wisconsin's wild fisheries. R/SFA-3

Effectiveness of a Lake Trout Refuge at Gull Island Shoal, Lake Superior

Michael Hansen, UW-Stevens Point, (715) 346-3420, mhansen@uwsp.edu

Lake trout were the predominant fish predator in Lake Superior before stocks collapsed from exploitation and sea lamprey predation. In Wisconsin waters of the lake, the Gull Island Shoal refuge, created in 1976 to prevent depletion of a remnant lake trout stock, enabled the stock to recover by providing recruitment to the entire Apostle Islands area. Previous research has shown that growth and recruitment of lake trout in the Apostle Islands region changed from density independent during early recovery to being density dependent at present, which indicated that the population was nearing carrying capacity and may be able to sustain harvest. This project will thoroughly evaluate historical effectiveness and future need for the Gull Island Shoal Refuge on lake trout stocks residing in Wisconsin waters of Lake Superior. R/SFA-4

Reducing the Level of Bio-Contaminants in Fish-Based Foods

Mark Richards, UW-Madison, (608) 262-1792, mprichards@ansci.wisc.edu

Concern about mercury contamination of fish-based products is an issue that negatively affects fish consumption. The focus of this continuing work is to determine the location of mercury in fish tissues and to determine if certain processing steps can be used to lower mercury levels in the resulting food product, specifically, a process that manipulates pH. That process is now used to manufacture surimi, imitation crab meat. R/SS-1

Outreach

Fishing Tournament Organizers and Professional Anglers: Preventing the Spread of AIS by Extending AIS-HACCP and the Stop Aquatic Hitchhikers Campaign in the Great Lakes (Moy) – Most public information campaigns related to preventing the spread of aquatic invasive species (AIS) have been directed toward recreational boaters. However, recent unpublished research and anecdotal information suggests that fishing tournaments may serve to exacerbate the transport/colonization risk posed by zooplankton and disease organisms. This project will train professional anglers and tournament organizers in preventing the spread of AIS and produce brochures and booklets to help anglers become part of a broader citizen AIS monitoring network. Funding source: National Sea Grant Office. A/AS-64

A Comprehensive Regional Public Outreach Campaign on AIS (Moy) – Using an array of tools, Invasive Species Specialist Moy will work with Minnesota Sea Grant to coordinate the work of the Great Lakes Sea Grant programs and other external partners to educate students, sportsmen, recreational boaters and the general public about aquatic invasive species in both Lakes Michigan and Superior. Funding source: the Great Lakes Restoration Initiative. A/GLRI-3

Climate Change Outreach (Cross-cutting: all outreach/IT staff)–See page 19 for a full description.

National Sea Grant Goals:

- *Sound scientific information to advance understanding of the nature and value of our coastal, ocean, and Great Lakes resources; to identify new ways to conserve and use these resources; and to support evaluation of the environmental impacts and socio-economic trade-offs involved in coastal decision-making.*

- *An informed public that understands the value and vulnerability of coastal, ocean, and Great Lakes resources, and demands informed science-based decisions about the conservation, use, and management of these resources, and a well-trained workforce that will make this a reality.*

- *Decision-making processes that involve the full-range of coastal interests, that integrate efforts of public and private partners at the federal, regional, state, and local levels, and provide mechanisms for establishing common understandings and generating outcomes that balance multiple interests.*

The 2004 U.S. Commission on Ocean Policy Report emphasized that restoring and sustaining our coastal environments requires an informed citizenry that understands the value and vulnerability of these resources. NOAA has also identified ocean and aquatic literacy as a strategic priority. UW Sea Grant has long supported K-12, undergraduate, graduate, professional and technical education, and we remain committed to advancing coastal and Great Lakes literacy. This is accomplished by using Wisconsin Sea Grant's strong university partnerships and its education and extension capacities to develop educational programs for schools, professional education and workforce training. We also help teachers develop their scientific knowledge and skills to bring aquatic science to their students more effectively. We foster lifelong learning by extending aquatic science education to local communities, museums, parks and other public venues. One of our long-standing priorities is to provide opportunities for graduate and undergraduate students to participate in all kinds of UW Sea Grant program activities.

Projects

Great Lakes Earth Partnership

Cheryl Bauer-Armstrong, UW-Madison, (608) 262-5264, cherylbauer@wisc.edu
Richard Hall, UW-Madison, (608) 262-5367, rdhall@wisc.edu

University researchers, students and natural resource professionals will collaborate with K-16 students to assess environmental and human impacts on the watershed, collect data on water quality interventions, and predict and track change on the landscape. Researchers will collaborate with existing Earth Partnership School (EPS) Centers to implement Great Lakes Earth Partnership teacher training institutes, adapt EPS activities to riparian and shoreline habitats, and align EPS curriculum with existing Great Lakes curricula from other programs. Students, teachers and citizen volunteers will collaborate as community stewards for rain garden planting and restorations at schools and in the community. Students will develop public outreach materials based on their watershed assessments that will inform citizens about how they can reduce stormwater impacts by building rain gardens, installing rain barrels or changing lawn care practices. E/ML-16

Lake Sturgeon Bowl, Wisconsin's Regional Academic Competition

Caroline Joyce, UW-Milwaukee, (414) 227-3365, caroline@uwm.edu
Carmen Aguilar, UW-Milwaukee, (414) 382-1755, aguilar@uwm.edu

The local qualifier for the National Ocean Science Bowl (NOSB), Wisconsin's Lake Sturgeon Bowl (LSB), allows high school teachers and students to advance their scientific knowledge through formal and informal educational opportunities in ocean and aquatic sciences literacy. Seventy-eight percent of Wisconsin students surveyed responded that participating in the LSB helped them increase their interest in freshwater and ocean science, while 67 percent of their coaches stated that the LSB resulted in an increased infusion of marine science into their classroom teaching. LSB is a vehicle not only for developing student interest in ocean and aquatic sciences but also for meeting professional development needs of high school teachers—especially those of under-represented groups—to increase their marine/aquatic science literacy. Further, as a measure of success, Wisconsin's LSB champion Marshfield High School went on to claim the national

championship of the NOSB in both 2009 and 2010. Wisconsin Sea Grant support helps fund logistics for the LSB, professional development components for teacher coaches, officials and students, and expanded teacher professional development training for diversity teachers and their teams. E/ML-17

Aquatic Sciences Exploration: Onboard and Online

Carmen Aguilar, UW-Milwaukee, (414) 382-1700, aguilar@uwm.edu

The Aquatic Sciences Exploration: Onboard and Online Program provides immersion science learning to middle and high school students and teachers during authentic research cruises on Lake Michigan. Distance learning communication technologies such as wireless shipboard-based interactive videoconferencing allows participants to share and distribute their findings with others. The program provides the mechanism to test both the hands-on, hypothesis testing components ("onboard") and the distance learning component ("online") using pre-assessment, formative and summative evaluations as components of the program material. The program encourages the inclusion of under-represented students from the Milwaukee area. E/ML-9

Outreach

Great Lakes Center for Ocean Science Education Excellence (Lubner) – The goal of this five-year Great Lakes Sea Grant Network project is to implement a Great Lakes Center for Ocean Science Education Excellence (COSEE), which is designed to help teachers deliver high-quality educational programs in aquatic sciences by creating dynamic linkages between Great Lakes researchers and 4th- to 10th-grade educators and their students. The goal of the seven regional COSEEs is to help U.S. citizens become more scientifically literate and environmentally responsible through standards-based science curricula and programs. Funding source: National Science Foundation. A/AS-58

Science of the Great Lakes for the K–12 Classroom (Lubner) – In partnership with such organizations as Discovery World at PIER Wisconsin, the Schlitz Audubon Nature Center and UW Great Lakes WATER Institute, UW Sea Grant's education coordinator will continue to develop programming for K–12 teachers on a diversity of Great Lakes issues. Courses and workshops provide educators with content knowledge about the Great Lakes and hands-on activities for use in their classrooms. Courses often include on-the-water and other field experiences that are available for credit.

Marine Science at Sea: A Hands-on Laboratory (Lubner) – This three-credit UW–Milwaukee course provides a hands-on, shipboard opportunity to learn the basics of oceanography and nautical science. Students sail aboard the S/V Denis Sullivan, a replica of an 1880s three-masted schooner, for two weeks as it travels from its winter port in Florida to Bahamian waters. They become members of the crew and engage in all aspects of shipboard operations while learning about the physical, chemical, biological and geological aspects of the ocean as well as the history and culture of the Bahamas.

Grandparents University (Lubner/Moy) – This Wisconsin Alumni Association "university" is a two-day program of coursework in a number of subject areas that is offered each summer for youngsters and their grandparents. UW Sea Grant and the UW–Madison Center for Limnology collaborate to offer a popular course on the study of lakes that includes taking water samples aboard a research vessel, hands-on operation of underwater robotic technology and activities involving aquatic invasive species.

Wisconsin's Water Library (Moser) – UW Sea Grant will continue to develop and promote Wisconsin's Water Library *(aqua.wisc.edu/waterlibrary)* during the next biennium. All Wisconsin residents as well as UW System faculty, staff and students can check out any library material free of charge. Materials can be picked up at the library or sent to the user's local public library for pick up and return, providing easy access to the more than 30,000 items in the collection. The library develops annotated reading lists emphasizing coastal and Great Lakes ecosystems, provides water facts to help educate residents about the importance of water, and provides a lending library and activities for children through Wisconsin's Water Library for Kids. The library also provides all level of reference and referral service to any Wisconsin resident on a wide range of water-related inquiries.

Library Services to Underserved Populations (Moser) – The staff of UW Sea Grant's Wisconsin's Water Library will continue to expand its services to underserved populations of Wisconsin residents. In addition to involvement in story times for early elementary students in the Allied Drive neighborhood of Madison, the library also collaborates with the Head Start Program for preschoolers at the Ho-Chunk Nation in Baraboo. As with the program at Allied Drive, each story hour is organized around a water-related theme and includes art projects and snacks. These bimonthly events are conducted in partnership with several organizations including the UW-Madison School of Library and Information Studies, the Madison School & Community Recreation Safe Haven Childcare Program and the Ho-Chunk Nation, Head Start Program.

Climate Change Reading List and Resources (Moser)
Through a generous grant from the Friends of UW Libraries, books about climate change and its impact on Wisconsin are purchased by Wisconsin's Water Library and made available for statewide circulation. A reading list is created that includes both the books and additional resources to consult on this important topic. Titles are collected for both a lay audience, university staff and for children and teachers. The list can be found at the Water Library's website at *aqua.wisc.edu/waterlibrary* in the "Wisconsin Residents" section.

Climate Change Outreach (Cross-cutting: all outreach /IT staff) – See page 19 for a full description.

Dean John A. Knauss Marine Policy Fellowship

seagrant.noaa.gov/knauss/knauss.html

Contact: Anders W. Andren, Director, UW Sea Grant Institute, (608) 262-0905

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

Sea Grant/NOAA Fisheries Graduate Fellowship

seagrant.noaa.gov/funding/fisheriesgradfellowship.html

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

Carl J. Weston Memorial Scholarship

Contact: Mary Lou Reeb, UW Sea Grant Institute, mlreeb@aqua.wisc.edu

Established in 1995, the Carl J. Weston Memorial Scholarship fund provides support for deserving undergraduate students working on Wisconsin Sea Grant-supported projects. Funding source: Dr. and Mrs. Carl B. Weston.

Useful UW Sea Grant Institute Websites
for Investigators, Staff and Students

UW Sea Grant Institute
seagrant.wisc.edu
Find links to and launch searches of all UW Sea Grant Institute websites, including Wisconsin activities in each of Sea Grant's national focus areas and various products of UW Sea Grant-funded research, outreach and education.

Funding
seagrant.wisc.edu/funding
Provides links to information about grant opportunities, graduate student competitions and more.

Interactive Project Reporting Online (iPRO) System
aqua.wisc.edu/ipro
Permits project investigators to manage, report progress and view information about their project(s), including results, accomplishments, benefits, student activities and budget.

Projects
seagrant.wisc.edu/projects
Information about the research, education and outreach projects currently funded by UW Sea Grant Institute.

Great Lakes Internet Resources
greatlakesseagrant.org

National Sea Grant Network
seagrant.noaa.gov
Links to online directories of federal and university Sea Grant staff nationwide and the websites of every Sea Grant program, the National Sea Grant Library and the Sea Grant Association.

Aquatic Sciences Chronicle
aqua.wisc.edu/chronicle
Published four times a year, this four- to eight-page newsletter reports on the activities of the UW Sea Grant and Water Resources programs. It is available free of charge to anyone interested in receiving it. To get on the mailing list, contact Linda Campbell. (See "Key Contacts.")

Aquatic Sciences Center Publications
aqua.wisc.edu/publications
This website features an annotated listing of our most popular publications, including brochures, fact sheets and posters, as well as online access to a wide range of other UW Sea Grant and Water Resources program information. The site includes an online shopping feature that allows users to make purchases with a credit card or obtain items free of charge.

Wisconsin's Water Library
aqua.wisc.edu/waterlibrary
This UW–Madison library contains nearly 30,000 volumes of water-related information, with particular emphasis on issues concerning Wisconsin and the Great Lakes, available for loan to all Wisconsin residents. The collection also contains publications from state Water Resources Research Institutes nationwide. For more information, contact Anne Moser. (See "Key Contacts.")

AquaLog
aqualog2.blogspot.com
Wisconsin's Water Library uses blog technology as a way to connect with library patrons, water researchers and Great Lakes residents on a daily basis. In this era of information overload, the goal of AquaLog is to provide an organized way to share information on current trends in the water field and new, useful and reliable resources. AquaLog posts are searchable by topic, and a monthly archive is available.

National Sea Grant Library
nsgd.gso.uri.edu
As the official national program archive, the NSGL maintains a complete collection of Sea Grant-funded documents on a wide variety of subjects. The NSGL's searchable 40,000-record bibliographic database contains citations and abstracts of all Sea Grant publications and online access to a full-text copy of many of these documents as well.

Index of Project Principal Investigators

Aguilar, Carmen 38, 39

Babiarz, Christopher 15, 32

Bauer-Armstrong, Cheryl 38

Berges, John 10

Binkowski, Fred 31, 32

Bootsma, Harvey 16

Broihahn, John 23

Carvan, Michael 11

Goetz, Rick 32

Goldberg, Tony 34

Hall, Richard 38

Hansen, Michael 33, 34

Hartleb, Christopher 31

Heideman, Warren 11, 13

Janssen, John 16

Joyce, Caroline 38

Karasov, William 14

Kern, Anthony 12

Kitchell, James 13, 33

Liao, Qian 15

Liebl, David 25

Malison, Jeffrey 31

McLellan, Sandra 14

McMahon, Katherine 12

Mooney, Margaret 23

Peterson, Richard 11, 13

Phillips, Jean 23

Potter, Kenneth 25

Provencher, R. William 24

Radeloff, Volker 24

Richards, Mark 35

Sandgren, Craig 10

Shafer, Martin M. 17

Silbernagel, Janet 17

Vander Zanden, M. Jake 10, 16

Ventura, Stephen 24

Wu, Chin 15, 25

Key Contacts

Administration

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

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

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

Finance and Grants Administration—Daniel Marklein, (608) 263-3252, *marklein@aqua.wisc.edu*

Communications Manager—Moira Harrington, (608) 263-5371, *moira@aqua.wisc.edu*

Outreach Program (Advisory Services)

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

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

Education Coordinator & Marine Safety Training—James Lubner, UW–Milwaukee, (414) 227-3291, *jflubner@aqua.wisc.edu*

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

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

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

Information & Publications (Communications)

Media Contact—Moira Harrington, (608) 263-5371, *moira@aqua.wisc.edu*

Publications/Mailing Lists—Linda Campbell, (608) 263-3259, *publications@aqua.wisc.edu*

Water Resources Library—Anne Moser, (608) 262-3069, *AskWater@aqua.wisc.edu*

University of Wisconsin Sea Grant Institute
UW Aquatic Sciences Center
Goodnight Hall, 2nd Floor
1975 Willow Drive
Madison, WI 53706-1177
Phone: (608) 262-0905
Fax: (608) 262-0591
seagrant.wisc.edu