



2006-08 Implementation Plan

University of Wisconsin Sea Grant College Program

Submitted by Anders W. Andren, Director, December 1, 2005

NOTE: *This document, as outlined in the Table of Contents, addresses each element of the “Outline for Writing a Sea Grant Implementation Plan” contained in the National Sea Grant Office’s Policy Document on the Implementation of Program Evaluation Procedures and Omnibus Proposal Submission in the National Sea Grant College Program – Appendix B: Implementation Plan Guidelines (NSGO, September 2000).*

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Table of Contents

I. Review of Program Strategic Plan

1. Mechanisms for the Establishment of Strategic Planning	1
2. How It Relates to NOAA Sea Grant Strategic Plan	3
3. Context of Institutional and Territorial Characteristics	3
4. Involvement of Faculty, Staff and Constituents	7

II. Implementation Plan Development

1. Process of Selecting Priorities	13
2. Milestones for the Implementation of Priorities	17
3. Program Elements and Personnel Needed	20
4. Time Frame for Implementation	20

III. Program Implementation

1. Program Elements and Context	21
2. Integration of Program Elements and How We Will Move toward Implementation	21
<i>Aquaculture</i>	22
<i>Aquatic Invasive Species</i>	23
<i>Biotechnology</i>	26
<i>Coastal Communities & Economies</i>	28
<i>Coastal Natural Hazards</i>	30
<i>Digital Ocean-Great Lakes Geospatial Technologies</i>	33
<i>Ecosystems & Habitats</i>	34
<i>Fisheries</i>	36
<i>Marine & Aquatic Science Literacy</i>	38
<i>Seafood Science & Technology</i>	42
<i>Urban Coast</i>	43
<i>Innovative Science & Technology</i>	46
<i>Institutional Goals & Priorities</i>	47
3. Our Evaluation Process: How We Will Measure Success	56
4. Interaction and Integration with Other Programs	57

IV. Review, Revisions and Results

1. Timing and Mechanisms for Reviewing Program Progress and Results	59
2. Program Revision and Redirection during Implementation	59
3. How We Will Synthesize, Package and Disseminate Results	60

V. Nationalization of the Implementation Plan

1. Program Elements with National and Regional Application	61
2. Implementation Plan Relationship to National Needs and How It Reaches Users	69
3. Suggested National and Regional Efforts to Implement Results	69

Figures

1. Organizational Chart	4
2. Outreach Office Locations	9

Tables

1. UW Sea Grant Advisory Council	2
2. Advisory Committee on Outreach & Education	2
3. University of Wisconsin Sea Grant Institute Professional Staff	5
4. External Review Panels, 2005	14

Appendices

A. National Sea Grant Theme Priorities	71
B. UW-Madison Strategic Goals & Initiatives, 2005-06	72
C. Outreach Staff Memberships	74
D. Wisconsin's Great Lakes Restoration and Protection Priorities	76
E. Theme Area Coordinators	77
F. Participating Institutions and Departments, 2006-08	78
G. Outreach Projects Partnerships, 2006-08	80
H. 2006-08 Omnibus Proposal Preparation Schedule	83
I. Program Management Decision Process	85
J. Matrix of National Sea Grant Themes-Wisconsin Sea Grant Projects, 2006-08	86

I. Review of Program Strategic Plan

1. Mechanisms for the Establishment of Strategic Planning

The mechanisms and process of strategic planning for the University of Wisconsin Sea Grant College Program are straightforward and relatively simple in concept.

In 1998, the Sea Grant Association and NOAA Sea Grant adopted an issue-oriented thematic approach to enhance the National Sea Grant College Program's effectiveness in addressing the nation's most important ocean, coastal and Great Lakes issues. Three purposes of this approach, among others, were to help organize Sea Grant activities under areas of common interest, facilitate the synthesis of thematic efforts on a national scale, and provide a common framework for strategic planning at the state, regional and national levels. Accordingly, Wisconsin Sea Grant's strategic plan was restructured to mirror the National Sea Grant College Program's thematic areas, with the national goal(s) cited in each of the 11 national themes serving as the starting point for developing Wisconsin priorities within that theme (**Appendix A**).

In addition, our strategic plan incorporates the institutional goals and priorities of the University of Wisconsin-Madison's strategic plan (**Appendix B**). By combining the strategic plans of NOAA Sea Grant and our parent institution, our strategic plan thus provides a clear and highly relevant blueprint for Wisconsin Sea Grant research, outreach, education *and* program administration.

Built on this foundation, our program's general strategic planning approach is a bottom-up process that is repeated every two years in connection with preparing our biennial Request for Proposals (RFP). It begins with our six Advisory Services specialists—who serve as the primary mechanism through which the research, outreach and education needs of resource managers, users and other constituent groups are communicated to program managers—canvassing constituents in their respective coastal service areas to update and/or identify new state and regional research, outreach and education priorities in each thematic area. They also take into consideration the mix of strategic priorities identified by the various local, state, regional and national advisory boards, committees, commissions and professional organizations to which they belong (**Appendix C**).

This revised draft strategic plan is posted on the UW Sea Grant website and circulated for comment to a mailing list of hundreds of individuals, including representatives of local, state and regional constituent groups; city, county, state and federal government officials, research scientists and university administrators. The solicited as well as unsolicited feedback from these individuals is used to refine the program's state and regional strategic priorities in each national Sea Grant theme, and the revised draft is presented to the UW Sea Grant Advisory Council (**Table 1**) and our Advisory Committee on Outreach and Education (**Table 2**) for approval and adoption. Representing other units of the UW System, state and local government, industry, and the public, these two advisory bodies represent a wide range of viewpoints and help ensure the program's accountability to faculty, staff and constituents statewide.

These advisory bodies, along with UW Sea Grant staff, are also actively involved in helping program managers identify special research opportunities and new talent for the program's unique 12th thematic area, Innovative Science and Technology.

The national goals and Wisconsin priorities so identified in each Sea Grant theme are used, *verbatim*, as the core of UW Sea Grant's biennial RFP. Revised and updated in this manner every two years, the UW Sea Grant strategic plan is thus a working document that is constantly evolving. This keeps our program flexible, innovative and responsive, enabling us to adapt relatively quickly to meet changing needs and take advantage of new opportunities.

TABLE 1: UW Sea Grant Advisory Council

ANDERS W. ANDREN (*ex officio*)
 Director, Aquatic Sciences Center
 University of Wisconsin-Madison

LEE KERNEN
 Citizen representative
 Madison, Wisconsin

STEPHEN BRANDT
 Director
 Great Lakes Environmental Research Laboratory
 Ann Arbor, Michigan

REUBEN H. LORENZ
 Citizen representative
 Madison, Wisconsin

RICHARD R. BURGESS
 Professor, Oncology
 McArdle Laboratory
 University of Wisconsin-Madison

LARRY J. MACDONALD
 Owner, Apostle Islands Outfitters & General Store
 Mayor of Bayfield
 Bayfield, Wisconsin

BEVERLY A. FRENCH
 Partner, Orde Advertising, Inc.
 West De Pere, Wisconsin

JOHN J. MAGNUSON
 Professor Emeritus, Zoology
 Center for Limnology
 University of Wisconsin-Madison

FRANCES C. GARB
 Senior Academic Planner, Office of
 Academic Affairs
 University of Wisconsin System
 Madison, Wisconsin

KEVIN MCSWEENEY
 Professor, Soil Science & Environmental Studies
 Director, School of Natural Resources
 University of Wisconsin-Madison

HALLETT J. "BUD" HARRIS (*chair*)
 Professor Emeritus, Natural & Applied Sciences
 University of Wisconsin-Green Bay

DAVID T. MICHAUD
 Principal Scientist, Environmental Department
 Wisconsin Electric Power Company
 Milwaukee, Wisconsin

REINHOLD HUTZ
 Interim Associate Dean for Research
 Research Services & Administration
 University of Wisconsin-Milwaukee

NATHANIEL E. ROBINSON
 Vice Chair, National Sea Grant Review Panel
 Senior Advisor to the President,
 Wisconsin Technical College System
 Madison, Wisconsin

TABLE 2: Advisory Committee on Outreach & Education

CARMEN AGUILAR (*Research and Education*)
 Great Lakes WATER Institute
 University of Wisconsin-Milwaukee

KONNIE LEMAY (*Communications*)
 Lake Superior Magazine
 Duluth, Minnesota

JEFF DUMEZ (*Geographic Information Systems*)
 GIS/LIO Coordinator, Brown County
 Green Bay, Wisconsin

ANGIE TORNES (*Non-profit Organizations*)
 NPS, Rivers, Trails, and Conservation Assistance; Milwaukee,
 Wisconsin

KAREN GREEN (*Education*)
 Metropolitan High School
 Milwaukee, Wisconsin

DAVE WENTLAND (*Coastal Engineering*)
 Coastal Planning and Design
 STS Consultants, Ltd
 Green Bay, Wisconsin

LEE HAASCH (*Charter Fishing*)
 Haasch Guide Service
 Algoma, Wisconsin

LARRY WAWRONOWICZ (*Aquaculture*)
 Lac du Flambeau Band of Lake Superior Chippewa
 Lac du Flambeau, Wisconsin

AL HOUSE (*Recreational Fishing*)
 Apostle Islands Sportfishing Association
 Washburn, Wisconsin

ROY ZELLMER (*Boating Safety*)
 Boating Safety Administrator
 Wisconsin Dept. of Natural Resources
 Madison, Wisconsin

JOHN KENNEDY (*Water Quality*)
 Green Bay Metropolitan Sewerage District
 Green Bay, Wisconsin

2. How It Relates to NOAA Sea Grant Strategic Plan

The philosophy of our approach to basic research as well as quick-response projects is to provide information that will allow industry, government and the public to make wiser use of Great Lakes, coastal and ocean resources, to enhance the value of those resources, and to find solutions to problems that threaten their sustained use. This philosophy is in complete concordance with both the NOAA strategic plan as well as with the ideas presented in the NOAA Sea Grant strategic plan.

As noted in section I-1, the UW Sea Grant strategic plan is structured in accordance with the 11 national Sea Grant thematic areas. The national priorities used in the UW Sea Grant plan were taken directly from NOAA Sea Grant's *Strategic Plan for FY2003-2008 and Beyond: Science for Sustainability in the 21st Century*, which in turn are consistent with the mission and strategic plan of the National Oceanic & Atmospheric Administration (NOAA).

All of the national, state and regional priorities identified in our strategic plan were updated in 2004 and included in our 2006-08 Request for Proposals. Moreover, "strategic relevance" was one of the three principal criteria used by our external review panel—besides peer review scores and their own collective ratings—to rank project proposals for funding during the biennium. Each and every project selected for inclusion in Wisconsin Sea Grant's 2006-08 program thus addresses one or more NOAA Sea Grant priorities, and the diving safety research and outreach project funded via our Innovative Science & Technology theme supports the mission and goals of NOAA's Diving Programs.

3. Context of Institutional and Territorial Characteristics

Institutional Characteristics

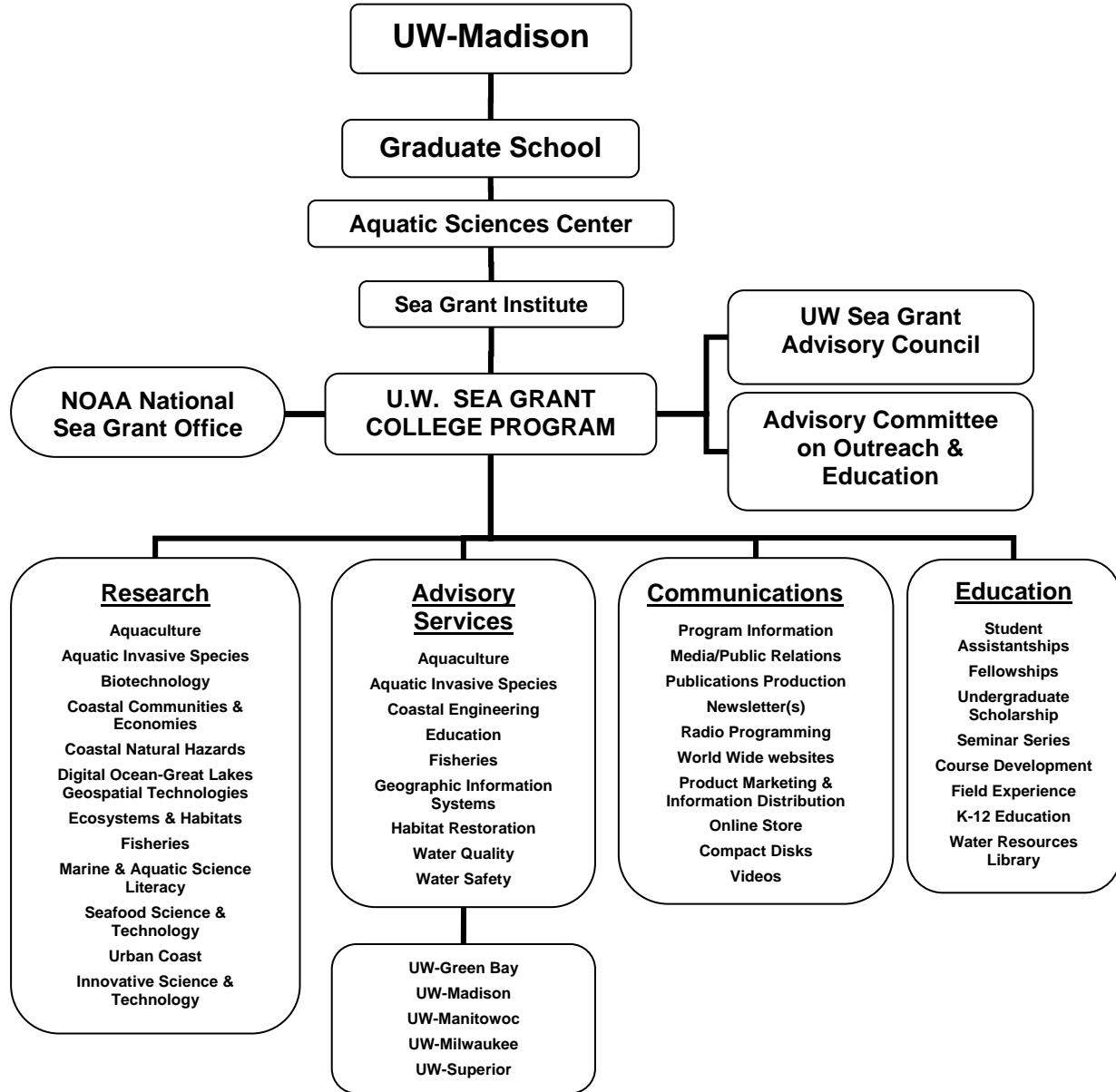
The first Sea Grant program in the Great Lakes region and among the first programs in the nation, Wisconsin Sea Grant initiated its first research and outreach projects on June 1, 1968. Just four years later, in October 1972, then-U.S. Secretary of Commerce Peter G. Peterson designated the University of Wisconsin a Sea Grant College for its "sustained excellence in research, education and public service dedicated to wise use of America's marine resources." It was the sixth program to achieve college status in what is now a national network of 30 colleges, consortia and programs.

Policy and operational responsibility for the University of Wisconsin Sea Grant College Program was formally transferred to University of Wisconsin-Madison under the University of Wisconsin System General Administrative Policy Paper #23 on December 1, 1978. At the same time, the Sea Grant Institute was created as an academic unit of the UW Madison Graduate School, and the institute was assigned the responsibility for administering the Sea Grant College Program on behalf of the UW System. In 1999, because of the complementary nature of their missions, administration of the Sea Grant Institute and the Water Resources Institute was combined under the auspices of the UW-Madison Graduate Schools' new Aquatic Sciences Center (**Figure 1**).

Though the Sea Grant Institute is headquartered on the Madison campus, the Wisconsin Sea Grant College Program is UW System-wide and statewide in scope. More than a half-dozen UW System campuses and other Wisconsin public and private colleges and universities regularly participate in the Wisconsin Sea Grant program.

The director of the UW-Madison Aquatic Sciences Center serves as director of the institute and the UW Sea Grant College Program and reports to the dean of the Graduate School at the UW-Madison. On a day-to-day basis, the Wisconsin Sea Grant program is managed by the UW Aquatic Sciences Center management team. Regular weekly management team meetings—attended by the Director (**Anders Andren**), Assistant Director for Administration & Information (**Mary Lou Reeb**), Assistant

FIGURE 1: Organizational Chart



Director for Research & Outreach (**James Hurley**), Finance & Grants Administrator/Information Technology Coordinator (**Daniel Marklein**), and Communications Manager (**Stephen Wittman**)—are held to coordinate program management, personnel and budget matters, and institutional communications. In sum, this management team has more than a century of experience with the UW Sea Grant program.

The program managers keep UW Sea Grant staff informed of program developments and coordinate individual activities through biweekly conference calls of all Advisory Services specialists, weekly meetings of Communications and Information Technology staff, and joint quarterly meetings involving all Advisory Services and Communications staff members (**Table 3**). Program managers also conduct semiweekly information technology meetings to develop policies and procedures to streamline, clarify and support information technology activities by researchers, staff and students. Financial management is handled through regular meetings of the Director, Assistant Director for Administration and Information, and Finance & Grants Administrator and Information Technology Coordinator.

The UW Sea Grant Advisory Council (see Table 1), appointed by the chancellor of the University of Wisconsin-Madison, provides policy guidance within established institutional goals, approves the overall program plan and budget, and participates in program planning. Consisting of state leaders from academia, state and local government, industry, and the public, the council brings a wide variety of viewpoints to the program and helps ensure the program's accountability to users and constituents. The Committee on Advisory Services was created in 1992 to provide guidance on the direction of the UW Sea Grant's Advisory Services efforts. The role and membership of this committee was expanded in 2005 to provide guidance on all of our outreach efforts, including communications, and education efforts, and it was renamed the Advisory Committee on Outreach and Education (see Table 2).

TABLE 3: University of Wisconsin Sea Grant Institute Professional Staff		
ANDERS W. ANDREN		
Director		
JAMES F. HURLEY	MARY LOU REEB	
Assistant Director for Research & Outreach	Assistant Director for Administration & Information	
<u>ADVISORY SERVICES STAFF</u>	<u>COMMUNICATIONS STAFF</u>	<u>INFORMATION TECHNOLOGY STAFF</u>
FRED BINKOWSKI Aquaculture Specialist UW-Milwaukee	STEPHEN WITTMAN Communications Manager	DANIEL MARKLEIN Finance & Grants Administrator and Information Technology Coordinator
GENE CLARK Coastal Engineering Specialist UW-Superior	RICHARD HOOPS Radio Producer/Editor	RICHARD DELLINGER Web Developer
VICTORIA HARRIS Water Quality & Habitat Restoration Specialist UW-Green Bay	JOHN KARL Science Writer	THOMAS DELLINGER Assistant Web Developer
DAVID HART Geographic Information Systems Specialist UW-Madison	KATHLEEN SCHMITT Science Writer	JAMES GRANDT Information Systems Engineer
JAMES LUBNER Education & Marine Safety Specialist UW-Milwaukee	ELIZABETH WHITE Publications Editor	JOANN SAV OY Librarian
PHILIP MOY Fisheries & Aquatic Invasive Species Specialist UW-Manitowoc	TINA YAO Art Director/Designer	RYAN WILSON Information Systems Student Assistant

A world-class university, the University of Wisconsin-Madison offers unique strengths and research opportunities through its internationally recognized Center for Limnology, Environmental Chemistry & Technology Program and Biotechnology Center, which coordinates a multidisciplinary research program involving more than 50 campus units. The campus Biotron has a number of unique facilities for controlled environments, including high- and low-pressure chambers for simulating deep-water to high-altitude conditions. Since 1995, UW-Madison's Land Information & Computer Graphics Facility has promoted coastal applications of GIS in a cooperative venture with the UW Sea Grant Institute. UW-Milwaukee's Aquaculture Institute and Great Lakes Wisconsin Aquatic Technology & Environmental Research (WATER) Institute provide us with leadership in aquaculture and estuarine/coastal processes research, while well-developed natural resources research, outreach and education programs at UW-Stevens Point, UW-Green Bay, UW-Superior, UW-La Crosse, UW-Manitowoc, Lawrence University and other Wisconsin campuses add to the wealth of research talent and capabilities of the state.

Home of "The Wisconsin Idea"—the public service concept that the boundaries of the university should extend to borders of the state—UW-Madison has proven to be extremely fertile ground that has enabled the Sea Grant concept to grow and flourish in Wisconsin. State support for its university system in general and the UW Sea Grant program traditionally has been strong. Despite multibillion-dollar budget deficits that recently forced the state to make a \$250 million cut in the UW System budget, state and university support for the Wisconsin Sea Grant program continues to be solid, and Wisconsin's U.S. senators and its state and federal legislators from coastal districts remain nearly unanimous in their support of the Sea Grant program.

Territorial Characteristics

With about 1,000 miles of shoreline on Lakes Michigan and Superior, Wisconsin has many Great Lakes-related issues in common with the rest of the region. All of the state's coastal communities and electric power plants draw their water from the lakes, and millions of dollars have been spent to prevent them from becoming clogged with zebra mussels. Preventing the spread of zebra mussels and other **aquatic invasive species** to the state's 15,000 lakes and other inland waters is a major concern. As in other coastal areas of the region and nation, **beach closings** due to bacterial contamination are a growing concern, and nuisance algal blooms are increasing as a result of high nutrient loads in runoff.

Five of the 43 U.S.-Canadian International Joint Commission (IJC) severely polluted Great Lakes "Areas of Concern" (AOC) are located in Wisconsin, and the Fox River-Green Bay AOC in particular is one of the largest single sources of the PCBs, dioxin and other **toxic chemical contaminants in Lake Michigan fish** today. More than a dozen other large rivers and numerous smaller tributaries that drain rural, suburban and urban coastal watersheds also contribute significant sediment and contaminant burdens to Wisconsin waters of Lake Michigan, which adversely affect the water quality, habitat and biota of tributary and nearshore water alike.

About 2.5 million people—nearly half of the state's population—live in watersheds that drain into Lakes Michigan or Superior, and it is likely that continued coastal development and urbanization, if not planned carefully, will have adverse effects on **coastal water quality and nearshore habitat**. Recognizing that accurate land-use data is essential to "smart growth" planning, Wisconsin leads the nation in modernization of its land information system through the use of computer-based Geographic Information Systems (GIS). Ultimately, however, the restoration and protection of coastal water quality and habitat will require that **GIS and other geospatial data** from coastal watersheds be assimilated and integrated with data obtained from *in situ* lake observation systems and remote satellite data to develop an analytical tool with predictive capability.

Wisconsin's population in 2000 was estimated at 5.4 million, more than 37 percent of whom live in the 11 counties bordering Lake Michigan and Green Bay. These coastal counties and adjacent inland

counties have experienced above-average population growth for the last 20 years. The state's four heavily urbanized and industrialized southeastern coastal counties – Kenosha, Racine, Milwaukee and Ozaukee – are home to about 25 percent of Wisconsin's population. Much of this area has experienced severe drawdowns in local groundwater supplies, creating a growing **demand for Lake Michigan water** for residential and industrial uses – a contentious issue because most of this area lies outside the Lake Michigan basin.

Alongside agriculture and manufacturing, **tourism** is one of the state's top three industries—and Lake Michigan is a big part of it. Tourists from Chicago and neighboring states are drawn to Wisconsin's Lake Michigan coast, which offers an attractive selection of eight state parks, two state forests, dozens of public beaches and some 73 lake access points, many featuring marinas and boat launches.

Fishing and boating are exceptionally popular activities throughout Wisconsin, where there are more than a half-million registered boats and more than 700,000 resident fishing licenses are sold annually. About 90 percent of Wisconsin's 250 Great Lakes charter fishing boats operate on Lake Michigan, which also supports about 50 commercial fishing operations using gillnets and trap nets.

While the population of the state's four Lake Superior coastal counties grew less than 3 percent during the 1990s, they have also shown steady growth in recreation and tourism businesses directly related to the lake—particularly in the Apostle Islands National Lakeshore area—including charter boat fishing, marinas, sailboat and sea kayak rentals and instruction, and related tourist support services.

One of the fastest-growing segments of Wisconsin's agriculture industry is **aquaculture**. According to a recent survey by the Wisconsin Department of Agriculture, Trade & Consumer Protection, aquaculture in the state has been growing at a rate of more than 10 percent per year and now has an annual value of almost \$9 million. Wisconsin has the requisite resources and climatic conditions for culturing several marketable cold- and cool-water species of fish, including trout, salmon, whitefish, ciscoes, walleye and perch. This presents a huge potential for significant long-term economic development, not only of food fish but baitfish and hatchery enterprises as well.

Climate change projections for this region of the United States are beginning to raise a number of issues at the local and state levels. **Regional climate change** projections call for rising annual average temperatures, leading to more frequent and severe storms and greater stormwater runoff in summer, and less snow and ice cover due to shorter, warmer winters. Such projected changes in precipitation, evaporation and groundwater recharge rates have significant implications for the state's shipping and port facilities, municipal sewer/stormwater systems and drinking water supplies as well as potentially huge consequences for its agriculture and tourism industries.

4. Involvement of Faculty, Staff and Constituents

In addition to our standard process for updating our strategic plan described in section I-1, our 2004 biennial update benefited from a series of eight public-input workshops held that year in each Great Lakes state as part of a coordinated effort to reach regional consensus on the most important priorities for Great Lakes restoration and protection efforts.

This effort began in October 2003, when the Council of Great Lakes Governors (CGLG) identified nine overarching priorities for Great Lakes restoration and protection. In 2004, the Great Lakes Commission (GLC) obtained funding from the National Sea Grant College Program to sponsor a series of workshops—conducted in each Great Lakes state by its Sea Grant program, governor's office and relevant state agencies—to gather public input and constituent group feedback on which of the nine priorities were most important with regard to that state's Great Lakes restoration and protection needs.

In collaboration with the CGLG, GLC, University of Minnesota Sea Grant College Program, Wisconsin Department of Natural Resources (WDNR) and Wisconsin Coastal Management Program (WCMP), the UW Sea Grant Institute organized and hosted three half-day workshops during the summer of 2004 to gather feedback and input on the governors' Great Lakes priorities from Wisconsin citizens. These public workshops were held in Duluth, Green Bay and Milwaukee to ensure focused consideration of the different sets of issues confronting Lake Superior, Green Bay and southern Lake Michigan, respectively.

More than **500** individuals, concerned organizations and government agency officials, including coastal district state legislators and congressional representatives, were invited to these workshops, with thousands more informed via announcements in area news media, email listservers, and on the UW Sea Grant, WDNR, WCMP and GLC websites.

A total of **203** people participated in the three workshops, representing harbors and ports, community and public service organizations, environmental engineering and lakeshore development businesses, recreational and commercial fishing interests, educators, public universities, environmental and conservation groups, Indian tribes, city and county government, and state and federal government agencies. In addition, post-workshop comments were received from nearly two dozen more individuals via email and an online survey on the UW Sea Grant website.

The results indicated that—while all of the nine Great Lakes restoration and protection priorities developed by the Council of Great Lakes Governors are important—the five most important restoration and protection priorities for Wisconsin waters of the Great Lakes were:

- 1. Ensure the sustainable use of water resources while confirming state authority over the use and diversions of Great Lakes waters.**
- 2. Control pollution from diffuse sources into water, land and air.**
- 3. Stop the introduction and spread of nonnative aquatic invasive species.**
- 4. Enhance fish and wildlife by restoring and protecting habitats and coastal wetlands.**
- 5. Adopt sustainable use practices that protect environmental resources and enhance the recreational and commercial value of our Great Lakes.**

In addition—noting the need for better K-12, university and public education on all Great Lakes issues—citizens at both workshops suggested that education be added as a 10th protection and restoration priority, or that the need for greater public and formal education be made explicit in each of the governors' nine priority areas. Besides ranking the nine priorities in order of importance, workshop participants also suggested specific action items for addressing each (**Appendix D**).

All of these Wisconsin Great Lakes restoration priorities fit within the strategic framework of several Sea Grant national theme areas (AIS, Coastal Communities & Economies, Ecosystems & Habitats, Urban Coast, Fisheries and Marine & Aquatic Science Literacy), and those action items relevant to the UW Sea Grant mission were considered fully in drafting the revised strategic plan.

Then, following the process outlined in section I-1, a PDF copy of our updated strategic plan was distributed via email in October 2004 to more than **530** individuals for feedback, including:

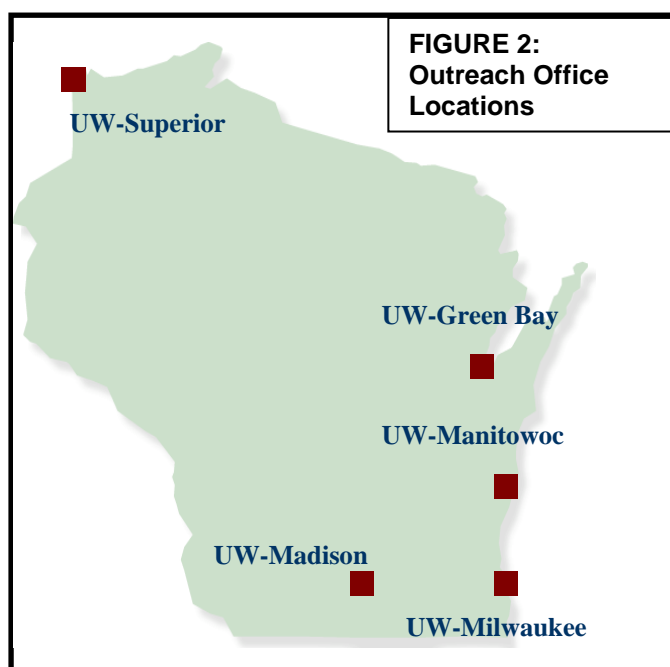
- All members of the UW Sea Grant Advisory Council
- All members of the UW Sea Grant Committee on Advisory Services
- All current UW Sea Grant-funded investigators
- All investigators who submitted proposals within the preceding five years
- All UW Sea Grant Advisory Services specialists

- All UW Aquatic Sciences Center staff
- All Great Lakes Sea Grant Directors
- UW-Madison department chairs
- UW System chancellors, deans, department chairs and directors and their equivalents at five private universities and colleges in the state.

Copies were also provided to key individuals in the WDNR, WCMP, Wisconsin Department of Transportation, Trout Unlimited-Upper Midwest and U.S. Geological Survey (USGS), including the USGS Great Lakes Science Center and USGS-Middleton. A copy of the draft plan and an invitation to submit comments was also placed on the UW Sea Grant website.

In addition, Advisory Services staff personally distributed copies of the draft plan to more than **160** constituents in their coastal service areas (**Figure 2**), as well as other local, state and regional entities interested in Great Lakes issues in their specialty area, including:

- City, county, state and federal officials (e.g., planners, natural resources managers, engineers, coastal county land information officers, sewerage district officials, port authorities, etc.)
- Coastal engineering firms
- Southeastern Wisconsin Regional Planning Commission
- Fox-Green Bay Remedial Action Plan officials
- Lake Michigan Fishery Forum members
- Environmental organizations and other interested non-governmental organizations (NGOs)
- Recreational fishing associations, charter captains and commercial fishers
- Tribal officials
- Educators
- Great Lakes Commission staff
- NOAA Great Lakes Environmental Research Laboratory staff



Each of these individuals was asked to address two questions for updating and strengthening the UW Sea Grant strategic plan; specifically:

1. What do you see as the most critical current and emerging state and/or regional issues that fall within these broad national Sea Grant theme areas?
2. What should be Wisconsin Sea Grant's short- and long-term research priorities for addressing these national program themes?

A total of 17 individuals responded, providing us with 20 pages worth of comments and suggestions.

Lastly, two topical strategic planning conference calls were arranged between key constituents and program managers. The participants included:

Digital Ocean-Great Lakes Geospatial Technologies

- Tony LaVoi, NOAA Coastal Services Center
- Jeff DuMez, Brown County Land Information Office, Green Bay
- Kate Barrett, Wisconsin Department of Natural Resources Office of the Great Lakes
- Roger Gauthier, Great Lakes Commission Data & Information Management Program
- David Lee, Bayfield County Land Records Department, Washburn
- Damon Anderson, Ozaukee County Land Information Office, Port Washington

Aquaculture

- Larry Wawronowicz, Lac du Flambeau Band of Chippewa
- John Wolf, Alpine Farms
- David LaBomascus, St. Croix Waters Fishery
- Bill West, Wisconsin Aquaculture Association

All comments received were compiled by program management and reviewed by the UW Sea Grant Advisory Council (Table 1) for updating the Wisconsin priorities in each national theme. This updated list of priorities then became the program's 2006-08 RFP, reflecting council guidance that the RFP should include all priorities identified within each theme area to "cast a wide net" for improving the program's chances of getting the state's best investigators interested in submitting proposals. Reflecting council guidance that we should also identify specific high-priority research areas, the RFP indicated that our highest-priority research, education and outreach goals fall into four thematic areas: (1) **Aquaculture**, (2) **Aquatic Invasive Species**, (3) **Biotechnology** and (4) **Digital Ocean-Great Lakes Geospatial Technologies**.

More than 450 copies of the 2006-08 RFP were distributed throughout the Wisconsin academic community via both print and electronic distribution, and it was also posted on the UW Sea Grant website. Preproposals were received via electronic submission in mid-December 2004.

Our strategic priorities for 2006-08 were pared down in January 2005, based on the recommendations of an external preproposal review panel in accordance with our thematic area and preproposal decision principles (see section II-1). This preproposal advisory panel was asked to review each submission based on its relevance to our strategic plan, potential applicability, originality and likelihood of success. Of the **79** preproposals submitted, **44** were invited to submit full proposals; however, it is UW Sea Grant policy to accept and process all proposals received whether or not a preproposal was encouraged.

Prospective investigators were then invited to a proposal writing workshop held Feb. 23, 2005, on the UW-Madison campus at which UW Sea Grant staff presented an overview of the Sea Grant national themes concept and relevant state and regional priorities. To foster collaboration and complementary efforts, the workshop then broke into thematic area groups where investigators with similar research interests were introduced to each other and met with our thematic area coordinators (**Appendix E**) regarding our constituents' interests and potential outreach activities related to their proposed research.

Following the selection of preproposals to be invited for full proposals but just two weeks prior to the meeting with these prospective investigators, a two-day combined Advisory Services-Communications-Education program planning retreat was held in Feb. 7-8, 2005, in Sheboygan, Wis., to develop specific programs and projects to address the program's outreach and education strategic priorities over the next two to four years. We feel strongly that all Sea Grant outreach plans and efforts should be developed as a team approach to produce a comprehensive, coordinated and more effective outreach and education effort. Facilitated by our assistant director for research and outreach, this planning effort also took into account recent or anticipated research project results and ways to tap the expertise of past, present and especially prospective Sea Grant project investigators for addressing the program's strategic outreach and education priorities.

After the meeting with prospective PIs, this draft outreach and education plan was then further discussed and refined at a two-day “all hands” meeting in April in Madison and at a June meeting with our Advisory Committee on Outreach and Education (see Table 2). Then the entire draft was sent out for confidential peer review to each member of our advisory committee and 18 individuals with the expertise to evaluate specific portions of the plan (invasive species, GIS, beach closings, education, communications, etc.). The resulting 2006-10 outreach and education plan has three types of focus areas:

1) Cross-cutting program initiatives involving most of our outreach staff and consisting of several projects addressing the same general issue. During 2006-10, these will be:

- **Climate Change and Coastal Communities**
- **Coastal Community Development: Planning for Clean Water and Sustainable Communities in Wisconsin’s Great Lakes Watershed**
- **Great Lakes Center for Ocean Science Education Excellence**

2) New projects consisting of individual projects with a more focused target audience, involving specific products or addressing a specific need:

- **Emerging Issues for Wisconsin Beaches**
- **Great Lakes Circle Tour Coastal Access Guide**
- **History of Sturgeon in the Lake Winnebago System**
- **Critical Outreach Issues in Great Lakes Fisheries**
- **Merging Mercury Science and Policy**
- **Puerto Rico Diver Safety Outreach**

3) Continuing specialty efforts that continue to serve constituents via outreach in the areas of aquaculture, coastal engineering, fisheries, GIS, habitat restoration, invasive species, marine safety and water quality.

As a result of these efforts to involve faculty, staff, and the full spectrum of constituents in our strategic planning and biennial program development process, more than a half-dozen UW System campuses and other Wisconsin public and private colleges and universities regularly participate in the Wisconsin Sea Grant program. The 2006-08 Wisconsin Sea Grant program will involve faculty, staff and students in 32 departments or units at seven UW System campuses, UW-Extension, Lawrence University and Marquette University, plus the Wisconsin Historical Society, four units of three state agencies, 14 out-of-state universities, and seven units of three federal agencies (**Appendix F**). This includes 61 faculty and staff, 45 students and one post-doc during 2006-07, and 56 faculty and staff and 35 students in 2007-08.

In addition, more than 200 public agencies, businesses, NGOs and individuals will be partnering with UW Sea Grant Advisory Services and Communications staff on new and continuing outreach and education projects during 2006-08, including a dozen units of UW-Madison and a dozen more at four other UW System campuses, 16 units of seven state agencies, two Wisconsin tribal governments, three regional organizations, five units of NOAA and five other federal agencies, and universities and state agencies in a half-dozen other states (**Appendix G**).

II. Implementation Plan Development

1. Process of Selecting Priorities

As described in the previous section, development of our biennial implementation plan flows directly from our program strategic plan and goes hand-in-hand with the development of our biennial omnibus proposal for funding (**Appendix H**). In addition to having scientific merit, as determined by the peer review process, project proposals are selected for inclusion in the omnibus proposal on the basis of their relevance to our strategic plan goals and priorities and the overall Sea Grant mission.

All new project proposals undergo rigorous peer review, which is directed by UW Sea Grant's assistant director for research and outreach. UW Sea Grant administration maintains a reviewer database drawn from the Community of Science and similar databases, online expert lists and departmental directories at major universities, as well as suggestions from our NOAA Sea Grant program officer and proposal investigators themselves. *Outreach staff members do not participate in the review or evaluation of any proposal on which he or she is an investigator.*

In addition, we use two external Technical Review Panels to help us screen and select project proposals (**Table 4**). The first one helps us evaluate preproposals and select those for which to invite full proposals. The second panel helps us evaluate the electronic external peer reviews and recommends a selection of new projects that would create the strongest suite of activities in a given thematic area. Our NSGO program officer (Dr. Dorn Carlson) and UW Sea Grant Advisory Council members also are invited to attend these review panel meetings. The recommendations made by the technical review panels thus form the basis of project selection in the omnibus proposal decision-making process. While our selection of implementation plan priorities originates with our strategic plan, they are thus modified by available talent, available funding, peer-review rankings and the recommendations of our technical review panels. A schematic of this process is presented in **Appendix I**.

The following subsections detail the decision principles implemented in each step in the 2006-08 program development process—principles that will continue to be used to guide future program decisions during this biennium and into the next.

Thematic Area Decision Principles

- Does the issue fall within Sea Grant's mission and would work on it be an appropriate university activity?
- Is the issue consistent with the strategic plans of the National Oceanic & Atmospheric Administration (NOAA), National Sea Grant College Program and Wisconsin Sea Grant?
- Is the issue important to the region and to this program's clientele?
- Is there a reasonable probability that meaningful progress can be made toward addressing the issue within the funding limitations of Sea Grant?
- Is there a reasonable probability that meaningful progress can be made toward addressing the issue within the time frame of most Sea Grant projects (2-3 years)?
- Will Sea Grant support be a meaningful contribution toward addressing the issue? Will the issue remain unaddressed without Sea Grant involvement? Relative to the scale of the issue, how much is already being invested by other entities?
- Are the talent, expertise and interest available in Wisconsin or elsewhere in the region to address the issue? Might Sea Grant support for work on this issue directly or indirectly enhance the talent base in marine and coastal issues in the state or the region?

TABLE 4: External Review Panels, 2005

Preproposals Review Panel Members, Jan. 11-12, 2005

Mr. CARLOS FETTEROLF

Former member of Sea Grant National Review Panel
Great Lakes Fishery Commission (retired)
Chelsea, Michigan

Dr. BRADFORD PRICE

Senior Scientist
Proctor & Gamble
Mason, Ohio

Dr. HALLET J. "BUD" HARRIS

Professor Emeritus
Natural & Applied Sciences
UW-Green Bay

Dr. CARL RICHARDS

Director
University of Minnesota Sea Grant College Program
Duluth, Minn.

Mr. MARTIN JAFFE

Great Cities Institute
University of Illinois at Chicago
Chicago, Illinois

Full Proposals Technical Review Panel Members, Aug. 23-24, 2005

Dr. MEGAN AGY (*ex officio*)

Wisconsin Program Officer
NOAA Sea Grant Office
Silver Spring, Maryland

Dr. BRADFORD PRICE

Senior Scientist
Proctor & Gamble
Mason, Ohio

Dr. SERGE DOROSHOV

Department of Animal Science
University of California-Davis

Dr. PETER W. SORENSEN

Department of Fisheries, Wildlife & Conservation
Biology
University of Minnesota
St. Paul, Minnesota

Mr. CARLOS FETTEROLF

Former member of Sea Grant National Review Panel
Great Lakes Fishery Commission (retired)
Chelsea, Michigan

Dr. DONALD TILLITT

Biochemistry & Physiology Branch
Columbia Environmental Research Center
U.S. Geological Survey Biological Resources Discipline
Columbia, Missouri

Dr. SHERIDAN HAACK

Michigan Water Science Center
U.S. Geological Survey
Lansing, Michigan

Preproposal Decision Principles

- Are the principal investigators eligible to receive Sea Grant funding?
- Does the proposed work duplicate research that is ongoing or has been completed?
- Is it an issue that falls within Sea Grant's mandate and mission, and is it an appropriate university activity?
- Is addressing the issue consistent with the strategic plans of NOAA, the National Sea Grant College Program and Wisconsin Sea Grant?
- Is the issue significant or potentially significant to Wisconsin, the Great Lakes region or the nation? Is it an issue that is considered important by Sea Grant's audience or clientele?
- Is there a reasonable probability that meaningful progress can be made toward addressing the issue within the time frame of most Sea Grant projects (2-3 years)?
- Is there a reasonable probability that meaningful progress can be made toward addressing the issue within the funding limitations of Sea Grant?
- Will Sea Grant support toward addressing this issue substantially contribute to the overall effort? Will the issue remain unaddressed unless Sea Grant becomes involved? Relative to the

scale of the issue, how much support is being invested by other sources of research and outreach?

- Are the talent, expertise and interest available within Wisconsin or the region to address the issue?
- Will Sea Grant support for work directed toward this issue directly or indirectly enhance the talent base to address marine and coastal issues in the state or region?

Peer Review Criteria

- *Rationale* – the degree to which the proposed activity addresses an important issue, problem or opportunity in development, use or management of marine or coastal resources.
- *Scientific or Professional Merit* – the degree to which the activity will advance the state of the science or discipline through the use and extension of state-of-the-art methods.
- *Innovativeness* – the degree to which new approaches will be employed for solving the problems and exploiting opportunities in resource management or development or in public outreach on such issues; alternatively, the degree to which the activity will focus on new types of important or potentially important resources and issues.
- *Qualifications and Past Record of the Investigator(s)* – the degree to which investigators are qualified by education, training and experience to execute the proposed activity; the record of achievement with previous funding.
- *User Relationships* – the degree to which users or potential users of the results of the proposed activity have been brought into the planning and execution of the activity or will be kept informed of progress and results.
- *Written Peer Reviews* – assessment of the proposal’s merits made by the several external reviewers, based on the five criteria above, and expressed in the written reviews. In cases where written reviews vary substantially (i.e., two levels or more), the panel member is asked to consider both opinions and to interpret and evaluate the reviews in making his/her own judgment.

Technical Review Panel Decision Principles

- **Other Members of the Review Panel** – The expressed evaluations of a proposal’s merits made by other members of the review panel may or may not be used by a panel member. That decision rests entirely with the panel member.
- **The Proposal’s Relative Merits** – Unlike the peers who provide written reviews, members of the review panel are exposed to all of the proposals that are under review at one time. Therefore, in addition to evaluating the merits of each proposal independently, panel members may adjust their scores for a proposal based on its merits relative to others under consideration at the same time.

Advisory Council Decision Principles

- Does the proposed project address an issue that is among the highest priorities for Sea Grant?
- Is the project likely to make a meaningful contribution toward responding to that issue? Will the results be useful?
- Does the proposed project have strong outreach elements? Is it linked with Extension or directly with potential users of the results?

- Does the project involve researchers from a federal agency, particularly NOAA, or is the project otherwise well linked to such an agency?
- Does the proposed project provide a good opportunity for meaningful Sea Grant involvement in a new and important issue?

Final Program Funding Decision Principles

- Is the proposed project regional both in the scale of its perspective and in the involvement of researchers from other Sea Grant programs?
- Does the proposed project in any way duplicate any of the proposed past or ongoing work of Sea Grant or any other entity? Is it a good fit with the rest of the package of research proposals?
- Based on past performance, is the researcher likely to be a full participant in the University of Wisconsin Sea Grant program – for example, will she/he be willing to confer with clientele or with Extension faculty about the project?
- Is the researcher from an institution of higher education in Wisconsin that rarely seeks or receives Sea Grant funding?
- Does the project involve a researcher who received his/her Ph.D. within the past five years? Would funding this proposal encourage a young researcher to become involved in work that is important to Sea Grant's priorities?
- Does the project involve a well-established and highly productive researcher who is new to Sea Grant? Would funding this project encourage highly productive researchers to become involved in work that is important to Sea Grant's priorities?

During the course of the 2006-08 program, decisions on the use of our Program Development funds will be decided according to the following criteria:

Program Development Funding Decision Principles

- Does the proposed work meet the technical and scientific standards for Sea Grant support?
- Does it have strong relevance to Sea Grant mission, mandate and strategic goals?
- Would it strengthen an existing thematic area effort?
- Is the proposal from a new faculty member whose interests coincide with Sea Grant mission and interests?
- Would it help involve underrepresented groups in the Sea Grant program?
- Is there a need for funding an exciting research project that needs "seed money" before a full proposal can be written?
- Is it a request for special support that would permit the orderly completion and termination of a Sea Grant project? In particular, would it support a graduate student to complete his/her degree?
- Is it a request for a new project, or for funds to supplement an existing grant to allow broadening the work to pursue a promising, but unforeseen, direction?

Despite giving special consideration to cultivating promising new talent, we are generally limited by all of these decision criteria to funding only the best available talent, often the same individuals, from among only the top-caliber academic disciplines in Wisconsin institutions. However, this has served to establish strong, long-term relationships with some of the best scientists Wisconsin has to offer. Such consistent Sea Grant support has enabled these scientists to have a great impact in the areas of

fisheries management, the transport and fate of toxic contaminants in aquatic systems, freshwater aquaculture, diving physiology and, most recently, in geographic information systems.

Consequently, we are confident that the overall University of Wisconsin Sea Grant College Program organization and operation, coupled with the program development and proposal process described above, ensure that the Wisconsin program continues to be well-balanced and addresses important state, regional, national and international Great Lakes, coastal and marine resource problems and opportunities, thereby ensuring that the program is of exceptionally high scientific quality.

2. Milestones for the Implementation of Priorities

Our strategic plan lists several performance measures for implementation. From the updated strategic priorities in each national theme and institutional strategic plan, we have identified the following principal milestones for measuring the effective implementation of those priorities, presented in the context of the goals and priorities of the UW-Madison and NOAA Sea Grant strategic plans.

Theme Area Milestones

The following milestones are being used to measure progress in the most significant areas of Wisconsin Sea Grant activity in each national theme area:

Aquaculture

- Tools and technologies developed and transferred to users for significantly reducing the adverse effects of stress in aquacultured fish.
- Successful transfer and applications of Recirculating Aquaculture Systems, Intensive Aquaculture Technology and broodstock manipulation and development technologies.
- The number of new aquaculture enterprises developed in the state and region.
- Increasing amounts of aquacultured yellow perch and walleye among the seafood consumed in Wisconsin.

Aquatic Invasive Species

- Development of a model to quantitatively predict zebra mussel impacts on the relationship between primary producers and higher trophic level organisms in Lake Michigan.
- Development of a model that explains the causes of the expansion of monotypic cattail stands and predicts the degree to which species-rich native sedge meadows can recover passively or need to be actively restored.

Biotechnology

- The adoption by the World Health Organization of 30 or more relative toxic equivalency factors for risk assessments of chlorinated aromatic hydrocarbons.

Coastal Communities & Economies

- The number of counties that adopt and use geographic information systems for “smart growth” planning in Wisconsin coastal watersheds.

Coastal Natural Hazards

- The development, transfer and application of geographic information systems for assessing, predicting and reducing natural coastal hazard risks.

Digital Ocean-Great Lakes Geospatial Technologies

- Digital spatial data assimilated from multiple distributed online sources, enabling remote access and real-time integration of these data by multiple users for specific applications.

Ecosystems & Habitats

- The design and assessment of a coastal habitat rehabilitation and restoration project.

Fisheries

- The adoption and use of the *Fish Identification and Bioenergetics Model* by at least 100 educators and fisheries managers.

Marine & Aquatic Science Literacy

- The doubling of cost-recoveries from sales of UW Sea Grant products to \$50,000 annually, along with a tripling in the amount of Sea Grant information products distributed to more than 55,000 items annually.

Seafood Science & Technology

- The returns on investment resulting from successful development of a new commercial fishery for siscowet (fat trout) on Lake Superior.

Urban Coast

- Identification of the sources and effects of PBDEs, mercury and other trace contaminants in the Great Lakes.
- The transfer and application of information regarding the sources, transport mechanisms and fate of bacterial and viral contamination responsible for beach closings to 10 Lake Michigan beach managers.
- Identification of the causes of accelerated corrosion of Great Lakes harbor facilities and the dissemination of this information to all port, harbor and marina operators in the region.

Innovative Science & Technology

- A reduction in the incidence of decompression sickness and dysbaric osteonecrosis in Puerto Rican seafood divers, as documented by follow-up research.
- More than 800 scientists meet in Madison, Wisconsin, and reach consensus on a policy-relevant conference declaration of the present state of scientific knowledge regarding the atmospheric sources, public health risks and societal consequences of global mercury pollution.

Institutional Milestones

Promote Research

- State-of-the-art research project management and reporting software developed and implemented.

- The number of promising new investigators brought into the UW Sea Grant research program.
- The amount of supplemental grants and other funding obtained by program staff and PIs.
- The number of peer-reviewed journal articles resulting from UW Sea Grant-supported projects.
- The number of professional presentations, publications, patents, articles, websites and radio programs resulting from Sea Grant-funded research, outreach and education.
- Documented acceptance and use by peers of new methods, approaches, information and tools resulting from UW Sea Grant-supported work.
- Long-range information technology strategies developed.

Advance Learning

- The number of students supported financially on Sea Grant projects.
- The number of Sea Grant-supported students successfully completing their Master's and doctorate degrees.

Accelerate Internationalization

- The number of international partnerships developed in research, outreach and education.
- The involvement by UW Sea Grant staff, students and/or researchers in international conferences.
- The amount of "hits" on UW Sea Grant websites and the number of publications and other information requests from foreign sources.

Amplify 'The Wisconsin Idea'

- The number of UW Sea Grant efforts addressing local, regional and national priorities in research, outreach and education issues.
- The number of UW Sea Grant staff and PI appointments and interactions with committees and advisory boards charged with guiding state, regional and national research and resource management activities.
- The number and/or amount of documented increases in revenues, or savings, in existing business or government operations resulting from the application of Sea Grant-funded work.
- The number of individuals informed through UW Sea Grant workshops, presentations, exhibits and other outreach activities.
- The amount of supplemental grants and other funding obtained by program staff and PIs.

Nurture Human Resources

- Implementation of an Equity & Diversity Plan for the UW Sea Grant College Program.
- Evidence of continual UW Sea Grant staff professional development and advancement.
- Participation and leadership by program staff in local, state, regional or national activities and associations related to the Sea Grant mission.
- Documented approval of operations by the University of Wisconsin System, University of Wisconsin-Madison and NOAA Sea Grant Office.

3. Program Elements and Personnel Needed

As described in Section I, the University of Wisconsin Sea Grant College Program since 1996 has employed a thematic approach in accordance with Sea Grant's 11 national themes. These thematic areas ultimately engage all elements of our program.

The principal personnel for developing and implementing program activities in each of these thematic areas are the project investigators, UW Sea Grant outreach and education staff, and program managers. The implementation of our program also requires the involvement and assistance of our Advisory Council, Advisory Committee on Outreach & Education, external proposal review panels, our NOAA Sea Grant program officer, research and outreach project partners, and numerous state and regional agencies and constituent groups.

Altogether, the 2006-08 Wisconsin Sea Grant program will involve 61 faculty and staff, 45 students and one post-doc in 2006-07 and 56 faculty and staff and 35 students in 2007-08, representing a total of 32 departments or units at seven UW System campuses, UW-Extension, Lawrence University and Marquette University, plus the Wisconsin Historical Society, four units of three state agencies, 14 out-of-state universities, and seven units of three federal agencies (Appendix F).

Besides the project principal investigators, the primary program implementation personnel are outreach staff selected to be thematic area coordinators in accordance with their area of specialization (see Appendix E). At the biennial workshop for prospective investigators, PIs with projects in a given thematic area are encouraged to meet and discuss potential outreach initiatives with these coordinators. The thematic area coordinators then work with UW Sea Grant program managers and other staff to identify and select appropriate mechanisms for information and technology transfer (e.g., presentations to program staff, outreach workshops, scientific conferences, public meetings, news media events, websites, publications, etc.).

4. Time Frame for Implementation

The UW Sea Grant College Program operates on a five-year, rolling horizon basis. Our thematic area priorities are updated every two years in connection with the RFP for preparing our biennial omnibus proposal submission (Appendix H). The NOAA Sea Grant Office requires submission of a two-year implementation plan (this document) in connection with each biennial omnibus proposal. Our rolling-horizon, five-year strategic plan and biennial implementation plan are both adjusted to take into account the two- to four-year funding cycles for individual projects in our research, outreach and education subprograms in the context of the 11 national theme areas.

The execution of each biennium's projects—along with satisfying the annual progress reporting requirements and the four-year federal program assessment and review process—thus constitutes the basic time frame for implementation of the UW Sea Grant College Program.

III. Program Implementation

1. Program Elements and Context

The University of Wisconsin Sea Grant College Program for 2006-08 is organized in an issue-oriented, thematic area approach that we initiated with our 1996-98 biennial program. Our guiding principle in selecting projects—based on peer reviews and external panel reviews of all proposals—is to help fulfill national Sea Grant theme area goals, using the strengths that our program and our state’s academic community can bring to bear on them, while also taking into account the research, outreach and educational needs and strategic priorities of our parent institution, the State of Wisconsin and the Great Lakes region.

The 11 themes used for organizing our 2006-08 program are the same as those adopted jointly by NOAA Sea Grant and the Sea Grant Association:

- **Aquaculture**
- **Aquatic Invasive Species**
- **Biotechnology**
- **Coastal Communities & Economies**
- **Coastal Natural Hazards**
- **Digital Ocean-Great Lakes Geospatial Technologies**
- **Ecosystems & Habitats**
- **Fisheries**
- **Marine & Aquatic Science Literacy**
- **Seafood Science & Technology**
- **Urban Coast**

Besides these national themes, the Wisconsin Sea Grant program will continue to invite proposals for projects that take advantage of emerging new technologies and opportunities to address other coastal, ocean and Great Lakes issues as part of its **Innovative Science and Technology** theme.

Every project we plan to fund during 2006-08 addresses one or more theme priorities in the NOAA Sea Grant Strategic Plan (see Appendix A). Our highest-priority research, education and outreach goals, as identified in our Request for Proposals, fall into four thematic areas: **Aquaculture**, **Aquatic Invasive Species**, **Biotechnology**, and **Digital Ocean-Great Lakes Geospatial Technologies**. A matrix of our 2006-08 projects and the national theme areas is presented in **Appendix J**.

All 42 new project proposals submitted for the 2006-08 UW Sea Grant College Program were reviewed via a rigorous mail peer-review process as well as an external technical panel. All of the biennium’s 16 new projects were selected on the basis of confidential peer reviews and the recommendations of our external technical review panel.

Due to budget constraints, many full proposals that received high scientific and overall relevance ratings in peer and panel reviews could not be funded. Of the 16 new projects to be funded during 2006-08, six will not begin until FY07. Should funding become available to do so, we plan to support four other new research projects (R/AQ-42, R/EH-2, R/UC-2 and R/UC-3) as described in the next section.

The University of Wisconsin Sea Grant College Program for 2006-08 presented herein was formally approved at the Oct. 4, 2005, meeting of the UW Sea Grant Advisory Council.

2. Integration of Program Elements and How We Will Move toward Implementation

The integration of all program elements is achieved through the identification of Wisconsin research, outreach and education priorities in each national theme area and the assignment of outreach staff to serve as coordinators for each theme (Appendix E). Integration and cross-fertilization is further encouraged through regular communications between outreach staff and research investigators, semiannual outreach staff conferences and workshops, and occasional thematic area meetings involving researchers, outreach staff and/or constituent groups, program managers, and sometimes the public and news media.

Also, implementation of the interactive Project Reporting Online (iPRO) program management and reporting systems has helped facilitate the integration of research with outreach by providing our staff with easily accessed and up-to-date research project results and other information, as well as a searchable database of related publications, dissertations and theses.

Aquaculture Theme

National Goal: Develop the scientific, technological information and expertise needed to propagate and successfully culture fish with commercial and/or recreational value to the United States as well as the rest of the world.

Wisconsin currently has a moderately sized and diverse aquaculture industry that includes the production of food fish, baitfish and fish for stocking. The industry has great growth potential, particularly in the area of food fish production, because of the availability of ample supplies of high-quality water, land, labor and markets. The most likely candidates for expansion in Wisconsin are yellow perch and other cool-climate, freshwater fish species. One major obstacle to achieving the state's aquaculture growth potential is conditioning these species to intensive culturing, including improving growth rates, reducing stress and disease, and controlling reproduction. Practical, cost-effective production parameters are need to be developed, along with environmentally sound aquaculture systems focused on reducing water usage and waste effluents.

OMNIBUS-FUNDED PROJECTS

“Endocrine and Environmental Regulation of Growth in Yellow Perch” (Malison/Barry R/AQ-38). This continuing project addresses our cross-cutting Aquaculture and **Biotechnology** priority of improving the growth and controlled reproduction of cultured fish by developing biotechnological approaches. The objective of this research is to gain a better understanding of key environmental and endocrine mechanisms that control growth and reproduction in yellow perch. Two current constraints on yellow perch aquaculture are the lack of information on growth rates to achieve market-sized fish and the inherently slow growth rate of the species. This project is attempting to develop simple cost-effective methods to enhance growth rates of yellow perch, thereby increasing profitability and providing impetus to expand this phase of the aquaculture industry in Wisconsin.

“Tetracycline Antibiotics and Resistance Genes in Aquaculture Environments: Genotypic Diversity and Potential Resistance Reservoirs” (McMahon/Pedersen, R/AQ-40). In this continuing project, the PIs are attempting to determine the concentrations of antibiotics in waters and sediments associated with aquaculture facilities to assess whether this constitutes a problem in aquaculture activities in the Great Lakes region. This work addresses a **Biotechnology Theme** priority and complements Wisconsin Sea Grant's longstanding focus on developing accurate approaches for assessing and predicting environmental risks to fauna and flora exposed to persistent chemical contaminants. It also satisfies an institutional priority to encourage promising new investigators and underrepresented groups to participate in the UW Sea Grant program.

“Development of Yellow Perch Broodstocks for Selective Breeding” (Goetz/Binkowski, R/AQ-41). The recent decline of the yellow perch fishery in Lake Michigan and a corresponding loss of its commercial fishery have led to a shift toward aquaculture to replace this lost food resource. Yellow perch aquaculture is an emerging industry; however, there are many unknowns that add risk to development of a viable aquaculture business. One complicating factor is that aquaculturists need to develop broodstocks that are viable and that have the ability to produce offspring at multiple times during the year, unlike natural populations. The investigators of this project propose to evaluate broodstocks from wild perch derived from several geographic regions in the United States and determine genetic variation and phylogenetic relatedness of perch and their cross-breed offspring using DNA microsatellite markers. This project will both test the viability of this genetic marker approach for aquaculture broodstock and manipulate stocks for out of season spawning. This project addresses the cross-cutting priority in our Aquaculture and **Biotechnology** themes of developing and applying selective breeding and biotechnological approaches to improve the growth and controlled reproduction of cultured fish, and it complements the work of the continuing project by Malison and Barry (R/AQ-38).

“Increasing the Efficiency of Yellow Perch Fingerling Production by Optimizing Pond Trophic Dynamics and Feed-Training Strategies” (Hartleb/Malison, R/AQ-42). Pond-based aquaculture is another growing segment of the aquaculture industry in Wisconsin. *If funding becomes available*, we intend to also support this well-reviewed project, which will address two common obstacles on the path to successful pond-based aquaculture enterprises. First, the investigators propose to assess various nutrient-addition strategies to optimize plankton production and benthic assemblages in pond systems. Next, they plan to determine the role of prey availability on successful survival of sensitive yellow perch larvae. Production of viable fingerlings is critical for maintaining cost-effective yellow perch aquaculture pond systems, and these investigators—who partnered with Wisconsin Sea Grant in 2005 to publish a comprehensive, 125-page manual, *Best Management Practices for Aquaculture in Wisconsin and the Great Lakes Region*—propose to couple their research to a well-planned outreach program in the Great Lakes region. This work also nicely complements our other proposed and continuing projects on yellow perch.

“Aquaculture Advisory Services for the Great Lakes Region” (Binkowski, A/AQ-1). This new Advisory Services outreach and education project responds to the needs of practicing and prospective aquaculturists and aquaculture educators in the Great Lakes region, who require efficient, accurate and effective information and technology transfer. This multitiered outreach program in aquaculture, a Wisconsin Sea Grant priority outreach area, will provide education, hands-on training, and technical assistance to meet the needs of vocational aquaculture educators and aquaculture entrepreneurs at all levels of development. The USDA’s Regional Extension Facilitator for the U.S. North Central Regional Aquaculture Center is located at the same UW-Milwaukee facility as the investigator (UW Sea Grant’s aquaculture outreach specialist), which further expands our ability to provide aquaculture outreach to neighboring Midwest states. Our outreach specialist will provide not only general guidance and resource information, but also specialized workshops, monthly “open house” sessions, on-site technical assistance and Web-based technology in conjunction with intensive aquaculture technology (IAT), recirculating aquaculture systems (RAS) and integrated fish production. Our proposed aquaculture outreach program provides an effective means of delivering technical information, and our specialized expertise and user engagement meets the needs of this growing state and regional industry.

Aquatic Invasive Species Theme

National Goals: (1) Understand AIS impacts on aquatic systems and our economy; (2) understand the biology of invasive species to develop effective means of prevention and control; (3) identify safer and

more effective control strategies, and (4) identify more effective and less expensive strategies to prevent new introductions.

Aquatic invasive species (AIS) pose a major threat to coastal and Great Lakes ecosystems and create significant economic costs and human health risks. From parasitic sea lampreys in the 1940s to zebra mussels in the 1990s, the Great Lakes in particular have been severely impacted by invasions of nonindigenous aquatic species. As of 2004, there were 162 confirmed invasive species in the Great Lakes. Since 1990, the Great Lakes have been invaded at a rate of one new aquatic species a year, and some studies indicate the rate of introductions is likely to increase in the future. As indicated below, the priorities in this cross-cutting theme are also priorities in other national Sea Grant themes.

OMNIBUS-FUNDED PROJECTS

“Quagga Mussel Invasions: Functional Morphology, Biomechanics, Zebra Mussel Displacement and Future Spread” (Lee, R/LR-91). This work directly addresses the national Sea Grant strategic priority of understanding the biology of the invaders to develop effective means of prevention and control. Quagga mussels are likely to displace zebra mussels and spread into the western Great Lakes and Wisconsin waters in the near future. This project is using a state-of-the-art biotechnological approach to learn why the quagga mussel seems to out-compete the zebra mussel for substrates on which to settle. The PI hypothesizes that the functional morphology of the quagga is more plastic than that of the zebra mussel. AIS mitigation strategies require a clear understanding of why quagga mussels may ultimately dominate. Determining the genetic controls for mussel habitat preferences within lakes could indicate where mitigation efforts should focus. It is known that these mussels exhibit a greater shape variation than zebra mussels; this project will examine to what extent phenotypic plasticity in quagga mussels determine their shape.

“Predicting the Impact of Zebra Mussels on Trophic Transfers in Green Bay: Ecosystem Modeling and Lower Food Web Interactions with Fish” (DeStasio/Reed, R/LR-93). This project is attempting to address the question: “What role has the zebra mussel, an exotic invertebrate invader, played in recent changes in phytoplankton, benthos, zooplankton and fish of Green Bay?” This ecosystem is particularly well suited for this study in that the zebra mussel invasion has been very aggressive in several parts of the bay. Results from this continuing project will have broad applicability for other lakes as well. Besides addressing the national Sea Grant goal of understanding the ecological changes effected by aquatic invasive species, this project meets a high-priority **Fisheries Theme** objective of evaluating the biological impacts of aquatic invasive species on the Great Lakes’ fisheries.

“Expanding Cattails and Shrinking Sedge Meadows: Reversible?” (Zedler, R/LR-96). Cattails are considered to be an invasive species in Lake Michigan wetlands, and little is known about what happens to native species after cattails have invaded a coastal wetland. This continuing project will try to evaluate the resilience of degraded sedge meadows and predict the degree to which they are restorable. This work complements that of other projects in this high-priority theme area and addresses a cross-cutting priority in our **Ecosystems & Habitats Theme** of research for deterring, eradicating and/or controlling invasive species.

“Impact of the Round Goby on Yellow Perch Recruitment” (Janssen, R/AI-1). A decline in Lake Michigan yellow perch in the early 1990s forced closure of the commercial fishery and restrictions in sport harvest, but perch recruitment is still low. Spawning areas for yellow perch are typically rocky, and it is believed that the western side of Lake Michigan, where rocky conditions dominate, is the key region for yellow perch reproduction. However, this substrate is also key habitat for the exotic round goby. The ongoing invasion by round gobies is likely to have wide-ranging impacts on yellow perch. The Wisconsin coast offers an excellent opportunity to study variation in the yellow perch-round goby interaction because round gobies are invading from three harbors—two adjacent to nearly 100 percent rocky habitat, and one centered among a mosaic of rocky and sandy habitats. Understanding

the interaction between these species at multiple sites allows for comparison of invasion mechanisms and will provide a framework to develop predictive and management tools for yellow perch in the lake. This project directly addresses an Aquatic Invasive Species (AIS) priority of evaluating the ecosystem and biological impacts of invasive aquatic species on Great Lakes fisheries as well as a **Fisheries Theme** priority of identifying key factors preventing the yellow perch fishery's recovery in Lake Michigan.

“Cercopagis Invasion of Lake Michigan: Predictable Responses or ‘Invasional Meltdown’ of the Planktonic Food Web?” (Sandgren/Berges, R/AI-2 – FY07 Start). Like its predecessor *Bythotrephes cederstroemii*, the recent invasion of Lake Michigan by *Cercopagis pengoi*, a predatory cladoceran zooplankton native to the Ponto-Caspian area, is of great concern. Very little research has been directed toward understanding the dynamics of this species in Lake Michigan, and its invasion offers an important opportunity to test the predictability of Great Lakes ecosystems' responses to repeated invasions by ecologically similar planktonic species. This project will examine Lake Michigan's ability to absorb this new perturbation by better understanding the dynamics of competing invertebrate predator populations, testing for competitive interactions based upon their feeding preferences, and quantifying shifts in the underlying herbivorous zooplankton-phytoplankton-nutrient interactions that maintain integrity of the resource base. This project directly addresses the cross-cutting AIS and **Fisheries** themes priority of evaluating the effects of invasive aquatic species on Great Lakes food webs as well as an **Ecosystems & Habitats** priority of evaluating the significance of invertebrate species to planktonic food webs.

“Reciprocal Spread of Invasive Species in Lake Michigan Coastal Habitats” Vander Zanden, R/AI-3 – FY07 Start). Coastal areas and ports of the Great Lakes have been a major focal point of research and monitoring for AIS. The spread of AIS is generally through anthropogenic means (boat trailers, bait buckets, etc.), but an often overlooked pathway is through tributaries in the Great Lakes watershed. This project will study the distribution and invasion processes of round goby *from* the Great Lakes and rusty crayfish *to* the Great Lakes. Monitoring and modeling this movement with various management scenarios (e.g., dam removal, stream restoration) will help better understand options for future control in light of cross-habitat invasions between inland waters and the Great Lakes. This work also addresses a cross-cutting AIS priority in the **Ecosystem & Habitats Theme** of research aimed at deterring, eradicating and/or controlling invasive species.

“Sea Grant Non-Indigenous Species (SGNIS) Web Site: Development and Support” (Moy, A/AS-53). A collaborative outreach and education project with Illinois-Indiana Sea Grant, this continuing effort coordinates the input of new, peer-reviewed information on the national SGNIS website. The ever-growing SGNIS database presently contains more than 1,700 items, including 922 completed research findings, 384 research and outreach papers in six conference proceedings, 91 issues of newsletters, a 109-slide image library and 176 education and outreach publications. Contributions to SGNIS have been made by over 100 organizations (20 of which are Sea Grant Programs) and 148 peer-reviewed journals. Users from 125 nations have visited the SGNIS webpages and downloaded more than 3 million files. About two-thirds of SGNIS users are U.S. residents. Over 70 percent of users rate it as “excellent” compared to other sites.

CORE PROGRAM

Our AIS outreach specialist will continue to cochair of the **Chicago Sanitary and Ship Canal Dispersal Barrier** Advisory Panel, a multiagency member body that meets semi-annually to advise the U.S. Army Corps of Engineers on development of the invasive species dispersal barrier in the Chicago Sanitary and Ship Canal.

We will also continue to conduct workshops on applying **Hazard Analysis & Critical Control Point** principles to control the potential spread of AIS through wild bait harvest, aquaculture and field sampling activities. HACCP training was first used to successfully educate wild bait harvesters about

their potential to spread AIS, and this training is now being provided to field staff of natural resource agencies.

We also plan to continue and expand our ongoing public information campaign via the UW Sea Grant AIS Theme website and a **computer kiosk of AIS information** stationed each summer on the Lake Michigan car ferry *Badger* and each winter at the Wisconsin Maritime Museum in Manitowoc.

We also will continue to produce **AIS Attack Packs** and provide them at no cost for high school students and nonprofit organizations to use to teach others about invasive species. These self-contained AIS outreach backpacks contain preserved specimens, games, activities, maps and other materials regarding the identification of invasive species and how their spread can be prevented.

With continued support from the Wisconsin DNR, UW Sea Grant will field at least three AIS **watercraft inspectors** at Wisconsin Great Lakes boat landings each summer during 2006-10 to instruct boaters and anglers on how to avoid spreading invasive species.

During 2006-08, we will also continue our **“Zebra Mussel Watch” campaign** as part of our larger AIS effort and adapt this strategy to also addressing the quagga mussel, which research (see project R/LR-91 above) indicates are potentially more invasive than zebra mussels. This will include, among other things, yearly distribution of letters to Wisconsin Chambers of Commerce, County Extension Offices, Academic and Public Libraries and state agencies offering free AIS cards and other AIS program materials; development of AIS exhibits and displays for events, media coverage via radio and newspaper articles, and marketing and maintenance of our “Zebra Mussel Watch” website.

Biotechnology Theme

National Goal: Encourage and support a wide range of freshwater and marine biotechnology research for (1) restoring and protecting aquatic ecosystems; (2) improving risk characterization of toxicants to aquatic animal life; (3) enhancing aquaculture and seafood safety, and (4) developing new pharmaceuticals, biomaterials and bioprocesses.

From a scientific standpoint and particularly in Wisconsin, the study of freshwater aquatic organisms provides an essential complement to studies of marine organisms. For the Great Lakes region—which already supports a vibrant and growing biotechnology industry—biotechnology offers new opportunities for addressing such problems as contamination of Great Lakes fish and sediments with toxins, control of nonindigenous species, and enhanced production at public game fish hatcheries and private bait and food fish farms.

It is a Wisconsin Biotechnology Theme priority to develop more accurate approaches for assessing and predicting the risks to feral fish populations exposed to persistent bioaccumulative chemical contaminants; specifically, to develop gene microarrays in fish for identifying alterations in gene expression associated with chemical and physical stresses.

Biotechnology is more of a *tool* than a coastal theme, but its use is widely dispersed among our other thematic areas. An institutional goal in this thematic area over the next two years is to engage and involve more of Wisconsin’s potent biotechnology community in Sea Grant research on priority topics that could benefit from biotechnological approaches, especially in our Aquaculture, AIS, Fisheries, Ecosystems & Habitats, Urban Coast and Seafood Science & Technology thematic areas.

Examples in the Aquaculture Theme include genetic engineering to enhance growth and broodstock selection of aquatic organisms such as finfish; development of a food particle for finfish that is nutritionally valuable with a physical mechanism that simulates natural forage characteristics (motion) at the onset of first feeding; fish disease detection techniques for epidemiological study and treatment; and improved biofiltration performance through enhanced nitrifying bacteria production.

Examples in AIS, Fisheries, Ecosystems & Habitats and Seafood Science & Technology include using genetic markers for tracing the origins of native and invasive species; developing new processing methods and new food products utilizing burbot, siscowet and white perch, and finding some means of dealing with the nuisance alga *Cladophora* that blankets some Lake Michigan beaches with foul-smelling mats.

Among Urban Coast Theme priorities, biotechnology could develop the new microbial tracking methods needed to determine the sources of bacterial pollution on Great Lakes beaches and to more rapidly detect and report risks to the public.

OMNIBUS-FUNDED PROJECTS

“AhR Signaling in Rainbow Trout and Zebrafish” (Heideman/Peterson, R/BT-17). This continuing project seeks to extend our knowledge about aryl hydrocarbon receptor (AhR)-mediated toxicity from mammalian models to fish. To date, the assumption has been that AhR works the same way in fish as in mammals, which appears not to be the case. This project will fill this knowledge gap by determining the DNA sequence requirements for AhR binding and identifying protein partners for AhR in fish. The findings of this project should be of value not only in terms of providing detailed knowledge about toxic pathways in fish at the molecular level, but also enabling risk assessment efforts to be more rigorous. This project thus addresses a Wisconsin **Urban Coast Theme** priority of assessing the threats to human health and aquatic life posed by chemical contamination of aquatic ecosystems as well as the national Sea Grant Biotechnology Theme goal of improving risk characterization of toxicants to aquatic animal life.

“Latent Toxicity in Adult Zebrafish Following Early Life Stage Exposure to 2,3,7,8-Tetrachlorodibenzo- ρ -Dioxin” (Peterson/Heideman, R/BT-20). Building on the previous work of these investigators, this highly ranked project also addresses the national Biotechnology Theme goal of improving risk characterization of toxicants to aquatic animal life. Exposure to 2,3,7,8-tetrachlorodibenzo- ρ -dioxin (TCDD) in the early stages of fish development can have lasting influence. Using sublethal levels of TCDD, this project will use zebrafish to determine if development is disrupted, organs are degraded or diseased, feeding is inhibited, body growth is affected or if reproduction is affected. This research will also enable the investigators, who have extensive experience in the use of genetic biomarkers, to better understand if such effects are permanent or reversible. Sublethal concentration of TCDD may affect feeding, predation-avoidance behavior and reproduction in feral fish populations. This work likewise addresses the Wisconsin **Urban Coast Theme** priority of assessing the threats to human health and aquatic life posed by chemical contaminants.

“Parallel Toxicogenomic Resources for Zebrafish and Rainbow Trout: Identifying Conserved Molecular Biomarkers of Toxicant Exposure” (Rise/Carvan, R/BT-21). Another new project in our Biotechnology strategic focus expands the use of genomic tools in a study of toxicant response in both zebrafish and rainbow trout. Further, they plan to evaluate TCDD and methylmercury effects on gene expression. They will combine DNA microarray work with quantitative reverse transcription-polymerase chain reaction methodologies. The researchers will develop a library that can then be used as reference for examining toxicant responses among Great Lakes feral fish species. The lead investigator is a recent hire at the UW-Milwaukee’s WATER Institute, and it is an institutional strategic priority to encourage promising new investigators to participate in the UW Sea Grant program. This project received the highest Biotechnology Theme rating from the combined peer reviews of our external technical review panel and complements work by other researchers in this theme.

“Genomic Approach to Understanding TCDD Toxicity in Zebrafish” (Heideman/Peterson, R/BT-22 – FY07 Start). A third new project dealing with zebrafish will directly address gene expression changes associated with TCDD exposures. The zebrafish is used as a model because its

genome has essentially been mapped; this research team will take advantage of such information to evaluate genetic effects of exposures. The goal of the project is to determine whether different TCDD responses in tissues correspond to distinct gene expression patterns. By 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 feral fishes of the Great Lakes. This work builds on completed and continuing Sea Grant-funded research by these exceptionally well-qualified investigators and directly addresses a Wisconsin Biotechnology priority of developing more accurate approaches for assessing and predicting the risks to feral fish populations exposed to persistent bioaccumulative chemical contaminants—specifically, to develop gene microarrays in fish for identifying alterations in gene expression associated with chemical and physical stresses.

Coastal Communities & Economies Theme

National Goals: (1) Strengthen coastal planning through better evaluations of coastal resources and amenities (“natural capital”) and by educating coastal planners and decision makers; (2) stimulate integrated coastal management by constructing frameworks for sustainable development and developing decision-support systems, and (3) contribute to community and economic development by building leadership, supporting the development of science-based ocean, coastal and Great Lakes policies, and revitalizing economically depressed coastal communities.

The continuing economic growth occurring within our nation’s coastal regions stimulates land use change and competing demands for the use of the shoreline. Without sound planning, it is likely that coastal degradation associated with coastal development and urbanization will continue. Sound planning can also help minimize risks to regional economies posed by such natural disasters as hurricanes, storm-driven coastal flooding and dramatic changes in sea level elevations caused by climatic variations. Balancing economic growth and coastal resource quality are important issues for all of the nation’s coastal communities—including those around the Great Lakes.

OMNIBUS-FUNDED PROJECTS

“Measuring Interrelated Demands for Commercially Caught Fish” (Bishop, R/PS-57). A Wisconsin priority in this thematic area is to develop and validate new techniques for economic valuation of Great Lakes resources and their importance to thriving coastal communities and businesses. This continuing project is a collaborative effort between professors Richard Bishop at the UW-Madison and Matthew Holt at North Carolina State University, both of whom have done groundbreaking work in economic evaluation of fish harvests—the former in the Great Lakes, and the latter in the Mid-Atlantic region. The PIs are updating and expanding unit-price landings data for a large number of fish species relevant to the Mid- and South-Atlantic regions as well as the Great Lakes in an effort to obtain econometric estimates of multiregional, multispecies demand models. The results of these efforts will not only be relevant to lower Atlantic coast and Great Lakes regions, but useful for fisheries management nationally. Fishing is big business, and through the National Sea Grant College Program we have a seamless mechanism that allows two world-class social scientists to work together on an issue that affects thousands of jobs in the fishing industry and millions of fish consumers. Based on work to date in this project, the investigators are presently developing a fish markets overview and trends for UW Sea Grant publication.

In addition, we will use our **Coastal Community Development** funds to partially support a new project in our Digital Oceans Theme, “Geospatial Technologies for Land Use Planning in Great Lakes Coastal Communities” (**Ventura, R/DO-1**), as well as some of the closely related activities of our Advisory Services GIS outreach specialist (see below).

CORE PROGRAM

Community Planning Resource for Great Lakes Coastal Communities (Hart) – The Community Planning Resource (CPR) is a website designed to provide access to a broad selection of planning resources to help elected officials, planning professionals, and others concerned about land use understand the issues and access the tools needed to participate in decisions about Wisconsin's future. The Great Lakes Coastal Communities section of CPR will be enhanced by UW Sea Grant's GIS specialist to provide a GIS-based toolkit to support comprehensive planning and sustainable development along the Lake Michigan and Lake Superior coasts of Wisconsin. This will include:

- *Collaboration with the Wisconsin Department of Natural Resources' Land Use Team on Computer Tools for Planning, Conservation and Environmental Protection:* The WDNR is working with the Midwest Spatial Decision Support System Partnership to develop information and resources for citizens and local governments interested in addressing land use issues. UW Sea Grant's Coastal GIS Specialist will collaborate with the WDNR to apply these tools to Great Lakes coastal communities.
- *Collaboration with the NOAA Coastal Services Center on integration of interoperable Web Feature Services of land use data into water quality models:* Several watershed management tools utilize land use/land cover data to estimate impervious surfaces and pollutant loads within watersheds. Several sources of land use and land cover data exist, each with strengths and weaknesses. A single interface is proposed that will combine Web Map Services (WMS) for land cover data and Web Feature Services (WFS) for local and regional land use data and feed these data directly into common models for nonpoint-source pollution, such as the Impervious Surface Analysis Tool (ISAT) and Nonpoint-Source Pollution & Erosion Comparison Tool (NSPECT) developed by the NOAA Coastal Services Center, the Long-Term Hydrological Impact Assessment tool developed by Bernie Engel at Purdue University, and the Source Loading and Management Model (SLAMM) developed by Robert Pitt at the University of Alabama.

Comprehensive Planning Training Program (Hart) – Michigan State University Extension developed the Citizen Planner Program to address the basic training needs of citizens appointed to serve on local planning boards and commissions, which often have high turnover rates. Michigan Sea Grant has been instrumental in incorporating coastal and watershed planning issues in Citizen Planner, and it is currently working with the NOAA Coastal Services Center and the U.S. Environmental Protection Agency to adapt Citizen Planner to develop planning training for local and regional decision makers. In this project, UW Sea Grant's GIS Specialist will work with Michigan Sea Grant to examine the applicability of specific Citizen Planner modules (planning for water quality, riparian rights, hazard mitigation, principles of new urbanism, low impact design, planning for tourism, and working across community borders) for use in Wisconsin and conduct training developed as part of the NOAA/EPA collaboration at sites in Wisconsin.

Nonpoint Education for Municipal Officials (Harris) – NEMO is a national network of education programs coordinated by the University of Connecticut that teaches local land use decision makers about the relationship between land use and natural resource protection. UW Sea Grant's Water Quality Specialist will provide NEMO presentations and educational materials to municipalities and counties in the Lake Michigan and Green Bay drainage area. (UW-Extension and others already conduct NEMO programs in the Lake Superior area.)

Baird Creek Watershed Outreach (Harris) – The Baird Creek watershed is the focus of several monitoring, restoration and preservation initiatives as well as smart growth planning. UW Sea Grant assisted the Lake Michigan Forum in conducting a Baird Creek Watershed Stewardship Assessment in 2004. Assessment recommendations include: encourage low-impact conservation development, protect and restore wetland and riparian areas, install riparian buffers, enhance public and private

partnerships, and provide additional monitoring and completion of an urban build-out scenario. A partnership has been formed and a Targeted Watershed proposal submitted to U.S. EPA to implement many of the recommendations. If funded, the grant will support a half-dozen Baird Creek outreach activities designed to build consensus on water quality goals among elected officials and stakeholders, promote low-impact sustainable development, reduce phosphorus fertilizer use and sediments in runoff, and promote the use of rain gardens to reduce runoff.

Great Lakes Circle Tour Coastal Access Guide (Hart) – In this project, our GIS outreach specialist will use internet mapping techniques to present online information linking Great Lakes natural features (parks, public access points, cultural features, lake bathymetry and other coastal characteristics) to the “Great Lakes Circle Tour” route established by the Great Lakes Commission (www.great-lakes.net/tourism/circletour). He hopes to capitalize on “ecotourism” interests in the region by providing an interactive site that is tailored for the individual user. This effort is being supported with funding from the Wisconsin Coastal Management Program in the outreach project.

Local Watershed Stewardship Assessment (Harris) – Another CC&E priority is to initiate new policy-relevant research and outreach on Great Lakes issues, including the valuation, ownership and stewardship of fresh water. Our water quality outreach specialist is working with the Lake Michigan Lakewide Management Plan (LaMP) Forum to assess the capacity for local stewardship within watersheds draining to Lake Michigan. The assessment process engages community leaders, agencies and interest groups in identifying water quality impairments and their causes, evaluating the effectiveness of ongoing stewardship and recommending strategies and actions to strengthen stewardship and reduce the loading of land runoff pollutants to Lake Michigan.

Wisconsin’s Water Library (Savoy) – To further address the strategic priority of initiating policy-relevant outreach on Great Lakes issues, UW Sea Grant will continue to develop and promote “Wisconsin’s Water Library” during the next biennium. This special project—developed for the Year of Water in partnership with UW-Madison Libraries, Wisconsin Public Libraries and Wisconsin Libraries’ Delivery Network—provides all Wisconsin residents easy access via the Web to reliable sources of water information, including more than 30,000 volumes of water-related information at the UW-Madison Water Resources Library. The library will be promoted via a press release, articles in appropriate publications and the wide distribution of Water Library bookmarks.

Our coastal engineering specialist addresses Coastal Communities & Economies issues related to development in the sensitive Wisconsin shoreline of Lake Superior. He is an expert in bluff stability and the placement of coastal structures. He participates in the “View from the Lake” program with UW-Superior and Minnesota Sea Grant by offering experiential learning to coastal planners and managers by viewing development options from a lake perspective.

Coastal Natural Hazards Theme

National Goal: Enhance preparedness to prevent or greatly reduce human deaths, injuries, property and environmental damages, and associated economic losses caused by coastal natural hazards.

This national theme is aimed primarily at mitigating the risks and damage posed by hurricanes and tsunamis along the nation’s saltwater coasts. In the Great Lakes region, the principal coastal natural hazards are coastal flooding, storm surges and wave run-up, especially during times of above-normal water levels, which can cause severe erosion and damage or destroy coastal structures. Conversely, below-normal water levels reduce navigation safety in shallow channels and the entrances to ports and marinas for mariners, commercial fishers and recreational boaters alike. Storms, extreme water levels and winter ice on these freshwater seas pose significant risks to profitable and safe navigation and to coastal infrastructure. Hazards for swimmers include coastal rip currents and bacterial

contamination of beach waters. Hypothermia is an ever-present natural hazard to everyone exposed to these cold northern seas.

Wisconsin Sea Grant's priorities in this thematic area are to (1) develop an understanding and communicate scientific, technical and public information on the impacts of climate change on Great Lakes coasts; (2) develop and apply geographic information systems (GIS) for assessing and reducing natural coastal hazard risks; (3) evaluate impacts of extreme Great Lakes water levels on coastal infrastructure; (4) develop an understanding and communicate to user groups the causes of and effective strategies for coping with coastal slope failures, shore erosion and flooding due to storm waves, lakebed erosion, storm surges and high Great Lakes water levels, and (5) increase public safety through greater awareness of Great Lakes hazards (hypothermia, rip currents, navigation hazards, etc.).

While Wisconsin Sea Grant will not be funding any research projects in this theme during the biennium, we will be actively addressing these priorities through our core education and outreach programs.

CORE PROGRAM

Gene Clark, our new coastal engineering specialist, is an individual with 23 years of experience in coastal issues with the private sector as well as state and federal agencies. His FY06-08 work plan development centers around providing sound advice on coastal engineering options, providing service to Wisconsin four Lake Superior counties and initiating a cross-cutting climate change outreach effort for UW Sea Grant (see below).

Climate Change and Coastal Communities (Clark) – This initiative directly addresses the NOAA mission goal of understanding climate variability and change to enhance society's ability to plan and respond as well as one of our thematic priorities in this theme. The objectives of this outreach initiative are to provide Great Lakes property owners, coastal facility managers, and local, state and regional decision makers with a comprehensive source of scientifically sound, nonadvocate information and technical guidance to help them prepare for the likely consequences of predicted climatic change. The most important possible effects of climatic change for Wisconsin coastal communities, shoreline property owners and port facility managers involve future water level fluctuations and changes in storm frequencies, tracks and intensities. In turn, these effects may result in unexpected changes in Great Lakes water levels, shoreline erosion and storm water runoff volumes and pollutant loads. The focus of this initiative will be on specific deliverables and mechanisms to provide up-to-date predictions and consequences of regional climatic change on coastal communities in Wisconsin and elsewhere around the Great Lakes. In connection with this effort, a proposal has been submitted to the Wisconsin Coastal Management Program (WCMP) for funding a seminar series that will focus on climatic change predictions and their potential effects on Wisconsin's Great Lakes coasts. Led by our coastal engineering outreach specialist, this initiative will ultimately involve nearly every member of our Advisory Services and Communications staff.

Our coastal engineering outreach specialist will also disseminate state-of-the-art technical information on all aspects of natural coastal hazards that could impact Wisconsin's Great Lakes shorelines via UW Sea Grant's Coastal Natural Hazards Theme website, educational opportunities and direct engineering assistance. Several new UW Sea Grant information booklets will be prepared and will be made available to property owners and resource managers along Wisconsin's Great Lakes shorelines. Property owner workshops will be conducted in partnership with the Wisconsin Coastal Management Program, and partnerships with local, regional, statewide and national resources agencies will be established to link Wisconsin informational needs and opportunities with those with similar shoreline issues and needs. Other activities will include demonstration projects and selected high priority project site investigations and preliminary designs. Direct links to additional information on our Natural Coastal Hazards Theme website will be made through the establishment of partnerships with

regional, statewide and national resources groups. Direct engineering assistance will be provided when appropriate to respond to all aspects of natural coastal hazards issues.

Coastal Recession Mapping (Hart) – Our GIS outreach program is an essential component of this thematic area, as it serves as a direct link for coastal user groups to the rapidly changing technologies for integrated information systems. We are using GIS to visualize and analyze the coastal impacts of changes in Great Lakes water levels. As a member of Wisconsin’s Coastal Hazards Work Group, our GIS specialist works closely with our state’s coastal managers to develop models for implementing coastal construction setback standards. He’s also using historical photography to trace coastal recession rates and communicating this important information to property owners and other stakeholders. He continues to apply the latest high-resolution elevation data available from local governments to address such topics as climate change effects on lake levels and floodplain mapping for coastal communities.

Coastal Visualization (Hart) – Information collected about coastal processes is often very technical in nature and difficult for coastal landowners to understand. Integration of 3-D visualization of the coast with animation, aerial photography, pictures, charts, and text can help the public better understand: (1) the natural process of coastal erosion; (2) how local land development decisions impact coastal erosion; and (3) the case for scientifically based coastal development setbacks. The GIS outreach specialist will oversee an effort to visualize coastal erosion processes, develop an integrated bathymetric/topographic digital elevation model of the Great Lakes coast, visualize changing lake levels, and show the components of coastal setback alternatives.

Other GIS outreach activities related to this theme during 2006-10 include:

- Developing interoperable Web Map Services to support communication of coastal hazards along the Lake Superior coast of Wisconsin.
- Reviewing the coastal setback methodology report developed by the WCMP Coastal Hazards Work Group and testing the applicability of this methodology using GIS data from Ozaukee and Bayfield Counties.

Boating & Water Safety Education (Lubner) – Our marine safety outreach specialist will continue to offer two to three accredited boating safety courses annually from late January up to Memorial Day for at least 50 youths and adults. In cooperation with state and national partners, this specialist will continue to provide training on water safety topics for boating safety organizations, such as the U.S. Coast Guard Auxiliary and the U.S. Power Squadrons, and instruct water-oriented clientele through seminars on such water safety topics as hypothermia, maritime weather, and boating rules and requirements. Training for USCG Auxiliary and Power Squadron members is done year-round on an as-needed, as-requested basis; seminars on water safety topics are also done on an as-requested basis. He also provides input on national and state boating safety policy and education through ongoing membership on the national staff of the USCG Auxiliary and the Wisconsin Boating Safety Advisory Council.

A related Wisconsin Sea Grant Communications priority in this area is to help increase public safety through greater awareness of everyday Great Lakes hazards, such as **hypothermia**, **rip currents** and navigation hazards posed by **commercial fishing nets** and **low lake levels**. This effort will continue during 2006-08 with the distribution of information about these hazards in the form of news releases and fact sheets, and offering NOAA rip current posters and flyers to all public beaches along Lakes Michigan and Superior. In addition, we plan to host a multistate workshop and organize a media event regarding rip currents and other hazards at least once during the next four years.

Digital Ocean-Great Lakes Geospatial Technologies Theme

National Goal: Develop tools to assimilate data from distributed observatories, or individual networked ocean sensors, and then connect this assimilated data with the various existing computer models of ocean processes.

Imagine placing the global ocean on a microchip. That's essentially what Sea Grant's Digital Ocean thematic area aims to do by developing methods to create extensive digital representations, or models, of ocean resources and phenomena, such as El Niño events. Such models will be able to translate chemical, biological and physical data into tools that will help us learn how best to use and tend to our marine resources. As part of this national effort, Wisconsin Sea Grant's priority in this area is to begin putting the Great Lakes on a microchip by developing research and monitoring tools and methods—including *in situ* as well as remote sensing technology, GIS and computer modeling tools—for continuously tracking and assessing in real time the nature and extent of chemical, biological, geological and physical changes in marine and Great Lakes waters.

OMNIBUS-FUNDED PROJECTS

“Geospatial Technologies for Land Use Planning in Great Lakes Coastal Communities”

(Ventura, R/DO-1). The overarching goal of our Digital Ocean-Great Lakes Geospatial Technologies Theme is to enable the integration of data obtained from lake *in situ* observation systems with GIS data in the watershed and satellite data. This new project expands our geospatial technologies outreach activities aimed at enabling stakeholders to take advantage of newer technologies such as integrated observation systems, automated retrieval of archived records and visualization by empowering local, regional and tribal governments to use GIS, Web mapping and spatial models in their planning efforts. It is clear that coastal development will continue along our Great Lakes shores and coastal management must address environmental protection, land use planning, economic development, ecosystem characterization, and hazard mitigation. Wisconsin Sea Grant will continue to play a role in this important technology transfer effort, a key focus area for our Coastal Communities Development Program funds. This project also addresses our **Coastal Communities & Economies Theme** priority of applying GIS and/or other state-of-the-art techniques to improve coastal resources management through science-based planning and development of coastal watersheds and shorelands, and our GIS outreach specialist will work closely with the PI to ensure effective transfer and application of this technology.

“LakeSat: Near Real-Time Monitoring of Water Quality in Green Bay and Wisconsin's Lake Michigan Coastal Waters via Satellite Remote Sensing” (Chipman/Lillesand, R/MW-88). The objectives of this continuing project are very much in tune with those of Sea Grant's national Digital Ocean Theme of developing tools to assimilate data from distributed observatories and then connecting this assimilated data with the various existing computer models of ocean/Great Lakes processes. The PIs seek to develop and demonstrate a prototypical, Web-based operational “Digital Great Lakes” information system for near real-time monitoring of water quality in Lake Michigan coastal waters using the latest satellite technology. Parameters to be analyzed include water clarity, chlorophyll-*a* (plankton), suspended solids and temperature. This also supports our goal in this theme of better integrating satellite observations with data collected in the watershed via our GIS efforts.

CORE PROGRAM

Dynamic and Distributed Coastal GIS (Hart) – Our vision of a Digital Great Lakes involves the use of interoperable Web mapping and other geospatial technologies to support a more holistic understanding of the Great Lakes ecosystem. A truly integrated land/water system ties together local government land records such as parcel mapping and land use within a watershed context with measurement of near real time conditions in the open water of the Great Lakes. Our GIS outreach specialist's other activities related to this theme during 2006-10 include:

- Conducting outreach for the Great Lakes Observing System in Wisconsin.
- Continuing development of “dynamic and distributed” GIS for the Lake Superior and Lake Michigan coasts of Wisconsin and explore expansion of interoperable Web mapping sites beyond the state by including spatial data custodians from Minnesota, Michigan, and Ontario.
- Providing GIS technical assistance to the tribal governments of the coastal Bad River and Red Cliff Chippewa Indian Reservations.
- Advocate for the implementation of light detection and ranging (LIDAR) data along the Great Lakes coast in Wisconsin.
- Exploring collaboration with Minnesota Sea Grant to extend the visualization tools included in the Duluth Streams website to Wisconsin.

Ecosystems & Habitats Theme

National Goals: (1) Develop a quantitative understanding of the structure and function of critical nearshore habitats and coastal ecosystems, and (2) identify the processes that control the transport, transformation and fate of biogeochemically important materials in the nearshore area, the impact of riverine inflows, and the influence of watershed management on coastal and estuarine systems.

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.

One of Wisconsin Sea Grant’s highest priorities related to this theme is to conduct research, outreach and education activities for deterring, eradicating and/or controlling ANS and invasive species, nuisance algae, and aquatic toxins.

OMNIBUS-FUNDED PROJECTS

“Impact of a Shifting Wind Field over the Laurentian Great Lakes on Accumulation and Resuspension of Sediments in Green Bay, Lake Michigan” (Waples/Klump, R/EC-10). This work addresses the thematic priority of developing technologies for better spatial and temporal characterization of nearshore environments and coastal ecosystem dynamics. In the early 1990s, the PIs noticed a significant shift in summer surface wind trajectories over the Laurentian Great Lakes. Such an effect is bound to influence sedimentation rates, especially in the shallower areas of the lakes. In this continuing project, the PIs will investigate whether sedimentation rates in lower Green Bay have changed due to the different wind trajectories. Green Bay historically has received some of the highest loads of persistent chemical contaminants in the entire Great Lakes Basin. Since the behavior of these contaminants is closely associated with sediment behavior, it is important to determine what effect these wind shifts will have on sedimentation and resuspension rates. Results from this project will thus address both climate change and contaminant issues, meeting the Wisconsin **Innovative Science & Technology** priority of quantifying the potential effects of climate change on Great Lakes hydrology and ecosystems as well as an **Urban Coast** priority of identifying and quantifying key physical processes and mechanisms that control the transport, distribution and fate of chemical contaminants and nutrients in coastal waters and the Great Lakes.

“Compensatory and Spatial Dynamics in Great Lakes Food Webs” (Kitchell, R/LR-94). Most researchers and research managers in the Great Lakes agree that we must focus a lot of energy on understanding ecological effects of invasive species. Such high-priority concerns are addressed by objectives of this continuing project. The PI will develop both empirical and theoretical tools for evaluating compensatory responses as indicators of trophic interaction changes. The researcher also

has an outstanding record of working with various sectors of the Great Lakes and ocean fisheries communities in their efforts to apply an ecosystem approach to the restoration of native fisheries. This project is thus a natural fit for both our Ecosystems & Habitats and **Fisheries** thematic areas. This work will have broad implications for fisheries managers in that it will provide information on the effects of invaders on several fisheries in the Great Lakes via food web dynamics.

“Lake Superior Food Web Dynamics: Modeling at Multiple Scales” (Kitchell, R/EH-1 – FY07 Start). Bioenergetic modeling of food webs has become the generally accepted aquatic modeling technique and is now a major component of many contaminant accumulation models. Pioneering work by Kitchell and his colleagues, much of which was Sea Grant-funded, is now the basis of many fisheries management models. This new project uses bioenergetics modeling to predict short-term trophic interactions in Lake Superior. The project links with a study funded by Minnesota Sea Grant that will serve as ground truth for modeling scenario. This is the first such attempt to model diel changes in predator-prey relationships in nearshore and offshore environments in the largest and deepest Great Lake.

“Growth and Detachment of *Cladophora* in Lake Michigan” (Young/Bootsma, R/EH-2). The re-emergence of the green filamentous alga *Cladophora* along the shores of western Lake Michigan has been a cause of alarm for coastal communities. The proliferation of this algal, mostly associated with excessive eutrophication, has been perplexing to many researchers. *If funding becomes available*, we intend to support this project, which aims to better understand processes that lead to the accumulation of decaying algal material on coastal beaches. It has been hypothesized that dreissenids (zebra and quagga mussels) have a role in *Cladophora* growth in that they have altered phosphorus cycling in nearshore waters. This project addresses an **AIS** thematic priority of investigating the effects of invasive species on nutrient cycling in the Great Lakes ecosystem, as well as the Ecosystems & Habitats priority of research on nuisance algal blooms. Few studies have addressed detachment of the alga from substrates, and this study will provide key data on physiological conditions of both *Cladophora* and dreissenids that influence this process. Working with partners from the Wisconsin DNR and the University of Waterloo, the researchers plan to develop a model of *Cladophora* dynamics in the Great Lakes.

CORE PROGRAM

Three other Wisconsin priorities in this theme are to (1) create partnerships to improve and enhance spawning habitat and nursery grounds to optimize native species rehabilitation; (2) improve the design, function and assessment of coastal habitat rehabilitation and restoration projects, and (3) develop an understanding of the importance of the near-nearshore environments and its importance to the aquatic food web. Some of our outreach activities in support of these Ecosystems & Habitats priorities include partnering with the NOAA Marine Managed Areas program to respond to an Executive Order to create a nationwide inventory of such areas. We are also partnering with the Wisconsin Coastal Management Program in this effort.

Critical Coastal Lands Acquisition (Hart) – Our GIS outreach specialist is working with the Wisconsin Coastal Management Program and the Wisconsin DNR to provide GIS support for the development of a Coastal and Estuarine Land Conservation Plan. This involves integration of digital parcels with tax assessment data for coastal counties to determine different classes of public ownership and the use of an interactive “smart board” to help stakeholders prioritize coastal land acquisition.

“The State of the Bay” Website (Harris) – Another outreach priority in this thematic area is to foster increased public understanding and commitment for protecting and rehabilitating Great Lakes ecosystems and habitats. This will be addressed through production of a “State of the Bay” website that will be used to educate local officials, user groups and students about the chemical, physical and biological interrelationships of a Great Lakes ecosystem and the impacts of human activities on its

water resources. In partnership with UW-Green Bay, Green Bay Metropolitan Sewerage District, Wisconsin DNR, and the Science & Technical Advisory Committee for the Lower Green Bay and Fox River Remedial Action Plan, *The State of the Bay* will report on the status of beneficial-use impairments in lower Green Bay, identify potential emerging problems, and document progress toward meeting the objectives of the Lower Green Bay and Fox River Remedial Action Plan. The results will also be incorporated into the Lake Michigan Lakewide Management Plan, the State of the Lakes Ecosystem reports and The Nature Conservancy's Ecosystem Integrity Assessment for Green Bay. The specialist is a member of the Core Science Team assisting The Nature Conservancy in defining conservation targets for Green Bay and its tributaries.

Our habitat restoration outreach specialist will also continue to be actively involved in remediation and restoration efforts regarding the Fox River estuary and Lake Michigan's Green Bay. As an active member of the Green Bay Remedial Action Plan Biota and Habitat Work Group, she is partnering with other agencies and interest groups to develop and implement habitat remediation projects recommended in the plan. Consistent with Wisconsin priorities in this thematic area, she is assisting the work group, the U.S. Army Corps of Engineers and Brown County Port Authority in designing the restoration of a chain of barrier islands in southern Green Bay and making beneficial use of dredged materials from the navigation channel.

Fisheries Theme

National Goals: (1) Develop an ecosystem perspective in renewable resource management; (2) understand the ecological changes effected by exotic aquatic species; (3) restore habitat and ecological conditions required by native species, and (4) understand ecological variability and its role in resource management practices.

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. Alewife and smelt replaced the native forage fishes. Thriving recreational fisheries have developed around the introduced Pacific salmon species. New invaders—such as zebra mussels, round goby, ruffe and white perch—pose different and equally significant challenges. Key research challenges include developing ways to control the spread of exotics, creative methods for reducing their adverse ecological effects, and the combination of conceptual and analytical tools required to evaluate the future of fishery restoration efforts.

Thus, Wisconsin Sea Grant's priority in the Fisheries Theme is to develop methods and models to improve management of Great Lakes commercial and recreational fisheries from a whole-ecosystem perspective. Recent work in this area has focused on the lake trout fishery and food web dynamics in Lake Superior, and the decline of yellow perch and smelt fisheries in Lake Michigan.

OMNIBUS-FUNDED PROJECTS

“A Retrospective Analysis of Lake Michigan and Lake Superior Food Webs” (Vander Zanden, R/LR-92). Rehabilitation of native fish populations is a Great Lakes Basin-wide priority of the fishing community, yet we know very little about the trophic ecology and niche partitioning within the historical lake communities. In other words, we need benchmarks against which to establish ecological rehabilitation goals. The PI of this continuing project will measure stable isotope fractionation of preserved museum fish specimens in an effort to reconstruct food web changes from these fish collected from Lakes Michigan and Superior. It is thus expected that Great Lakes restoration efforts will benefit by having a historical perspective on long-term ecosystem and food web changes. This project directly addresses a national Sea Grant Fisheries Theme goal as well as our cross-cutting **AIS Theme** priority of evaluating the effects of invasive aquatic species on Great Lakes food webs.

“Sustainability of Lake Trout Fisheries in Lake Superior” (Hansen, R/LR-95). Lake trout stocks collapsed in Lake Superior due to overfishing and sea lamprey predation. Restoration was pursued via stocking, and by 1996 data indicated that stocking could cease. However, all stock size estimates are based on a number of assumptions that are questionable. In particular, annual harvest quotas are based on an assumed total mortality rate, which in turn is based on a meta-analysis of lake trout stocks in North America. This approach has never been shown to be sustainable for lake trout stocks in Lake Superior. The PI in this continuing project is attempting to improve our stock size assessment capability by developing a dynamic age-structured model for simulating long-term effects of varying management strategies on lake trout population dynamics in Wisconsin waters of Lake Superior. The PI has a successful history of working with fisheries managers, and the effort nicely complements the work of the Kitchell project mentioned previously. Both projects address the Wisconsin Sea Grant priority in this thematic area of identifying the factors and conditions necessary for rehabilitation of self-sustaining populations of native fish species.

Hydrodynamics, Chlorophyll and Larval Fishes (Janssen, R/FI-1 – FY07 Start). A relatively small portion of environmental research on the Great Lakes has been directed toward understanding the effects of physical processes on top levels of the trophic food web. This new project examines the effect of thermal structure, particularly the development of thermal wedges and plumes on the success of larval fishes in Lake Michigan. The project will help determine if the recent poor year classes of pelagic fishes result from thermal factors in the lake. The shift from warm to cooler coastal waters results in lower productivity of both algae and zooplankton, thus affecting growth rates of sensitive larval fish, such as yellow perch. This project will help satisfy a thematic priority of elucidating the dynamics of yellow perch recruitment and identify the key factors preventing the fishery’s recovery from a population collapse in Lake Michigan in the early 1990s. Moreover, if these low recruitment events are due to thermal structure, it could indicate how climate change would directly affect the food web structure of the lake.

CORE PROGRAM

“Critical Outreach Issues in Great Lakes Fisheries” (Moy) – This outreach project is directed at resolving the conflict between commercial and recreational fishers over trap netting in the Sheboygan-Manitowoc-Two Rivers area of Lake Michigan. Our Advisory Services fisheries specialist will work with area commercial fishers, sport anglers and Manitowoc businesses to create greater awareness of trap net locations, how to fish near trap nets, and the safety risks of trolling around trap nets by producing and distributing trap net location and avoidance posters and handouts among recreational anglers in the Two Rivers-Manitowoc and Sheboygan region. This approach has previously been used and proven successful with Lake Superior anglers.

Lake Michigan Fisheries Forum (Moy) – Our fisheries specialist will continue to chair monthly meetings of the Lake Michigan Fisheries Forum, an advisory body formed by the Wisconsin DNR to address issues related to Lake Michigan fisheries. Its purpose is to facilitate information exchange between the department and interested groups and individuals, provide a forum for discussion of issues of concern, develop consensus among diverse interests on matters of common concern, and develop public advocacy for policies of general interest.

“History of Sturgeon in the Lake Winnebago System” (Schmitt/Binkowski) – Wisconsin has the largest and healthiest lake sturgeon stock remaining in the Great Lakes region, and its DNR has been conducting sturgeon management efforts for more than 100 years. Other states as well as many countries around the world have adopted Wisconsin’s lake sturgeon management practices for their own native sturgeon rehabilitation efforts. With such a long history of research, management and community involvement, the time is ripe to focus on education and outreach to widen the scope of sturgeon appreciation and conservation. This outreach and education project will create a website,

historical book and traveling educational display in a collaborative effort with the DNR and Sturgeon for Tomorrow.

Fisheries Extension (Hurley/Moy) – Our Advisory Services program is currently among several programs eligible for an additional position through the NOAA Sea Grant’s Fisheries Extension Enhancement. Our proposal for an extension specialist to address Green Bay’s unique fisheries issues has received positive reviews through the first round of competition. Funding for the position is contingent on passage of the Sea Grant request in the U.S. Commerce budget. One of our Fisheries Theme priorities that this specialist would help us address is to elucidate the dynamics of yellow perch recruitment and work with the Wisconsin DNR and local commercial fishers to identify the key factors preventing the fishery’s recovery from a population collapse in the early 1990s in Lake Michigan and recently in Green Bay.

Marine & Aquatic Science Literacy Theme

National Goal: Provide national leadership in the development of well-prepared professionals who understand marine and aquatic science and research, and to be a leader in enhancing public aquatic science literacy from “cradle to grave.”

Virtually every serious study of national goals for the new millennium underscores the critical importance of education to national prosperity. To sustain a growing economy, we must also be stewards of the natural environment upon which all life depends. UW Sea Grant contributes to this national Sea Grant thematic area by providing leadership in the development of well-prepared professionals who understand and are conversant in Great Lakes and aquatic science, by supporting teachers to advance and develop their scientific skills, and by extending science education beyond schools and into families and communities.

In pursuit of our thematic and institutional priorities to develop and/or enhance formal and informal educational opportunities on Great Lakes, coastal and marine subjects, we will create opportunities for K-12 teachers—especially those of underrepresented groups—to increase their marine/aquatic science literacy. In partnership with educational providers, we will offer courses and workshops on marine and aquatic subjects to preservice and in-service K-12 teachers (e.g., AIS “Attack Packs”) and to students enrolled in UW system science and education programs.

On a programmatic level, we will continue to provide opportunities for graduate and undergraduate students to participate in all aspects of UW Sea Grant program activities via research and project assistantships, employment as student writers for Earthwatch Radio, and our Weston undergraduate scholarship.

OMNIBUS-FUNDED PROJECTS

“Earthwatch Public Service Radio Program” (Hoops, C/C-2). This continuing Communications project addresses an overarching Marine & Aquatic Science Literacy priority of enhancing public awareness and understanding of Great Lakes, coastal and ocean issues. The longest-running program of its kind on radio, “Earthwatch Radio” is carried by about 125 individual radio stations, a network of around 20 U.S. radio stations, and the international Armed Forces Radio & Television Services network. Coproduced with the UW-Madison Gaylord Nelson Institute of Environmental Studies, this project supports our institutional strategic priority of advancing aquatic science education and scientific literacy statewide, regionally, nationally and internationally. Two to three graduate and undergraduate students will be employed on the project annually to produce 130 radio scripts per year on subjects related to science and the environment, particularly as they relate to the Great Lakes, the oceans, and the missions of Sea Grant programs and NOAA. A priority during 2006-08 is to expand Internet delivery of Earthwatch Radio programs and related information via email, the Web and transmission of audio files over the Internet using RSS technology and “podcasting,” which delivers

online audio content to iPods and other portable media players on request for playback at the listener's convenience.

“Wood, Steel and Steam: Shipwreck Archaeology, Preservation and Public Education” (Broihahn/Karl, C/ML-1). Ongoing public education and outreach efforts are needed to increase public appreciation and valuation of Wisconsin's submerged cultural resources. Shipwrecks are an exciting medium through which the larger story of Wisconsin's maritime history can be told, and telling this story effectively increases public support for historic preservation. This new Communications project will help Wisconsin maintain its position as a recognized leader in maritime heritage preservation by conducting archaeological surveys on two steam propeller shipwrecks and presenting research results via the “Wisconsin's Great Lakes Shipwrecks” and “Notes from the Field” websites (www.wisconsinshipwrecks.org and www.maritimetrails.org/participate.cfm). In addition, two lakeshore historical markers and site guides for divers will be produced, and about 25 multimedia presentations will be offered to students, teachers and the general public. This project also addresses our **Coastal Communities & Economies** priority of enhancing public appreciation of Great Lakes and historical and cultural resources by engaging public interest in the exploration of these resources.

“Recent Advances in Limnology and Oceanography Seminar Series” (Berges/Brooks, E/ML-1). It is a Wisconsin Sea Grant priority to provide support for special on-campus symposia, workshops and lecture series on marine and aquatic sciences and Great Lakes, coastal and ocean topics. Thus, we propose to once again support this popular 32-year-old series of lectures held Thursday evenings at the UW-Milwaukee Great Lakes WATER Institute. Open to the public, these lectures regularly attract 25 to 50 attendees as well as a dozen or so advanced undergraduate students and graduate students who enroll in the course.

“Lake Sturgeon Bowl: Wisconsin's Regional Academic Competition for the National Ocean Sciences Bowl” (Klump/Duffy, E/ML-2). The annual Lake Sturgeon Bowl helps focus students on oceanography and the aquatic sciences in preparation for the National Ocean Science Bowl competition in late April—and also helps them learn about career applications relative to marine and aquatic science. Twenty to 24 teams, each consisting of five high school students and a coach, participate in this head-to-head regional competition held each February at UW-Milwaukee. Participants come from throughout Wisconsin, ensuring that this effort reaches students from the inner city to rural, agricultural areas of the state. UW Sea Grant's education outreach specialist helps with the overall coordination of the regional competition and the training of teacher-coaches, students and event volunteers, and he serves as a competition official, accompanies the winning team to the national finals and provides scientific expertise on associated field trips to a marine site. Lake Sturgeon Bowl cosponsors include UW-Milwaukee and its Great Lakes WATER Institute, along with some funding from the Consortium for Oceanographic Research & Education and outside sources. This project addresses two Wisconsin Sea Grant priorities in the Marine & Aquatic Science Literacy Theme of attracting a new generation of young adults to professions in aquatic science and related disciplines, and of developing and/or enhancing formal and informal educational opportunities on Great Lakes, coastal and marine subjects. It also fits our institutional strategic priority of expanding our educational programs to K-12 students, nontraditional students and the adult public.

CORE PROGRAM

Great Lakes Center for Ocean Science Education Excellence (Lubner) – Perhaps UW Sea Grant's most notable effort in this theme during the next biennium and beyond involves the participation of our education program coordinator in a recently approved Great Lakes Sea Grant Network proposal to develop a Great Lakes Center for Ocean Science Education Excellence (COSEE). Funded by NOAA and the National Science Foundation, this five-year project is designed to enhance teacher capabilities for delivering high quality educational programs in Great Lakes/ocean sciences by creating dynamic linkages between Great Lakes researchers and 4th- to 10th-grade

educators and students. Wisconsin will be responsible for coordinating the first module of the teaching effort on Lake Superior in 2006. In collaboration with other COSEEs around the country, the principal goal of this project is to inspire citizens to become more scientifically literate and environmentally responsible through standards-based science curricula and programs that bridge the ocean and freshwater sciences. The Great Lakes COSEE will also add critical freshwater components to the National COSEE Network, improve ocean/Great Lakes sciences education to the quarter of the U.S. population in the Great Lakes region not served by other COSEEs, and involve regional tribal educational institutions, teachers and students in ways that improve the ocean/Great Lakes science literacy of this population.

Science of the Great Lakes for the K-12 Classroom (Lubner) – In partnership with organizations such as Discovery World at PIER Wisconsin, the Schlitz Audubon Nature Center and the Great Lakes WATER Institute, Wisconsin Sea Grant offers programming for K-12 teachers on a diversity of Great Lakes issues. Courses and workshops range in length, and provide educators with content knowledge about the Great Lakes, hands-on activities for use in their classrooms, and appropriate resources. Courses often include on-the-water and other field experiences, as well as being available for credit.

Marine Science at Sea: A Hand's-on Laboratory (Lubner) – This two-week, three credit course provides a hands-on, shipboard opportunity to learn the basics of ocean science and nautical skills. Students sail aboard the *S/V Denis Sullivan*, a three-masted schooner and Wisconsin's flagship as it travels from its winter port in Florida to Bahamian waters. Students become part of the crew, engaging in all aspects of shipboard operations, while learning about the physical, chemical, biological and geological aspects of the ocean, along with the history and culture of the Bahamas.

Grandparent's University (Lubner) – This UW Alumni Association "university curriculum" is conducted each summer for young people accompanied by their grandparent(s). Students select a course of study in a subject area and track through a two-day program of coursework. Sea Grant, in cooperation with the UW Center for Limnology offers a popular course of study on limnology, including water sampling on a UW research vessel, hands-on operation of underwater robotic technology, and activities on aquatic invasive species. The course of study is concluded with the presentation of diplomas at a graduation ceremony.

Institute for Exploration (Lubner) – During 2004 and again in 2005, Wisconsin Sea Grant worked with "Discovery World" at PIER Wisconsin to present informational programming about marine and Great Lakes science, history and culture to audiences from K-12 students to the general public. These programs were conducted at the Discovery World theater using live broadcasts featuring noted oceanographer Bob Ballard on the 20th anniversary of his discovery of HMS *Titanic* wreckage using underwater remote technology. We plan to continue participating in this annual program through the next biennium.

"Interactive Fish Identification and Bioenergetics Lab" (White) – Work was recently completed on this comprehensive database-driven educational website and software that will provide students at UW-Madison and elsewhere the opportunity to study fish identification, ecology and physiology using the latest techniques and scientific information. Developed in partnership with the WDNR and the Center for Limnology (CFL) at UW-Madison, the "Interactive Fish Identification and Bioenergetics Lab" website and desktop software on compact disk (CD) include data and photographs covering every species of fish in Wisconsin. The site is already being used extensively by resource managers at the WDNR and students in undergraduate classes at the CFL. During 2006-08, we will continue to help publicize the website and market the CD to educators, fisheries managers, anglers and other interested individuals throughout Wisconsin and beyond.

Madison JASON Project (Reeb) – Wisconsin Sea Grant sponsors the Madison JASON Project each year as a way to excite local students about science and to provide professional development to area teachers. The JASON Project is an international, interdisciplinary program that uses state-of-the-art

communications technology such as the Internet and satellite feeds to enable 4th- through 9th-grade students to see and talk with scientists and researchers doing field work in remote locations of the world. The UW Sea Grant education coordinator, in collaboration with Madison JASON project leader Mary Lou Reeb, plans and implements the teacher training activities each fall and cohosts the wintertime student sessions at a Madison-area technology center. These annual broadcasts include live feed from a scientific research site along with hands-on activities and a lively interchange on scientific issues with the students.

***Around Lake Superior: A Journey in Time and Place* Print and Electronic Publication**

(Reeb/Yao) – Wisconsin Sea Grant previously funded the research and publication of *Around the Shores of Lake Superior: A Guide to Historic Sites* (Bogue and Palmer, 1979), which has since gone out of print. Based upon its popular appeal, the University of Wisconsin Press has committed to publishing an updated version of this publication and will assume responsibility for the majority of marketing and sales. As part of the partnership agreement, we will fund a small portion of the publishing costs and be permitted to sell this guidebook via our online Publications Store. We will also have the right to publish an edited electronic version of part of this work on our website and/or in a multimedia format as a marketing tool. If/when the book goes out of print, should the UW Press decide not to reprint it, UW Sea Grant may publish an online version of the entire book. This project addresses the Wisconsin Sea Grant priority in this thematic area of enhancing public awareness and understanding of Great Lakes history, culture and resources.

“Great Lakes: Great Maps” Exhibit & Lectures (Savoy/Reeb) – UW Sea Grant previously partnered with the Wisconsin Humanities Committee and American Geographical Society (AGS) Collection of the UW-Milwaukee Golda Meir Library on a statewide traveling map exhibit on the influence of the Great Lakes in the development of Wisconsin. In May 2006, UW Sea Grant will expand the range of the exhibit by bringing it—along with a free public lecture by a noted historian—to the UW-Madison campus community. New partners will include the Wisconsin Historical Society Archives and the UW-Madison Libraries Department of Special Collections. We also have permission from the AGS to digitize their maps and create a Web-based product of this exhibit. The website will include an adult study guide featuring map-by-map descriptions, historical essays as well as a bibliography.

Applied GIS Workshop for Urban Planners (Hart) – As part of an affiliation with the UW-Madison Department of Urban and Regional Planning, our GIS outreach specialist will teach an applied GIS workshop focusing on coastal and environmental resource management issues annually during the spring semester. His spring 2006 course will partner with Louisiana Sea Grant to use GIS to explore alternatives for rebuilding the areas of New Orleans affected by Hurricane Katrina (our GIS specialist was a senior city planner for New Orleans from 1987 to 1993).

GIS Teaching Modules (Hart) – The GIS outreach specialist will continue the development of GIS “teaching models” to demonstrate how GIS can be applied to specific coastal issues, including shoreland management, coastal erosion, identification of agricultural riparian buffers to reduce nonpoint-source pollution, floodplain management, modeling urban nonpoint-source pollution, and land use planning/growth management. The teaching modules will be updated for the most recent version of ArcGIS software and will be consolidated into a single workbook.

Water Quality Education Outreach (Harris) – Our water quality outreach specialist organizes and hosts the “Edge of the Lake” seminar series at UW-Green Bay and at least three forums/workshops annually for local officials, decision makers and citizens. She also teaches a five-week course on Wisconsin’s water resources for the Institute for Learning in Retirement at UW-Green Bay. She will also continue to educate Lake Michigan coastal residents about the *Cladophora* nuisance algae problem.

Allied Drive Story Hours (Savoy) – In summer 2004, the UW-Madison Water Resources Library launched the first of a series of story hour programs in the Allied Drive neighborhood of Madison. Allied Drive is an area of poverty and crime with the highest concentration of children of any neighborhood in the metropolitan area. The students in the neighborhood have the lowest reading test scores in the Madison school district and do not have easy access to a public library. Each story hour was organized around a water-related theme and included art projects and snacks in addition to several children’s books. The project has grown to become a partnership with the UW-Madison School of Library and Information Studies, the Madison School and Community Recreation Safe Haven Childcare Program and six other UW-Madison libraries. The story hours are now a monthly occurrence. The Water Resources Library will continue to offer story hours as part of this project during 2006-2008.

Wisconsin’s Water Library (Savoy) – As mentioned previously in the Coastal Communities & Economies theme, UW Sea Grant will continue to develop and promote “Wisconsin’s Water Library,” a special project initially developed for Wisconsin’s “Year of Water” to provide Wisconsin residents with easy access via the Web to reliable sources of water information, including more than 30,000 volumes of water-related information at the UW-Madison Water Resources Library. During the next biennium, this project will include the development of annotated reading lists emphasizing Wisconsin issues in each of the national Sea Grant themes. We will also continue producing a periodic digital publication focusing on a Great Lakes issue of Wisconsin importance that will be made available on the Web and distributed via email. These special features consist of a short description of the problem, books or other documents available through the library or online and selection of a few highly reliable websites. It will also link to appropriate ASC newsletter articles and “Earthwatch Radio” scripts when possible. This project also meets the Coastal Communities & Economies priority of initiating outreach on Great Lakes issues.

Seafood Science & Technology Theme

National Goal: Improve the safety, quality, shelflife and marketability of existing and new seafood and seafood-derived products.

This national theme aims to develop new ways for Americans to reap the bounty of our waters on a sustainable basis. Sea Grant-sponsored research and technology transfer in this thematic area helps the seafood industry by improving processing technology, products and methods for assuring seafood safety. As wild fish stocks decline, we need to find new ways to reduce waste and by-catch by improving fishing gear, developing markets for underused species, and ensuring the safety and quality of products through better storage, processing and packaging techniques.

Examples of past Wisconsin Sea Grant-supported research and technology transfer in this area include applying Hazard Analysis Critical Control Point methods in commercial processing to ensure seafood safety, developing super-absorbent gels from fish protein extracts, and finding ways to use omega-3 fatty acids common in fish oils as nutraceuticals—foods or food additives that confer nutritional, therapeutic or preventative medical benefits to individuals at risk for cardiovascular disease, certain forms of cancer and diabetes, hypertension and other health problems.

CORE PROGRAM

A Wisconsin Sea Grant priority in this area is to develop new uses for seafood and Great Lakes fisheries products and by-products, including finding novel uses for by-catch, invasive exotic fishes and underutilized species for developing new fisheries. During 2006-08, we plan to collaborate with Minnesota Sea Grant and Lake Superior commercial and tribal fishers to conduct some workshops on possible uses and markets/interest for creating a commercial siscowet (fat trout) fishery on Lake Superior. Our fisheries outreach specialist will also continue working with the Wisconsin DNR and

Green Bay commercial fishers to explore and test the feasibility of developing a new gillnet fishery on Green Bay, Lake Michigan, based on the white perch, an invasive species. By creating a commercial market interest in white perch, this effort could provide local commercial fishers with an alternative to the native yellow perch fishery, which is currently under reduced harvest limits due to poor population recruitment. Besides potential profits for local fishers, a white perch fishery might also help control the population of this invasive species in the bay.

Urban Coast Theme

National Goals: (1) Resolving water quality, beach access, coastal land use and development, and similar coastal issues; (2) reducing contaminants, nutrients and other nonpoint-source pollution from urban watersheds; (3) enhancing ports, harbors and marinas to meet growing demands for service while addressing concerns about impacts on the local community and environment, and (4) resolving conflicts over existing and proposed uses of coastal space and resources.

Economic growth since 1950 has sparked increased urbanization of coastal areas—with corresponding rises in pollution and environmental degradation. In an urban setting, a shoreline has significant appeal, as shown in the demand for recreational, business and residential developments near the water. Communities and states must balance economic and environmental values, manage the impacts of nutrient 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 countless 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 and tourism/recreational industries. Population growth and development pose an increasing threat of water quality impairment by chemical contaminants and nutrient loading as well as increasing demand for and consumption of Great Lakes water. Research is needed to develop and support management programs designed to protect and enhance the quality of this vital ecosystem. Thus, Wisconsin Sea Grant’s principal priority in this area is to identify and quantify the key physical, chemical and biological processes and mechanisms that control the transport, distribution and fate of chemical contaminants and nutrients in coastal waters and the Great Lakes.

OMNIBUS-FUNDED PROJECTS

“Sources and Transport Mechanisms for *Escherichia coli* Contamination at Lake Michigan Beaches” (McLellan, R/MW-89). As mentioned previously, frequent beach closures are a growing national problem. This continuing project addresses our Urban Coast Theme priority of identifying the mechanisms, sources and fate of bacterial and viral contamination responsible for beach closings in the Great Lakes and other coastal areas. Beach closings have become a high-profile issue in the Great Lakes region and throughout our nation, and due to new U.S. Environmental Protection Agency (USEPA) guidelines, they are becoming more frequent. This topic is an emerging field for Sea Grant research in our region that our Advisory Council in 2003 urged the UW Sea Grant program to address. This project also promises to advance the science of indicator research for determining the sources of *E. coli* through such biotechnological approaches as DNA fingerprinting and antibiotic-resistance profiling. It also addresses an institutional strategic priority of encouraging promising new investigators (especially those from underrepresented groups) to participate in the UW Sea Grant program.

“Evaluation of the Algal Nuisance *Cladophora* and its Effect on *E. coli* and Beach Closures” (Kleinheinz/McDermott, R/UC-1 – FY07 Start). The *Cladophora* problem was deemed an urgent problem and given a high-priority recommendation by our Lake Michigan constituents and members of our UW Sea Grant Advisory Council. The recurrence of nuisance *Cladophora* on its subsequent

detachment and accumulation on Lake Michigan beaches has led to renewed public awareness of a specie that responds to elevated nutrient inputs. At the same time, enforcement of U.S. EPA Beach Act (2000) monitoring standards has resulted in numerous beach closings on Wisconsin's coast. A multidisciplinary, multi-institutional team of investigators hypothesize that there is a link between *Cladophora* mats and elevated *E. coli* counts that trigger beach closings. The results of this study have potential widespread implications for management of this nuisance alga and for interpretation of sources of coliform that lead to beach closings. It directly addresses a cross-cutting priority of our Urban Coast and **Biotechnology** thematic areas of developing biotechnological tools for addressing the problems of beach closings, harmful algal blooms and related water quality issues. It also addresses an **Ecosystems & Habitats** priority of conducting research for deterring, eradicating and/or controlling nuisance algae and aquatic toxins.

“Development and Application of Molecular-Based Methods for Identifying Sources of Fecal Pollution at Lake Michigan Beaches” (McLellan, R/UC-2). As noted above, the federal BEACH Act of 2000 brought about major changes in monitoring of the nation's recreational beaches and increasingly frequent beach closures. The indicator organism for determination of beach closures is *E. coli* bacteria, which has multiple sources, ranging from gull feces to human sewage system overflows. The diverse sources of *E. coli* make it difficult to develop appropriate and effective mitigation strategies. It is also an Urban Coast priority in our **Biotechnology Theme** to develop biotechnological tools for addressing the problems of beach closings, harmful algal blooms and other water quality issues, as well as the Urban Coast Theme priority of identifying the mechanisms, sources and fate of bacterial and viral contamination responsible for beach closings in the Great Lakes and other coastal areas. Therefore, *if funding becomes available*, we intend to support this project, which proposes to develop and refine methods that use genetic markers to pinpoint sources of fecal contamination, to validate these methods in the field under various environmental conditions and to relate new supplemental methods to help better address sources of contamination.

“Ecological Immunology of Amphibians in Stressed Great Lakes Ecosystems” (Karasov, R/UC-3). Recent discovery of amphibian deformities in the Great Lakes region has led to numerous studies that have been directed at causes and effects. Certainly, amphibians have been shown to be a sentinel specie for environmental changes. *If funding becomes available*, we also hope to support this project, which addresses an important Wisconsin priority in the Urban Coast Theme of assessing the threats to aquatic life posed by parasites and chemical or pathogenic contamination of the Great Lakes and other aquatic ecosystems. This project will study the response of the northern leopard frog to organic and trace metal contaminant exposure and compare the results of their exposure with, *Xenopus tropicalis*, a well-studied frog species that has been used in developmental genetic studies. There is clear evidence that frogs found in the Fox River-Green Bay Great Lakes Area of Concern are contaminated with immunotoxic contaminants, and this study aims to identify key developmental steps that are affected by xenobiotics.

CORE PROGRAM

Our outreach activities in this thematic area are quite diverse and address several priorities in our strategic plan:

Urban Coastal Infrastructure Value & Vulnerability (Hart) – An outreach priority in this thematic area is to assess the vulnerability of coastal urban infrastructure to changing and/or extreme Great Lakes water levels. Our GIS outreach specialist is using this technology to determine who owns what on the coast for developing an inventory of coastal land valuation and ownership. We will use GIS to develop coastal land valuation indices and couple these data with other datasets that influence valuation. For instance, fluctuating lake levels may threaten the value of coastal property or of marine and lakeshore transportation infrastructure. Our GIS specialist will also continue to refine stormwater management GIS educational materials developed for the Fox-Wolf Watershed Alliance 2003

Stormwater Conference and make them accessible to a broader audience, as well as provide GIS support for Nonpoint Education for Municipal Officials (NEMO) projects in Wisconsin.

Ports-Harbors-Marinas Maintenance & Growth Issues (Clark) – Partnerships with Wisconsin ports, harbor and marina managers and owners and other regional/national technical resource agents will be developed to identify and respond to various facility-related maintenance and growth issues. Two or more fact sheets will be prepared detailing such problems as the accelerated freshwater corrosion seen in sheet pilings at the Duluth-Superior harbor and the deteriorating timber piles and crib structures observed at many of Wisconsin’s major ports. UW Sea Grant will also investigate the tasks required and the interest of state and local agencies in initiating a “Clean Marina” program in Wisconsin.

Sediment Dredging & Remediation (Clark) – In a related effort, state-of-the-art information on dredging technology, such as new techniques and equipment, will be made available via the UW Sea Grant Urban Coast Theme website, along with possibly a maintenance dredging workshop as well as one-on-one assistance from our coastal engineering specialist. Other potential workshops and training opportunities will be formulated to assist with problem identification and information transfer. New tools such as UW Sea Grant’s Remediation Simulation (REMSIM) model will be updated, verified and disseminated to assist planners with their project investigation studies.

As noted in Ecosystems & Habitats, our water quality outreach specialist also addresses issues related to remediation and restoration, including dissemination of information on PCBs in the Fox River and Green Bay, Lake Michigan. She will also assist in Nonpoint Education for Municipal Officials efforts and continue to educate Lake Michigan coastal residents about the *Cladophora* nuisance algae problem as well as its possible role in **beach closings** based on the results of the Sea Grant-funded research in this theme described above.

Flame Retardants in Fish (Wittman) – In connection with the findings of a recently completed UW Sea Grant Urban Coast research project, our Communications Office is developing a question-and-answer fact sheet about polybrominated diphenyl ethers (PBDEs) in the Great Lakes for initiating a regional public awareness campaign about PBDEs in Great Lakes fish. PBDEs have become a flashpoint for the larger issue of anthropogenic chemicals accumulating in the environment. Although debate continues over the health effects and risks of these chemicals, it is clear—as recent UW Sea Grant-funded research has helped show—that PBDEs are accumulating where they should not. The researchers created a database of the concentrations of six major PBDE congeners in 60 individual forage fish from four representative species collected on the eastern and western shores of Lake Michigan. They reported that PBDEs are present in all analyzed samples, and they observe increasing concentrations over time. The investigators on this project have tentatively identified decabrominated diphenyl ether (deca-BDE) in several Lake Michigan sediments samples, with indications that it may be degrading to more toxic compounds. This result, when confirmed, will be of major importance in ongoing efforts to remove some PBDEs from common usage.

Eighth International Conference on Mercury as a Global Pollutant (Hurley) – More than 800 scientists from around the world are expected to attend this Aug. 6-11, 2006, conference in Madison, Wis. Cosponsored by Wisconsin Sea Grant, the theme for this landmark event is *Integration of Science, Policy and Socioeconomics*. The conference will feature the latest scientific and technical advances in mercury research and provide a comprehensive, peer-reviewed synthesis of information relevant to both scientific and policy discussions on environmental mercury pollution. The final products (a conference declaration and four synthesis papers) will be published in a peer-reviewed journal or book. Copies of the conference declaration will also be provided to the editors of prominent scientific journals, such as *Science*, *Nature*, and *Environmental Science and Technology*.

Innovative Science & Technology

Goal: Provide an opportunity for university scientists and engineers to undertake original and innovative Great Lakes, coastal and ocean research, especially work that reaches beyond the established national Sea Grant research, outreach and education themes.

Investigations of the Great Lakes and ocean environments may be sweeping or sharply focused, aimed at specific locales or at vast regions. They may examine short or long periods of time; they may explore specific technologies or generic problems. Given the breadth of research possibilities, UW Sea Grant encourages scientists and engineers to undertake innovative and original research projects that fall outside the confines of present Sea Grant thematic areas. This includes the development of initiatives that take full advantage of special opportunities, apply state-of-the-art scientific techniques and new technologies, and tap the full spectrum of unique talents available in the Wisconsin scientific community.

Potent areas for such research include the ocean's role in climate change and the potential effects of climate change on Great Lakes hydrology and ecosystems; the application of state-of-the-art technology to marine resource utilization and ocean exploration, and a host of marine and Great Lakes-related human safety issues, particularly with regard to undersea exploration. Given UW-Madison's unique capabilities in this area with regard to both expertise and facilities, it is a Wisconsin Sea Grant priority to improve the safety and cost-effectiveness of diving through better understanding of physical and mental responses to the underwater environment, and to facilitate the transfer of research results to members of the diving community, medical professionals and other concerned groups.

OMNIBUS-FUNDED PROJECTS

“Improving Risk Estimation, Safety and Cost-Effectiveness in Scuba Diving” (Dueland/Lehner, R/ST-1). This new project proposal received one of the highest review rankings in the competition, both in terms of scientific quality and NOAA/Sea Grant relevance. Recreational, seafood, governmental, commercial and scientific divers may use some diving practices that likely carry unacceptable risks not fully understood by divers, attending physicians and physiologists. The PIs are extending their previous work on the effectiveness of diagnostic evaluation and screening for dysbaric osteonecrosis (DON) and osteoarthritis to populations of divers that may carry a potentially significant risk of developing these illnesses. This world-famous research group is one of a handful that is examining this very important topic, which is a high-priority NOAA item.

CORE PROGRAM

In connection with this project and recently completed research by the investigators on project R/ST-1 (above), the UW Sea Grant Communications Office plans to work with the PIs during 2006-08 on a major outreach effort to alert divers to the risks of DON. We plan to launch a multilingual national outreach in partnership with the Puerto Rico Sea Grant College Program, Divers Alert Network, the NOAA Diving Program and the national scuba diving industry.

Other strategic priorities in Innovative Science and Technology that we intend to pursue as opportunities to fund them become available are to:

- Evaluate the implications for the Great Lakes freshwater resource of possible changes in land use under foreseeable future climate scenarios, such as increasing pressure for interbasin as well as intrabasin transfer and other changes in consumptive and nonconsumptive use of Great Lakes water; analyze the economic, legal and political effects of possible climate change on valuation of water and other aquatic resources, and the region's institutional readiness to recognize and respond to the effects of possible changes in regional and global climate.

- Identify the principal sources and the long-range atmospheric transport and deposition mechanisms by which chemical contaminants from far outside the basin accumulate in Great Lakes waters.
- Explore and develop engineering and computer-aided design solutions for problems faced by private, municipal and industrial facilities in various Great Lakes, coastal and arctic marine environments, such as dock and marina design, dredging technology and remotely operated vehicle (ROV) development.

Institutional Goals and Priorities

Strategic planning is an invaluable process for identifying strengths and weaknesses, pointing out critical needs, and helping determine how best to meet those needs. By basing our institutional goals and priorities on the strategic priorities of our parent institution, we create a powerful base of shared values by which to chart our course and allocate our resources during the next biennium and beyond.

The priorities identified here echo traditional strengths while pointing toward critical areas of program development that will determine future success. They serve as guideposts for local action by the UW Sea Grant Institute to contribute to the continuous advancement of the UW-Madison as well as NOAA Sea Grant.

GOAL 1: Promote Research

- *Maintain a high quality Great Lakes and aquatic sciences research program.*

We will maintain a high quality Great Lakes and aquatic sciences research program through a continuing emphasis on effective strategic planning, statewide distribution of our biennial request for proposals, a rigorous peer-review process and the use of external advisory groups to develop our program and select project proposals for funding on a priority- and quality-driven basis. As recommended by our Program Assessment Team, we will convene a Technical Advisory Team in early 2006 to recommend ways to improve our aquaculture research and outreach program.

- *Enhance Great Lakes, coastal and marine research/educational experience for students.*

It is a longstanding UW Sea Grant tradition that research and graduate student education go hand-in-hand, primarily through research project assistantships for students. In 2006-08, we will continue to explore ways to better involve Sea Grant-supported graduate students in our program and its activities and provide opportunities to further their education. In October 2007, we will provide partial support for nine to 12 graduate students and three to five professors to participate in a weeklong field trip at the University of Georgia Marine Institute on Sapelo Island, Ga., as a part of the UW-Madison interdisciplinary course, "Problems in Oceanography," which provides an opportunity for graduate students in oceanography and related fields to learn firsthand about the estuarine environment and its ecology.

During 2006-08, UW Sea Grant will also provide ship time support for field work for the following research and outreach projects: "*Cercopagis* Invasion of Lake Michigan: Predictable Responses or "Invasional Meltdown" of the Planktonic Food Web?" (**R/AI-2**); "Impact of a Shifting Wind Field over the Laurentian Great Lakes on Accumulation and Resuspension of Sediments in Green Bay, Lake Michigan" (**R/EC-10**); "Hydrodynamics, Chlorophyll and Larval Fishes" (**R/FI-1**); "Lake Sturgeon Bowl: Wisconsin's Regional Academic Competition for the National Ocean Sciences Bowl" (**E/ML-2**), and "Advisory Services: Program Coordination and Field Offices" (**A/AS-10**).

- *Maximize administrative performance by developing Web-based financial and research project management systems, and supporting on-site training for staff, researchers and other users of these systems.*

During 2006-08, we will maximize administrative performance by further developing and refining Web-based financial and project management systems, and supporting continued on-site training for staff, researchers and other users.

- *Increase resources and improve infrastructure for research.*

We will provide electronic research administration for potential principal investigators and funded researchers via online information about grant opportunities, electronic submission of reports, and an interactive project budget management system. In 2006-08, we will continue to enhance our online proposal submission and review system to further automate and streamline the process. Investigators will be able to submit the details of their research proposals using a Web-based application. We will be able to assign reviewers from a database of experts who will be able to provide a detailed review to help us judge the merits of each proposal.

In addition, we will continue to support and develop our online abstract submission system, which will allow us to collect presentation abstracts for scheduled conferences. This will allow us to more easily collect, evaluate, organize and schedule presentations as well as help facilitate communication with presenters.

We will also be further refining and supporting the development of iPRO (Interactive Project Reporting Online), which allows project investigators and program staff to share project information via the Web.

- *Encourage promising new investigators (especially those from underrepresented groups) to participate in the UW Sea Grant program.*

During 2006-08, we intend to support the following proposals involving three new members. Two are from the UW-Milwaukee campus and one from the UW-Oshkosh campus (a new campus which has never before participated in our program): “Development of Yellow Perch Broodstocks for Selective Breeding” (Goetz/Binkowski, **R/AQ-41**), “Parallel Toxicogenomic Resources for Zebrafish and Rainbow Trout: Identifying Conserved Molecular Biomarkers of Toxicant Exposure” (Rise/Carvan, **R/BT-21**), and “Evaluation of the Algal Nuisance *Cladophora* and its Effect on *E. coli* and Beach Closures” (Kleinheinz/McDermott, **R/UC-1**).

- *Increase funding for Sea Grant program activities by encouraging staff and research project investigators to seek supplemental grants and other funding.*

All PIs and staff members are routinely encouraged to seek supplemental funding and/or in-kind support for their projects. Our assistant director for research and outreach continues to support an active mercury research program by securing outside funding from national, state and private sources. Our education program coordinator has received approval for a five-year Great Lakes Sea Grant Network proposal to develop a Great Lakes Center for Ocean Science Education Excellence (COSEE). With continued support from the Wisconsin DNR, our aquatic invasive species outreach specialist will field at least three AIS watercraft inspectors at Wisconsin Great Lakes boat landings each summer during 2006-10 to instruct boaters and anglers on how to avoid spreading invasive species.

- *Leverage Sea Grant funds through an emphasis on multi-institutional regional/national collaboration and partnering with public, private and nonprofit organizations.*

Perhaps UW Sea Grant's most notable effort in this area during the next biennium and beyond involves the participation of our education program coordinator in the above mentioned Great Lakes Sea Grant Network proposal to develop a Great Lakes Center for Ocean Science Education Excellence (COSEE). Funded by NOAA and the National Science Foundation, this five-year project, for the next biennium and beyond, is designed to enhance teacher capabilities for delivering high quality educational programs in Great Lakes/ocean sciences by creating dynamic linkages between Great Lakes researchers and 4th- to 10th-grade educators and students. Wisconsin will be responsible for coordinating the first module of the teaching effort on Lake Superior in 2006. In collaboration with other COSEEs around the country, the principal goal of this project is to inspire citizens to become more scientifically literate and environmentally responsible through standards-based science curricula and programs that bridge the ocean and freshwater sciences. The Great Lakes COSEE will also add critical freshwater components to the National COSEE Network, improve ocean/Great Lakes sciences education to the quarter of the U.S. population in the Great Lakes region not served by other COSEEs, and involve regional tribal educational institutions, teachers and students in ways that improve the ocean/Great Lakes science literacy of this population. We will also partner with the Great Lakes Information Network on advancing the application of GIS and other Web-based technology to Great Lakes issues.

- *Develop long-range information technology strategies regarding facilities, process and people.*

UW Sea Grant will continue to develop a long-range information technology strategy and monitor success toward objectives through achievement and documentation of milestones.

The backbone of our website and administrative applications is our SQL 2000 database server. We will be upgrading to SQL Server 2005, which will provide enhanced performance as well as integrated backup capabilities for all of our databases. This upgrade will enable us to have a failover system to provide 24/7 reliability.

We will be enhancing the capabilities of our conference room to provide easier and more reliable control of the lights, screen, projector, computer and other collaboration and presentation tools.

The University of Wisconsin-Madison is upgrading the network infrastructure for all departments on campus. This upgrade will improve our delivery of Web content through audio, video, and dynamic webpages. New network hardware will reduce management time, improve reliability, and reduce backup times.

- *Disseminate Sea Grant project results and transfer technology to promote economic development and benefit society. Specifically:*

We will continue to *communicate the findings and results of Sea Grant projects via a variety of media*, including publications, radio, websites, news releases, newsletter, video and television programming. Our 2006 plans include the development of several new Web-based applications. A Web-based Media Center will allow communications staff members to compose and post press releases and other materials for easy access by the media.

We will continue to *encourage and provide funding for the publication of the results of UW Sea Grant-funded work in peer-reviewed professional journals*. During 2006-08, we expect to receive and approve requests for travel funds for three to five students to attend professional conferences and/or present papers based upon their Sea Grant research. We will budget \$10,000 per year for the payment of reprint and page charges associated with publishing the results of Sea Grant-funded work in peer-reviewed professional journals.

- *Maintain and build public support for the National Sea Grant College Program at the state, regional and national levels.*

We will continually strive to maintain and build public support for the Sea Grant program through close coordination and collaboration on public, media and governmental relations with the UW-Madison Chancellor's Office, the Great Lakes Sea Grant Network and GLERL (Rochelle), the SGA, and NOAA Sea Grant. Our director and assistant director for research and outreach will conduct annual visits with Wisconsin state and federal legislators. In 2006, we will produce and distribute to interested individuals as well as the general public copies of our 2004-06 Biennial Report, 2006-08 Program Directory and program fact sheets, as well as copies of our current strategic plan, 2005 annual progress report and 2006-08 Implementation Plan.

GOAL 2: Advance Learning

- *Employ students to work on Sea Grant projects and provide financial assistance to students to complete their theses after projects have ended.*

During 2006-08, Wisconsin Sea Grant will provide support to 80 graduate and undergraduate students (45 in the first year and 35 in the second) and one post-doctoral student (first year) in 32 departments on eight campuses who participate in the program's 37 various projects. Many other students will also be involved via work-study programs and other Sea Grant-supported educational activities. Two talented and needy undergraduate students working on Sea Grant-supported projects will be awarded scholarships with the income available in the Carl J. Weston Memorial Scholarship fund. We also anticipate approving one to three requests (depending upon need) for six months to a year of funding for students to complete their theses after projects have ended.

We will also continue to employ three to four graduate and undergraduate students as student science writers on the "Earthwatch Radio" project annually, as well as project assistants on the SGNIS website project, various GIS projects, Wisconsin's Water Library, information technology support and other projects as they develop.

- *Provide post-graduate support for advanced training.*

During 2006-08, we will provide funding for one post-doctoral student to work on a Sea Grant project.

- *Provide travel support to students to attend professional conferences, present papers, and acquire on-site or at-sea field experience.*

In 2006-08, we expect to receive and approve requests for travel funds for three to five students to attend professional conferences and/or present papers based upon their Sea Grant research. Nine to 12 students will be supported to acquire field experience.

- *Encourage Wisconsin students to apply for national Sea Grant fellowships and provide support for those selected to receive them.*

In 2006, over 500 individuals (including all Wisconsin public and private university Chancellors, Deans, Associate Deans, Department Chairs and Directors of relevant Centers and Institutes as well as Sea Grant investigators for the past five years) will receive notice of Sea Grant fellowships opportunities such as, but not limited to, the Dean John A. Knauss Marine Policy Fellowship. UW Sea Grant will provide supplementary support for any Wisconsin students chosen for this or other relevant competitions during 2006-08.

- *Improve access to Great Lakes and water resources information.*

As detailed above, under the Marine and Aquatic Science Literacy Theme, we will develop annotated reading lists emphasizing Wisconsin issues for each of the Sea Grant thematic areas. The reading lists will be available on the Web and users can check books and other documents out of Wisconsin's Water Library as well as visit referenced websites.

In addition, Wisconsin's Water Library will continue to produce a periodic digital special feature focusing on a Great Lakes issue of Wisconsin importance for those interested in learning more about a subject. The special features will be available on the Web and distributed via email. Each will consist of a short description of the problem, books or other documents available through the library, and a few highly reliable websites. We will also link to appropriate *Aquatic Sciences Chronicle* newsletter articles and "Earthwatch Radio" scripts when possible.

To improve access to Great Lakes information for K-8 teachers, children's librarians, parents and students, we will develop a Kids section of the Wisconsin's Water Library website, which will include books and other materials available online and for checkout through the library, story hour resources and features developed just for kids.

"Wisconsin's Water Library" (aqua.wisc.edu/waterlibrary) is an outreach project of the UW Water Resources Library designed to make quality water-related library resources available to all Wisconsin residents. The Water Resources Library also has a website (wri.wisc.edu/library) that offers services to UW System faculty, staff and students. With the addition of the new Wisconsin's Water Library for Kids, we will redesign the Water Resources Library and the Wisconsin's Water Library sites to improve navigation and make the unique features of each site more accessible to all users.

- *Expand educational programs to K-12 students, nontraditional students and the adult public.*

We will continue to reach out to high schools across the state to encourage participation in the Lake Sturgeon Bowl, Wisconsin's regional academic competition for the National Ocean Sciences Bowl, and to provide related educational programming that builds awareness and understanding of the oceans and Great Lakes. This includes a commitment to recruiting and providing support to teams from the Milwaukee Public Schools and others serving students from populations underrepresented in the sciences.

We will provide partial funding for the "Recent Advances in Limnology and Oceanography Seminar Series (E/ML-1) at UW-Milwaukee. Open to the public, attendance at each lecture in past years has typically ranged from 25 to 50 people.

All UW-Madison faculty, staff and students are encouraged to become involved in building a more diverse and welcoming campus. The Water Resources Library will investigate and take part in campus-wide initiatives to encourage American Indians, African-Americans, Latinos, and southeast Asian-Americans to attend UW-Madison and to assist those already attending the university. Efforts will focus on aquatic sciences education.

To increase the understanding of the large majority of us who are not members of the groups listed above, the library will develop online reading lists and other materials. Wisconsin's Water Library currently makes available "Native Americans and the Environment: Past, Present and Future," an annotated recommended list of materials. The library will also investigate making one or more American Indian stories available online as part of the Water Library for Kids website.

As mentioned under the Marine and Aquatic Science Literacy Theme, the Water Resources Library will continue to offer story hours in the Allied Drive neighborhood in partnership with the UW-Madison School of Library and Information Studies, the Madison School and Community Recreation

Safe Haven Childcare Program and six other UW-Madison libraries. Story hours for children living in this area of poverty and crime will continue to focus on water-related themes.

GOAL 3: Accelerate Internationalization

- *Provide national/international leadership in Great Lakes and aquatic sciences.*

UW Sea Grant will continue, as opportunities present themselves, to cosponsor, host and participate in international meetings, conferences and seminars on Great Lakes, coastal and aquatic science issues, and disseminating the results of these events to interested parties. UW Sea Grant staff have leading roles in hosting the 2006 International Conference on Mercury as a Global Pollutant.

- *Build knowledge with Great Lakes and aquatic science partners in Canada and abroad.*

We will continue to develop and support regional (Canadian) and other international research, outreach and education partnerships that address critical Great Lakes issues with such regional agencies as the Great Lakes Commission and its Great Lakes Information Network project, NOAA's Great Lakes Environmental Research Laboratory, USEPA's Great Lakes National Program Office and the U.S.-Canadian International Joint Commission.

GOAL 4: Amplify 'The Wisconsin Idea'

- *Maintain and build a highly effective statewide outreach program.*

We will continue to develop and update our program strategic plans from a "ground-up" approach involving our outreach staff with input from their key constituent groups and other stakeholders. During 2006-08, a priority will be to partner with other university outreach entities, particularly UW-Extension, as well as with the Minnesota, Michigan and Illinois-Indiana Sea Grant Extension programs. An emphasis during the next biennium will be to develop a climate change outreach program and, if Sea Grant Fisheries Extension funding becomes available, to create a fisheries outreach specialist position focusing on the special needs of Lake Michigan's Green Bay.

- *Address Great Lakes issues through cross-disciplinary, multi-institutional and regional approaches.*

During 2006-08, we will launch a major multidisciplinary outreach and education initiative on the likely impacts of climate change on Great Lakes coastal communities in Wisconsin and elsewhere around the region. Our GIS outreach specialist will collaborate with UW-Madison researchers, Michigan Sea Grant and Michigan State University to enhance the Great Lakes Coastal Communities section of Wisconsin's Community Planning Resource website to address planning issues in Michigan and, in return, gain access to MSU's successful Citizen Planner program for training planning commissioners in Wisconsin coastal counties. We will also collaborate with Minnesota Sea Grant to explore the feasibility of developing a new commercial fishery and market for Lake Superior siscowet (fat lake trout).

The National Water Quality Program is a partnership between USDA CSREES (Cooperative State Research, Education, and Extension Service) and Land Grant Colleges and Universities. The goal of the program is "to protect or improve the quality of water resources throughout the United States and its territories, particularly in agriculturally managed watersheds." The Great Lakes Regional Water Quality Program is one of nine regional subprograms. The Water Resources Library will investigate providing online bibliographies of books, journal articles, other documents and websites for each of the Great Lakes priority program areas.

- *Advance Great Lakes, coastal and aquatic sciences education and scientific literacy statewide, regionally, nationally and internationally.*

As detailed earlier in the Marine & Aquatic Sciences Literacy Theme, our education outreach specialist will contribute to the development of the Great Lakes Center for Ocean Science Education Excellence, a five-year Great Lakes Sea Grant Network project designed to enhance teacher capabilities for delivering high quality educational programs in Great Lakes/ocean sciences by creating dynamic linkages between Great Lakes researchers and 4th- to 10th-grade educators and students. He will also help plan and lead the “Marine Science at Sea” course, a hands-on, three-credit UW-Milwaukee laboratory course aboard the S/V *Denis Sullivan*.

We will continue to support the “Lake Sturgeon Bowl” regional competition for the national Ocean Science Bowl and sponsor participation by educators of underrepresented students in the international, interdisciplinary JASON Project for Madison area schools. We will help publicize the recently completed “Interactive Fish Identification and Bioenergetics Lab” website and market the software CD to educators, fisheries managers, anglers and other interested individuals throughout Wisconsin and beyond.

In partnership with the Wisconsin Historical Society, we will continue to foster appreciation for Wisconsin’s maritime heritage through participation in the Maritime Trails project and continued development of our “Wisconsin Great Lakes Shipwrecks” website.

We will also continue to place an interactive kiosk on invasive species on the Lake Michigan car ferry that carries about 100,000 passengers between Manitowoc, Wis., and Muskegon, Mich., from April through September each year. During the remainder of the year, the kiosk will be on display at the Wisconsin Maritime Museum in Manitowoc, which attracts more than 60,000 visitors annually.

We will expand our “Earthwatch Radio” website to present longer essays on subjects related to science and the environment, particularly as they relate to the Great Lakes, the oceans and the missions of Sea Grant programs and NOAA to complement the project’s audio programs, especially those that feature UW Sea Grant research. A priority during 2006-08 is to expand the Internet functions of the Earthwatch Radio project to include online distribution of audio to radio stations.

In partnership with the international JASON Project, in spring 2006, we will be completely redesigning and updating our website "Great Lakes Migratory Birds" as an educational resource and enhancement for JASON teachers in Wisconsin (approximately 20,000), the nation (1.5 million) and the world who study the wetlands. Our UW Sea Grant habitat restoration outreach specialist will help to develop our Wisconsin wetlands section, which will feature her current Sea Grant activities in this area. If this partnership proves successful, it may continue in 2007 with the redesign and update of our websites on Great Lakes Fish.

During 2006-08, we will redesign the public Sea Grant website to be more user-friendly and topic-oriented while at the same time conforming with university and W3C accessibility standards.

In 2006, we will promote Wisconsin’s Water Library for Kids by a mass mailing of bookmarks, an article in the *Aquatic Sciences Chronicle*, emailings to various listservs interested in children’s science literature and other outreach efforts.

Our online Publications Store has proven to be a successful tool for reaching audiences for our publications worldwide. During 2006-08, we will continue to support and expand these capabilities by providing downloadable online versions (PDF format) of our publications, which will reduce printing, storage and distribution costs while providing immediate delivery for our customers.

- *Advance the Wisconsin and regional economy through outreach and technology transfer to Great Lakes-related businesses and emerging enterprises based on aquatic resources. Provide research-based expertise to state agencies, educational institutions and the private sector.*

These two priorities are addressed, to the fullest extent possible, by all UW Sea Grant staff members, particularly Advisory Services staff, and past and present project investigators. Three exceptional projects in terms of focusing on expert assistance and technology transfer being funded during the next biennium are “Aquaculture Advisory Services for the Great Lakes Region” (A/AQ-1), “Geospatial Technologies for Land Use Planning in Great Lakes Coastal Communities” (R/DO-1) and “Wood, Steel and Steam: Shipwreck Archaeology, Preservation and Public Education” (C/ML-1). Another exceptional outreach effort that will continue during the next biennium is the Lake Michigan Fisheries Forum, chaired by our fisheries outreach specialist (described in Fisheries Theme). We will also continue to encourage qualified Wisconsin students to seek Sea Grant Industrial Fellowships.

- *Encourage and support university, local, state and national public service by Sea Grant staff, researchers and students.*

Extramural public service by staff members is a hallmark of the UW Sea Grant program, as evidenced by their many professional and committee memberships (see Appendix C). It is even one of the criteria in annual performance reviews and evaluation for promotion of all academic staff members. During 2006-08, university/local/state/national public service will continue to be encouraged and rewarded for UW Sea Grant staff. Flexible time on a daily basis will be allowed for such activity.

- *Encourage and support Great Lakes, coastal and aquatic sciences outreach at UW System institutions and other public and private Wisconsin colleges and universities statewide.*

The “Great Lakes, Great Maps” exhibit along with a free public lecture will be held during May 2006 at the Department of Special Collections of UW-Madison Libraries. The exhibit, which details the development of Great Lakes mapping from the 16th century to the present day is described in further detail under the Marine and Aquatic Science Literacy Theme.

We will continue to actively encourage outreach project proposals and collaborations in connection with our biennial omnibus proposal process, NOAA Sea Grant’s National Strategic Investment opportunities and via our biennial prospective PI workshops. Our Advisory Services staff will actively pursue outreach partnerships with outreach staff at other campuses and regions of the state. During 2006-08, we will also seek to develop partnerships and a closer relationship with UW-Extension.

GOAL 5: Nurture Human Resources

- *Recruit and retain outstanding staff and students.*

To meet our priority of recruiting outstanding staff, salary rates for open positions for professional staff will be set as competitively as possible in accordance with UW-Madison salary ranges. Proper procedures will be followed to ensure qualified candidates from diverse backgrounds are notified of all vacant positions. Search and screen committees will be utilized and national searches will be conducted. To ensure quality control with program standards, all finalists will have a personal interview with the Wisconsin Sea Grant director who will make the final hiring and salary rate decision.

To ensure that outstanding staff members are retained, the performance of all professional staff will be reviewed annually. Written criteria for merit/promotion will be distributed to and submission of

written activities reports required of all staff members. In addition, throughout the year, professional development will be encouraged and supported.

Individual principal investigators with nationally peer-reviewed and approved Sea Grant-funded projects will be responsible for selecting and monitoring the performance of students on their individual projects. UW Sea Grant will also provide support for Sea Grant-funded graduate students to attend/present papers at professional meetings and complete their theses after projects end.

Begun in 2005 and continuing into 2006, a survey of former UW Sea Grant-supported graduate students is being conducted to measure the success of our efforts in this area. All former graduate students supported by our program since its inauguration in 1968 will be asked for information about their current employment and professional lives, whether they are employed in a field directly related to their graduate education, and whether they consider their Sea Grant experience to have had a positive influence on their career.

- *Establish workplace conditions that foster individual and organizational success.*

To meet this priority, all staff members at the time of hire will receive a written copy of university policies and procedures, together with program criteria for merit/promotion. During the year, staff members will receive updates on university and program policies via regular staff meetings and e-mail notification. A designated institute staff member will serve as the first step in grievance procedures for classified staff and the overall department contact for sexual harassment concerns.

All managers and supervisors will be required to take a course on effective management of people and processes. All staff members will be encouraged to attend university training programs offered throughout the year on maintaining a harassment-free workplace as well as diversity awareness seminars. Our assistant director for research & outreach and publications editor will continue to serve on the UW-Madison Graduate School Equity & Diversity Committee. Our assistant director for administration was selected for and is participating in the 2005-06 Joseph F. Kauffman Administrative Development Program, a 16-session management seminar series. Recently, our art director was approved to attend the UW-Madison campus Leadership Institute, a nine-month program addressing the development of human resources and the creation of a campus environment respectful of its diverse membership. These activities will continue into the 2006-08 biennium.

We will actively promote an attitude of respect and civility in the workplace. It is UW Sea Grant Institute policy that all employees be treated respectfully regardless of race, color, creed, politics, status or job.

- *Maximize the potential of our human resources.*

To meet our priority of maximizing the potential of our human resources, payment or employee reimbursement will be provided for at least one short course, workshop, meeting or independent learning of new skills and techniques directly related to job performance for each staff member in each of the next two years. The Sea Grant Information Technology team will also provide staff members in-house training programs (including workshops, short courses, and one-to-one assistance) in Internet and modern communications technologies and programs on a continuing basis.

All new academic staff members will receive a written appointment letter with the terms and conditions of their appointment, which will include a 12-month evaluation period with a written evaluation of performance after six months of service.

The Aquatic Sciences Center also maintains written criteria for annual merit and promotion evaluations. Staff members are required to submit written annual activities reports and offered an opportunity for a private interview with the Sea Grant director. They are also informed in writing that recommendations for annual merit allocations and, if appropriate, promotion are determined on the

basis of the annual written activities report, together with written and oral testimonials, comments from client groups served, and direct observation by the supervisor.

To foster effective communications and teamwork, staff meetings of managers will be held each week during 2006-08 to coordinate staff activities and program management. It will be the responsibility of this group to keep the outreach specialists and communications/library staff informed both of individual and of program developments as a whole. Twice a year, joint meetings of all staff—led by the center director—will be held. These will include updates on program policy and activities and provide an opportunity for questions and answers as well as providing a time to program and project planning. In addition, we will develop a centralized intranet for all ASC staff. The intranet will allow us to share documents, contact information, schedules and other information via a Web browser from any location.

In support of all three of the above Goal 5 priorities, a departmental Equity & Diversity Committee was formed in 2005 and an implementation plan developed. With the aid of this committee, UW Sea Grant will strive to hire and retain an outstanding and diverse staff and to cultivate a supportive workplace climate where all employees can succeed and excel in their careers.

3. Our Evaluation Process: How We Will Measure Success

Our strategic plan includes a list of performance measures for evaluating success in both administration and programmatic areas. Our milestones for implementing in each theme area and administrative priorities (described earlier in section II-2) will also serve as a means of evaluating and measuring success in those areas. What follows is our process for measuring the success of individual projects.

Research and Education Projects

When a project is included in the University of Wisconsin Sea Grant College Program, it is approved for a specific period of time (usually from one to three years). In-depth progress reports detailing progress toward meeting project objectives are required annually. Continuation of funding is dependent upon submission of a satisfactory progress report.

Specifically, we request that investigators describe their progress toward meeting each project objective and, where possible, document it with letters or other evidence. They are also asked to describe ways in which project results to date have been communicated to others (conference presentations, contacts with agencies and other researchers, meetings with user groups, etc.) and to note all publications and theses, degrees granted and/or students trained as a result of the project. We also require a detailed justification of any major shifts in project emphasis or significant budget changes.

These in-depth progress reports are reviewed and evaluated by UW Sea Grant Institute staff before a project is forwarded to the NOAA Sea Grant Office for continued funding. Continuing projects are not subjected to external review unless the project is making insufficient progress toward its objectives, or its focus has changed significantly from the originally approved work plan. Continued funding for these projects also depends on adequate funding of the overall Wisconsin Sea Grant program.

The PIs of *all* projects funded during the previous year—whether or not they continue into the next fiscal year—are required to submit a brief annual report summarizing the progress made on their projects during that time, which are compiled for developing our program's mandatory annual progress report to the NOAA Sea Grant Office in connection with our annual omnibus proposal submission. A similar progress report is also required for projects for which funding has terminated,

pending submission of a detailed project completion report within three months of the termination date of the project.

We also monitor project progress and results both during a project and after its completion, principally through our iPRO system and the presentation and publication of science journal papers resulting from each project. This is achieved by paying for journal publication charges (aka page charges) and article offprint/reprint purchases through our Communications Office budget and requiring that 10 copies of all other publications resulting from a UW Sea Grant project be submitted with the project completion report. This helps us monitor project progress and ensures that we are informed of all resulting publications, that Sea Grant funding is properly acknowledged, and that copies of the articles are disseminated to appropriate campus libraries, user groups and the National Sea Grant Library.

Outreach Programs

Per NOAA Sea Grant guidelines, a full project write-up, including updated work plan, is required every four years for our core Advisory Services and Communications programs. These programs are subjected to internal review, and the work plan for these programs are developed in consultation with program administration, external advisory groups and the NOAA Sea Grant Office. In addition, we require the submission of a detailed progress report and updated work plan every two years, and we conduct full external reviews of these programs every four years. Furthermore, all program staff members submit quarterly activities reports, and the director conducts annual performance reviews of all program staff. The assistant director for research and outreach holds weekly conference calls and makes at least semiannual visits to UW Sea Grant's four field offices. The Communications staff meets on a weekly basis and participates in "all hands" meetings with Advisory Services staff every six months.

Continuing outreach activities that require significant commitments of resources undergo periodic internal review as well as regular external evaluation. For example, a telephone survey of every radio station that carries "Earthwatch Radio" is conducted biennially to monitor the program's quality and value. A survey of all recipients of our new quarterly *Aquatic Sciences Chronicle* newsletter will be conducted every two years, starting in 2006. Media relations efforts and news release usage are monitored on a monthly basis through a newspaper clipping service. All major publications are evaluated internally at the conceptual phase and must undergo external peer/user review at the manuscript phase before they are accepted for publication. Publications marketing, sales income and distribution rates are monitored regularly by the Communications Manager. Use of our World Wide websites are monitored monthly through analysis of WebTrends® computer statistical logs.

All new special, noncore outreach projects must undergo and pass the same review and approval process as new research and education projects.

4. Interaction and Integration with Other Programs

UW Sea Grant staff members and researchers are regularly and actively involved in a wide variety of both Great Lakes and national Sea Grant network efforts. Examples of these interactions and integration with other programs during 2006-08 include establishing the Great Lakes Center for Ocean Science Education Excellence with the Great Lakes Sea Grant Network, exploring the potential for a commercial siscowet (fat trout) fishery on Lake Superior with Minnesota Sea Grant, the development of the Great Lakes Circle Tour Coastal Access Guide in partnership with the Great Lakes Commission and other interested states, outreach on scuba diving health risks to seafood and recreational divers in collaboration with Puerto Rico Sea Grant and Divers Alert Network, statewide dissemination of rip current warning signs and brochures in partnership with the Michigan and North

Carolina Sea Grant programs, National Weather Service (NOAA) and the U.S. Lifesaving Association, and continuing development of the national Sea Grant Non-Indigenous Species (SGNIS) website in collaboration with Illinois-Indiana Sea Grant.

The directors of the seven Great Lakes Sea Grant programs meet regularly and each serves as network chair on a rotating basis. The Great Lakes Sea Grant Network's Advisory Services/Extension and Communications staff members meet for an outreach professional development and planning workshop every 18 months. Each program serves as workshop host on a rotating basis. During 2006, the workshop will be hosted by Michigan Sea Grant and held in Alpena, Mich., the site of the recently established NOAA Thunder Bay National Marine Sanctuary and Underwater Preserve, the first national marine sanctuary in the Great Lakes.

Wisconsin Sea Grant staff members also are regularly called upon to serve in leadership roles at the regional and national levels both within and outside the Sea Grant program. For example, UW Sea Grant's director (**Andren**) chairs the Sea Grant Association's Program Mission Committee, and our assistant director for research & outreach (**Hurley**) is cochairing the 2006 International Conference on Mercury as a Global Pollutant and is member-at-large on the Sea Grant Extension Leaders Assembly's Executive Committee as well as the liaison to the Sea Grant Communicators National Steering Committee. Our assistant director for administration & information (**Reeb**) currently serves as SGA representative on the NOAA Sea Grant Program Information Work Group, and our communications manager (**Wittman**) is the Sea Grant communicators' liaison on the AIS Theme Team and chair of theme team communicators. "Earthwatch Radio" producer (**Hoops**) serves as chair of the Sea Grant communicators' national Radio Task Group. Our GIS specialist (**Hart**) is a member of the *Coastal Management Journal* Editorial Board and the Wisconsin Land Information Association's Board of Directors. Our water quality & habitat restoration specialist (**Harris**) serves on both the national and regional Ecosystems & Habitats theme teams and the Coastal Communities & Economies Theme Team. Our AIS specialist (**Moy**) cochairs the Chicago Sanitary-Ship Canal Fish Barrier Advisory Panel, chairs the Asian Carp Rapid Response Team as well as the Great Lakes Panel on Invasive Species' Research Coordination Committee and the Great Lakes Regional Collaboration AIS Team's Waterways and Canals Committee. And our education program coordinator (**Lubner**) is chair-elect for the Sea Grant Network's Education Steering Committee.

As shown by outreach staff memberships and service on a variety of committees, professional associations, and advisory boards (**Appendix C**)—along with our planned outreach partnerships with numerous local, state, regional and national agencies and organizations (**Appendix G**)—the UW Sea Grant program interacts directly with numerous local, state, regional and national organizations, and it is well integrated with a wide range of other agencies, such as NOAA's Great Lakes Environmental Research Laboratory and Coastal Services Center; U.S. Geological Survey; U.S. Coast Guard; Great Lakes Fishery Commission; Great Lakes Commission; USDA's North Central Regional Aquaculture Center; U.S. Environmental Protection Agency's Great Lakes National Program Office; U.S. Army Corps of Engineers, and the U.S.-Canadian International Joint Commission.

IV. Review, Revisions and Results

1. Timing and Mechanisms for Reviewing Program Progress and Results

Internal monitoring of our program's progress, budget and expenditures is conducted on an ongoing basis by the program's management team (director, two assistant directors, program information specialist and fiscal officer). The program management team and the program's Information Technology committee meet biweekly. Our Web-based project database and program management system is being further developed to enhance the compilation and access to program data and project results by both program management and outreach staff.

Our theme area coordinators (Appendix E) regularly assess progress in all projects within the theme. They are charged with planning, coordination and synthesis of results of their respective thematic areas in collaboration with other UW Sea Grant outreach staff. In addition, we have initiated an ongoing series of theme-area meetings, workshops and conferences to facilitate the transfer of information directly to agency personnel, potential users and the public. Three such theme-area meetings have been held to date. We plan to conduct at least one such meeting each year during 2006-08.

For additional details regarding the timing and mechanisms for monitoring and reviewing the progress and results of individual projects, see section III-3, "Our Evaluation Process: How We Will Measure Success."

2. Program Revision and Redirection during Implementation

Given the relatively short, two-year time span of our program implementation and the limited amount of discretionary funds available to us, we anticipate little need to significantly revise or redirect our program during the course of the 2006-08 biennium. We will use our program development and regional collaboration funds for rapid response to emerging issues and opportunities that arise during the grant period. Significant changes in project objectives and redirections in project funding require the program director's approval and, if major, NOAA Sea Grant approval as well.

As a matter of course, we regularly encourage our staff and potential investigators to respond to calls for proposals stemming from NOAA Sea Grant National Strategic Investments, fellowships and other special funding opportunities. PIs of proposals that deal with topics of NOAA Sea Grant National Strategic Investments (e.g., Aquatic Invasive Species, Oyster Disease and National Marine Aquaculture competitions) are encouraged to submit them for those competitions. We presently have two projects funded through the invasive species NSI – "Inhibition of Zebra Mussel Attachment by Bacterial Extracellular Polymers" (**Maki, R/BT-18**), which terminates May 31, 2006, and "Extending and Evaluating the National 'Stop Aquatic Hitchhikers!' Campaign along Key Invasion Corridors in Three Upper Midwest States" (**Moy, A/AS-57**), which continues through 2006-07 – along with a Sea Grant-Industry Fellowship ("A Hybrid Photocatalytic/Disinfecting Point of Use Drinking Water Treatment Device," **Anderson, E/E-49**) that ends May 31, 2006. In addition, we will use our **Coastal Community Development** funds to partially support a new project in our Digital Oceans Theme, "Geospatial Technologies for Land Use Planning in Great Lakes Coastal Communities" (**Ventura, R/DO-1**), as well as some of the closely related activities of our GIS outreach specialist (**Hart, A/AS-1**) in the Coastal Communities & Economies thematic area.

We will also continue to routinely seek grants and funding from a variety of other campus, state, regional and national sources to support and/or supplement our programs and special initiatives.

3. How We Will Synthesize, Package and Disseminate Results

As described earlier, our theme area coordinators (Appendix E) play a leading role in the synthesis, packaging and dissemination of the results of UW Sea Grant-supported research, education and outreach projects and related activities. This transfer of information and technology is achieved through a wide variety of means, including publication of project results in peer-reviewed science journals, thematic area meetings and outreach workshops, one-to-one assistance and hands-on training, presentations at professional associations and service clubs, media relations, newsletters and other publications, our “Earthwatch Radio” program, the World Wide Web, email listservers and other information technology.

Primary responsibility for reporting project results rests with the principal investigator(s). First and foremost, PIs are encouraged to seek publication of project results in the peer-reviewed professional journals in their fields. To facilitate this, the UW Sea Grant Communications Office pays any journal publication charges and also handles the purchase and distribution of reprints of all refereed research articles that are based on and properly acknowledge UW Sea Grant support.

Communications staff members regularly contact and meet with project investigators and students in connection with producing our quarterly newsletter and other program reports, news releases, “Earthwatch” radio programs, websites and other means of communicating the progress and results of all UW Sea Grant research, outreach and education projects. PIs are also asked to inform UW Sea Grant Communications staff immediately of any major developments or publications resulting from their project(s) so that this information can be conveyed to NOAA Sea Grant and other audiences as appropriate.

PIs are also encouraged to seek publication in related media, such as trade journals, magazines and newspapers. Communications Office staff work with PIs to prepare fact sheets, news releases and magazine articles about their work, and they are available to assist PIs in dealing with the news media and in making radio and television appearances. On request, Communications staff may also help PIs prepare materials for professional papers and presentations, with publicizing conferences and workshops, and with photographing or videotaping their work.

Besides formal reports, project progress is also monitored and reported through occasional theme-area briefings involving project investigators and UW Sea Grant outreach and management staff. Each member of our Advisory Services staff serves as the coordinator for one or more theme areas (see Appendix E) and tracks the progress of individual projects within their thematic areas. These theme area research and outreach workshops are designed to facilitate cross-disciplinary transfers of information among researchers as well as with outreach staff and potential users, and they serve as a reporting and project evaluation mechanism for program management. Outreach staff also use the results presented at these meetings to develop or enhance their work plans. We plan to continue holding such workshops on an annual basis during the next biennium.

During the last biennium, we established and implemented a one-month research/project assistantship outreach program whereby a graduate student researcher can be supported to work with our Communications and/or Advisory Services staff members to develop appropriate means of preparing, packaging and disseminating research results via journal articles, fact sheets, popular magazine stories, websites, workshops, public presentations, etc. We plan to continue and, if funding permits, expand this productive program during 2006-08.

V. Nationalization of the Implementation Plan

1. Program Elements with National and Regional Application

Appendix J shows the correlation of each UW Sea Grant project for the next biennium to the various national Sea Grant themes, which are the basis for the NOAA Sea Grant Strategic Plan for FY2003-08 (**Appendix A**) as well as UW Sea Grant's strategic plan.

Besides addressing the national priorities of the NOAA and NOAA Sea Grant strategic plans, the 2006-08 Wisconsin Sea Grant program also will address a wide range of priorities to benefit the full spectrum of constituents at the local, state, regional and national levels. The following sections detail the applicability of each individual Wisconsin Sea Grant project in each national Sea Grant theme.

Aquaculture

“Aquaculture Advisory Services for the Great Lakes Region” (Binkowski, A/AQ-1). Our aquaculture outreach efforts will assist in the sustained development of this rapidly growing state industry and promote further economic development. Because of the relative newness of this field, there is a critical need for practical and up-to-date information on rearing techniques. Many potentially marketable species are not fully domesticated. The UW Sea Grant Aquaculture Advisory Services Program provides needed information to both practicing and prospective aquaculture entrepreneurs. One of the stated objectives of the national Sea Grant Aquaculture Theme Team effort is to increase the value of domestic aquaculture production from \$900 million to \$5 billion by 2025. This project will assist this objective by increasing the value of aquacultured fish in the Great Lakes region. This new project focuses on coldwater fishes, such as perch and walleye, as the market for these in the Midwest is predicted to grow substantially due to the high quality of their flesh.

“Development of Yellow Perch Broodstocks for Selective Breeding” (Goetz/Binkowski, R/AQ-41). Yellow perch in the wild only spawn once a year, usually in the early spring in the Great lakes region. This new project seeks to develop broodstock of yellow perch that can produce offspring at multiple times during the year. Using DNA microsatellite markers, the investigators will examine broodstocks from multiple regions in the United States to see what characteristics may enhance the possibility of multiple spawnings in a given year. The implementation of this approach will help in the identification of gene complexes responsible for reproduction, growth and other desirable traits so that state-of-the-art genetic manipulations can be applied to yellow perch aquaculture.

“Increasing the Efficiency of Yellow Perch Fingerling Production by Optimizing Pond Trophic Dynamics and Feed-Training Strategies” (Hartleb/Malison, R/AQ-42 – *If funding becomes available*). Production of viable fingerlings is critical for maintaining cost-effective yellow perch aquaculture pond systems. The investigators seek to assess various nutrient addition strategies to optimize plankton production and benthic assemblages for pond culture. They will also try to determine the role of prey availability on successful survival of yellow perch larvae. If successful, this work will enhance organism growth and final product quality, as well as the stability of formulated feeding scenarios.

“Endocrine and Environmental Regulation of Growth in Yellow Perch” (Malison/Barry, R/AQ-38). This continuing project will develop methods for improving the growth and production characteristics of yellow perch reared under pond and tank aquaculture conditions. The implementation of these methods will directly improve the profitability of perch culture and thereby provide the impetus for expansion of this industry both in Wisconsin and throughout the Upper Midwest.

“Tetracycline Antibiotics and Resistance Genes in Aquaculture Environments: Genotypic Diversity and Potential Resistance Reservoirs” (McMahon/Pedersen, R/AQ-40). In our national theme effort, health and disease problems of aquacultured fish is a high-priority research area. There is a great need for improved diagnostic capabilities for aquatic pathogens and parasites as well as therapeutic treatments to deal with these pathogens. This continuing project will examine whether antibiotic treatment produces environmental problems. Specifically, the PIs hope to establish whether antibiotics released to the environment via aquaculture discharges affect microbial populations.

Aquatic Invasive Species Theme

“Impact of the Round Goby on Yellow Perch Recruitment” (Janssen, R/AI-1). The yellow perch recruitment in Lake Michigan is low compared to the early 1990s. Several theories have been put forth as to why this is. One plausible cause is that the round goby, a nonnative species, may be responsible for some of the decline. The round goby uses the same kind of rocky habitats as those where yellow perch spawn. The investigator has identified a number of areas in Lake Michigan where he can observe yellow perch-round goby interactions. Understanding the interaction between these two species at multiple sites allows for comparison of round goby invasion mechanisms and should provide a framework to develop predictive and management tools for yellow perch in any of the Great Lakes. This new project will address national research needs to understand the biology of the invaders to develop effective means of prevention and control, as well as understanding their impacts on aquatic ecosystems.

“*Cercopagis* Invasion of Lake Michigan: Predictable Responses or ‘Invasional Meltdown’ of the Planktonic Food Web?” (Sandgren/Berges, R/AI-2 – FY07 Start). *Cercopagis pengoi* is a predatory cladoceran zooplankton originally from the Ponto-Caspian region that is starting to invade Lake Michigan. The investigators propose to examine the ability of Lake Michigan to absorb the new perturbation by studying the dynamics of competing invertebrate predator populations, studying feeding preferences and quantifying shifts in the underlying herbivorous zooplankton-phytoplankton-nutrient interactions. The proposed research will address national research needs to understand the biology of the invaders to develop effective means of prevention and control, as well as understanding their impacts on aquatic ecosystems.

“Reciprocal Spread of Invasive Species in Lake Michigan Coastal Habitats” (Vander Zanden, R/AI-3 – FY07 Start). Tributaries provide a pathway for AIS from the Great Lakes as well as to the Great Lakes. This investigator proposes to study the invasion of round goby to inland lakes as well as the invasion of rusty crayfish to the Great Lakes. The proposed research will also address the national research priority of understanding the biology of the invaders for developing effective prevention and control methods and understanding AIS impacts on aquatic ecosystems.

“Quagga Mussel Invasions: Functional Morphology, Biomechanics, Zebra Mussel Displacement and Future Spread” (Lee, R/LR-91). While zebra mussels rank among the most undesirable invaders in North America, they are now being replaced by the quagga mussel in the Great Lakes. One of the reasons seems to be that quaggas can populate a larger variety of substrates, including soft bottoms. The goal of this project is to explore the functional morphology of the quagga as a mechanism for displacement of the zebra mussel. This continuing project will add to our national effort on research and outreach activities on invasive species. The nonindigenous species invasion poses one of the most serious threats to our nation’s ecosystems, and this project seeks to add to our knowledge of this invader.

“Predicting the Impact of Zebra Mussels on Trophic Transfers in Green Bay: Ecosystem Modeling and Lower Food Web Interactions with Fish” (DeStasio/Reed, R/LR-93). Coastal ecosystems in the Great Lakes have changed dramatically since the invasion of zebra mussels in the late 1980s. Green Bay, an important freshwater estuary in Lake Michigan, was intensively studied

prior to the invasion by zebra mussels. This continuing project will try to answer the question: “What role has the zebra mussel played in recent changes in phytoplankton, benthos, zooplankton and fish of Green Bay?” The PIs will use a combination of ecosystem and bioenergetics modeling approaches to address this question. New field data will also be collected for comparison purposes. This project addresses the national Sea Grant program goal of developing a better quantitative understanding of the structure and function of critical coastal ecosystems, especially as related to exotic invaders.

“Expanding Cattails and Shrinking Sedge Meadows: Reversible?” (Zedler, R/LR-96). Great Lakes coastal wetlands provide multiple “ecosystem services,” including biodiversity support. The Great Lakes wetlands are increasingly invaded by monotypic cattail stands at the expense of species-rich sedge meadows. As urbanization continues along the shores of the Great Lakes, human activities increasingly impinge on coastal wetlands. If Great Lakes wetlands are no longer resilient, their biological integrity is at risk. This continuing project is designed to provide land stewards with information about what causes cattail expansion and whether sedge meadows can recover passively or must be actively restored. This project will contribute to the national research and outreach effort on invasive species. It will also add to our knowledge of the functions of wetlands. As stated above, the nonindigenous species invasion poses one of the most serious threats to our nation’s ecosystems, and this project will further our knowledge of yet another invader.

Aquatic Nuisance Species NSI project: “Sea Grant Non-Indigenous Species (SGNIS) Web Site: Development and Support” (Moy, A/AS-53). We believe that making Sea Grant and other NOAA aquatic invasive species (AIS) research and outreach accessible via the Internet, while maintaining high scientific standards, directly enhances the management, control and prevention of AIS throughout the continent and beyond. Over the past year, the Sea Grant Non-Indigenous Species (SGNIS) website was accessed more than 3 million times, including nearly a million times by people in 125 other countries. This continuing project addresses the invasive species priority articulated in our national theme effort on Ecosystems & Habitats and is part of Sea Grant’s national efforts to respond with integrated, multistate programs of research, outreach and education to bioinvasive threats.

Biotechnology

“Latent Toxicity in Adult Zebrafish Following Early Life Stage Exposure to 2,3,7,8-Tetrachlorodibenzo- ρ -Dioxin” (Peterson/Heideman, R/BT-20). Exposure to 2,3,7,8-tetrachlorodibenzo- ρ -dioxin (TCDD) in the early stages of fish development can have lasting influence. Using sublethal levels of TCDD, this project will use zebrafish to determine if development is disrupted, organs are degraded or diseased, feeding is inhibited, body growth is affected or if reproduction is affected. This proposed research will also enable the investigators, who have extensive experience in the use of genetic biomarkers, to better understand if such effects are permanent or reversible. Sublethal concentration of TCDD may affect feeding, predation-avoidance behavior and reproduction in feral fish populations. This new project addresses the national Marine Biotechnology goal of producing sensitive and accurate means of predicting impacts of stressors on marine organisms to strengthen indices of coastal ecosystem health.

“Parallel Toxicogenomic Resources for Zebrafish and Rainbow Trout: Identifying Conserved Molecular Biomarkers of Toxicant Exposure” (Rise/Carvan, R/BT-21). The investigators plan to evaluate TCDD and methylmercury effects on gene expression. They will combine DNA microarray work with quantitative reverse transcription-polymerase chain reaction methodologies. The researchers will develop a library that can then be used as reference for examining toxicant responses among Great Lakes feral fish species. This new project also addresses the national Biotechnology Theme goal of producing sensitive and accurate means of predicting impacts of stressors on marine organisms.

“Genomic Approach to Understanding TCDD Toxicity in Zebrafish” (Heideman/Peterson, R/BT-22 – FY07 Start). This research will directly address gene expression changes associated with TCDD exposures. The zebrafish is used as a model because its genome has essentially been mapped; this research team will take advantage of such information to evaluate genetic effects of exposures. The goal of the project is to determine whether different TCDD responses in tissues correspond to distinct gene expression pattern. By 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 feral fishes of the Great Lakes. This proposed project will extend previous, continuing and new research by these PIs to address the Marine Biotechnology goal of predicting impacts of stressors on marine organisms.

“AhR Signaling in Rainbow Trout and Zebrafish” (Heideman/Peterson, R/BT-17). This continuing research will provide a better understanding of the processes that underlie toxic responses to AhR agonists that are observed in native North American fish species in the Great Lakes and coastal waterways. The potential findings have significant practical application and should be used extensively by state, national and international organizations to assess the risk to feral fish populations of low-level contamination by dioxins, furans, and PCBs. This well-reviewed project addresses the same national goal as our other projects in this theme.

Coastal Communities & Economies

“Measuring Interrelated Demands for Commercially Caught Fish” (Bishop, R/PS-57). The goal of this continuing research project is to improve methods to evaluate commercial fish harvests in a multiple-species framework that recognizes how different species are related in the marketplace. This effort is a multi-institutional undertaking involving scientists from both the University of Wisconsin-Madison and North Carolina State University. The PIs will use an updated and expanded set of econometric estimates of models of interrelated vessel-level demands for major finfish species landed in the Mid- and South-Atlantic areas, as well as for the Great Lakes and other regions, including the Gulf of Mexico and the north Atlantic. Fishing is big business. However, many of our nation’s marine and Great Lakes fisheries are in serious trouble. To make the best decisions, fishery managers must have a reasonable idea of how many fish comprise each population and how these populations interact. One of the national goals of Sea Grant is to provide socioeconomic data that will enable fisheries managers to understand the economic impacts of various harvesting scenarios. This is one of the first studies to examine these issues on a national scale.

Coastal Natural Hazards

With the hiring in 2004 of a new coastal engineering outreach specialist, UW Sea Grant will continue its outreach efforts in the Coastal Natural Hazards theme. We will continue to partner with the Great Lakes Sea Grant Network to increase awareness of the dangers of rip currents in the Great Lakes. In 2002, seven people drowned in a single day due to rip currents on the shoreline of Lake Michigan—a clear indication of a need for increased outreach activities on this subject. Along with our Communications staff, our Advisory Services water safety specialist will address these concerns in Wisconsin and also partner with NOAA Sea Grant and the National Weather Service (NWS) to utilize the emerging technologies of the NWS for a rip current early-warning system. In partnership with the NOAA Great Lakes Environmental Research Laboratory, we will also provide outreach on current climate change models and potential effects on Great Lakes water levels and coastal infrastructure.

Digital Ocean-Great Lakes Geospatial Technologies

“Geospatial Technologies for Land Use Planning in Great Lakes Coastal Communities” (Ventura, R/DO-1). This new project expands our geospatial technologies outreach activities aimed

at enabling stakeholders to take advantage of newer technologies such as integrated observation systems, automated retrieval of archived records and visualization by empowering local, regional and tribal governments to use GIS, Web mapping and spatial models in their planning efforts. This project will develop new tools for coastal environmental managers for better planning purposes. When integrated with *in situ* observation systems in coastal waters, these systems will serve as the backbone for incorporating state-of-the-art technologies to planning and modeling for natural disasters, community development and nonpoint-source pollution prevention.

“LakeSat: Near Real-Time Monitoring of Water Quality in Green Bay and Wisconsin's Lake Michigan Coastal Waters via Satellite Remote Sensing” (Chipman/Lillesand, R/MW-88). This continuing project seeks to develop and employ high-resolution satellite imageries to monitor water quality parameters in an important freshwater estuary in the Great Lakes. While Landsat images have been used with some success to study such water quality parameters as suspended sediment loads, chlorophyll *a*, temperature and turbidity, there were problems with the spatial resolution of these images. Recent satellites have been equipped with more advanced sensors, which must be calibrated. This project will access satellite images with better resolution, both in the spatial and temporal dimensions. A vigorous national effort to develop “ocean observation” systems is presently underway, especially in the marine coastal domain. The vision is that, in the not-too-distant future, a global integrated three-dimensional network of sensors will exist that is capable of measuring a host of physical, chemical and biological parameters in real time. A key requirement for such a system is the ability to make measurements in vertical as well as horizontal scales. Sea Grant is actively participating in this national effort. This project will thus contribute directly to this national effort.

Ecosystems & Habitats

“Lake Superior Food Web Dynamics: Modeling at Multiple Scales” (Kitchell, R/EH-1 – FY07 Start). This new project uses bioenergetics modeling to predict short-term trophic interactions in Lake Superior. The project links with a study funded by Minnesota Sea Grant that will serve as ground truth for modeling scenario. This is the first such attempt to model diel changes in predator-prey relationships in nearshore and offshore environments in the largest and deepest Great Lake. This project addresses a national priority in that Lake Superior, one of the world’s most important bodies of fresh water bodies, is also one of the least studied Great Lakes, especially in terms of fisheries. The predictive capabilities developed in this project also will be applicable to marine fisheries issues.

“Growth and Detachment of *Cladophora* in Lake Michigan” (Young/Bootsma, R/EH-2 – *If funding becomes available*). The re-emergence of the green filamentous alga *Cladophora* along the shores of western Lake Michigan has been a cause of alarm for coastal communities. The proliferation of this algal, mostly associated with excessive eutrophication, has been perplexing to many researchers. This proposed new project aims to better understand processes that lead to the accumulation of decaying algal material on coastal beaches. It has been hypothesized that dreissenids (zebra and quagga mussels) have a role in *Cladophora* growth in that they have altered phosphorus cycling in nearshore waters. This project addresses an AIS thematic priority of investigating the effects of invasive species on nutrient cycling in the Great Lakes ecosystem, as well as the Ecosystems & Habitats priority of research on nuisance algal blooms. Few studies have addressed detachment of the alga from substrates, and this study will provide key data on physiological conditions of both *Cladophora* and dreissenids that influence this process.

“Impact of a Shifting Wind Field over the Laurentian Great Lakes on Accumulation and Resuspension of Sediments in Green Bay, Lake Michigan” (Waples/Klump, R/EC-10). Beginning around 1990, a significant shift in summer surface winds occurred over the Laurentian Great Lakes. This wind shift may have changed sedimentation accumulation and resuspension patterns in several regions of the Great Lakes. Many contaminants are associated with sediments as

they travel from the watershed to their ultimate resting place on the lake bottom. Green Bay, a freshwater estuary in Lake Michigan, has been heavily contaminated by toxic chemicals. The bay has been intensively studied as part of a program to remediate all “Areas of Concern” in the Great Lakes. As a matter of fact, the so-called “Mass Balance” study of the late 1980s is considered a model for solving problems in all contaminated estuaries of the world. Understanding if and how the observed shift in wind direction has affected particle dynamics in Green Bay is crucial and might help to explain some fluctuations in chemical inventories and biological populations that are occurring. Important objectives for Sea Grant’s national Ecosystems & Habitats Theme in the area of “Healthy Coastal Ecosystems for a Healthy Economy” include research and outreach efforts to minimize the negative impacts of human-induced changes to our coastal ecosystems. Results from this continuing project will enable resource managers to better understand factors responsible for the transport and ultimate fate of contaminants in our nation’s estuaries.

“Compensatory and Spatial Dynamics in Great Lakes Food Webs” (Kitchell, R/LR-94).

Agencies charged with managing Great Lakes fisheries have developed fish community objectives that seek to maintain sustainable levels of forage and native populations. Such objectives recognize the realities associated with our limited ability to manage whole fish communities and our limited understanding of how complex dynamics have shaped Great Lakes food webs in the past, as well as how they will change in the future. This continuing project is designed to guide the development of efforts directed toward more effective management of predator-prey interactions in fish populations. The PI is developing both empirical and theoretical tools for evaluating the compensatory responses as indicators of change in trophic interactions. The PI will also modify their widely used ecosystem-scale models (*Ecosim* and *Ecospace*) to account for littoral versus pelagic subsystems and their interactions. As noted earlier, many of our nation’s marine and Great Lakes fisheries are in serious trouble. To make the best decisions, fishery managers must have a reasonable idea of how many fish comprise each population and how these populations interact. One of the national goals of Sea Grant is to provide biological data that will enable fisheries managers to understand how species interact and how these affect various harvesting scenarios. Great Lakes fisheries are perhaps the most managed large-scale fisheries in the world. Professor Kitchell and his colleagues are recognized leaders in fish bioenergetics and compensatory responses, and their work has influenced fisheries management all over the world.

Fisheries

“Hydrodynamics, Chlorophyll and Larval Fishes” (Janssen, R/FI-1 – FY07 Start). This new project examines the effect of thermal structure, particularly the development of thermal wedges and plumes on the success of larval fishes in Lake Michigan. The research will help determine if the recent poor year classes of pelagic fishes result from thermal factors in the lake. The shift from warm to cooler coastal waters results in lower productivity of both algae and zooplankton, thus affecting growth rates of sensitive larval fish, such as yellow perch. This project will help satisfy a thematic priority of elucidating the dynamics of yellow perch recruitment and identify the key factors preventing the fishery’s recovery from a population collapse in Lake Michigan in the early 1990s. Moreover, if these low recruitment events are due to thermal structure, it could indicate how climate change would directly affect the food web structure of the lake, as well as in other national aquatic fresh and marine water systems.

“A Retrospective Analysis of Lake Michigan and Lake Superior Food Webs” (Vander Zanden, R/LR-92). Rehabilitation of native fish populations is a basin-wide priority of the Great Lakes Fisheries Commission, yet little is known about the trophic ecology and niche partitioning within the historical lake communities. Furthermore, the present dominance of exotic fishes and invertebrates in the Great Lakes may severely constrain restoration options. This continuing project will use a combination of stable isotope analysis techniques and preserved museum muscle tissues to

reconstruct trophic relationships in the Great Lakes. As mentioned earlier, one of Sea Grant's national Ecosystem & Habitats objectives regarding the effect of invasive species is to understand their role in changing trophic interactions in fisheries. Since the isotopic signature of a species should reflect the isotopic distribution of their food, the PI should be able to establish quantitative relationships between different trophic levels. These observations can then be used to establish restoration benchmarks for any type of fishery.

“Sustainability of Lake Trout Fisheries in Lake Superior” (Hansen, R/LR-95). Lake trout stocks collapsed in Lake Superior due mainly to effects of fishing exploitation and sea lamprey predation. Stock restoration was pursued through stocking, control of sea lampreys and fishing quotas. Progress in restoration suggested that stocking could cease in 1996. However, recreational and commercial fishing demands will make it difficult to know what quotas should be maintained because no accurate biomass estimates are available for Lake Superior lake trout. Using data from U.S. Fish & Wildlife Service and an age-structured population model, with mortality submodels, the PI is estimating the maximum sustainable rate of total annual mortality for the Wisconsin waters of Lake Superior. One of our national program's important objectives in the Fisheries Theme is to estimate fish biomass. This continuing project will develop and test a fish population estimation technique in cooperation with U.S. Fish & Wildlife Service scientists.

Marine & Aquatic Science Literacy

Wood, Steel and Steam: Shipwreck Archaeology, Preservation and Public Education (Broihahn/Karl, C/ML-1). This is the sixth in a series of highly successful and hugely popular projects on Wisconsin's Great Lakes shipwrecks. Led by the state underwater archaeologist, this two-year project will support work to increase our understanding of Great Lakes schooners, 19th century waterborne commerce and seafaring life. Equally important, previous work has increased the public's appreciation of the historical, cultural and economic significance of the Wisconsin aspects of the Great Lakes' maritime past at the state, regional and national level. This effort is part of Sea Grant's national commitment to deliver aquatic science information to the public through lifelong learning experiences, including workshops, field trips, lectures and internet offerings. One of the primary benefits of these efforts is that they will foster environmental literacy and encourage wise use and conservation of our nation's maritime heritage, and it offers a highly successful model for similar efforts in other Great Lakes states.

“Recent Advances in Limnology and Oceanography Seminar Series” (Berges/Brooks, E/ML-1). This project will continue a popular 32-year-old seminar series at UW-Milwaukee. Featuring eminent scientists, the purpose of the series is to focus attention on existing and emerging problems facing the Great Lakes and oceans, convey new ideas and knowledge necessary to understand and formulate solutions to these problems, and encourage informed discussions about the problems among scientists, policymakers and citizens.

“Lake Sturgeon Bowl: Wisconsin's Regional Academic Competition for the National Ocean Sciences Bowl” (Klump/Duffy, E/ML-2). In 1998, “The Year of the Ocean,” the National Ocean Sciences Bowl was established as an educational outreach program by the Consortium for Oceanographic Research and Education (CORE). In 2002, UW-Milwaukee hosted the first annual Lake Sturgeon Bowl, Wisconsin's regional competition for the National Ocean Sciences Bowl. By helping sponsor the Lake Sturgeon Bowl during 2006-08, this project will contribute to fostering an interest among Wisconsin high school students in ocean and aquatic sciences, expose them to career opportunities associated with ocean and aquatic systems, and demonstrate to the public the importance of the oceans and Great Lakes in our daily lives.

Great Lakes Center for Ocean Science Education Excellence (COSEE). By its very nature, this new five-year project, funded by NOAA and the National Science Foundation, is designed to improve

ocean/Great Lakes sciences education to the quarter of the U.S. population in the Great Lakes region not served by other COSEEs by delivering a regionally coordinated, teacher-oriented program directed at linking university researchers with the teaching community, including tribal educational institutions and K-12 public and private educators throughout the region. It has national application in that the Great Lakes COSEE will add critical freshwater components to the National COSEE Network.

“Earthwatch Public Service Radio Program” (Hoops, C/C-2). This continuing project was praised in the 2001 federal Sea Grant Program Assessment Team’s report on the Wisconsin program, and the Earthwatch project proposal for 2006-08 was highly ranked in peer reviews. Besides supporting UW Sea Grant’s Marine & Aquatic Science Literacy priorities, this project will provide significant support to the Sea Grant network’s strategic national communications and media relations efforts as well.

Urban Coast

“Evaluation of the Algal Nuisance *Cladophora* and its Effect on *E. coli* and Beach Closures” (Kleinheinz/McDermott, R/UC-1 – FY07 Start). The recurrence of nuisance *Cladophora* on its subsequent detachment and accumulation on Lake Michigan beaches has led to renewed public awareness of a specie that responds to elevated nutrient inputs. At the same time, enforcement of U.S. EPA Beach Act (2000) monitoring standards has resulted in numerous beach closings on Wisconsin’s coast. A multidisciplinary, multi-institutional team of investigators hypothesize that there is a link between *Cladophora* mats and elevated *E. coli* counts that trigger beach closings. The results of this study have potential widespread implications for management of this nuisance alga and for interpretation of sources of coliform that lead to beach closings. It directly addresses a national cross-cutting priority of our Urban Coast and **Biotechnology** thematic areas of developing biotechnological tools for addressing the problems of beach closings, harmful algal blooms and related water quality issues. It also addresses a national **Ecosystems & Habitats** priority of conducting research for deterring, eradicating and/or controlling nuisance algae and aquatic toxins.

“Development and Application of Molecular-Based Methods for Identifying Sources of Fecal Pollution at Lake Michigan Beaches” (McLellan, R/UC-2 – *If funding becomes available*). The indicator organism for determination of beach closures is *E. coli* bacteria, which has multiple sources, ranging from gull feces to human sewage system overflows. The diverse sources of *E. coli* make it difficult to develop appropriate and effective mitigation strategies. It is also a national Urban Coast priority in our **Biotechnology Theme** to develop biotechnological tools for addressing the problems of beach closings, harmful algal blooms and other water quality issues, as well as the Urban Coast Theme priority of identifying the mechanisms, sources and fate of bacterial and viral contamination responsible for beach closings in the Great Lakes and other coastal areas.

“Ecological Immunology of Amphibians in Stressed Great Lakes Ecosystems” (Karasov, R/UC-3 – *If funding becomes available*). This project will study the response of the northern leopard frog to organic and trace metal contaminant exposure and compare the results of their exposure with, *Xenopus tropicalis*, a well-studied frog species that has been used in developmental genetic studies. There is clear evidence that frogs found in the Fox River-Green Bay Great Lakes Area of Concern are contaminated with immunotoxic contaminants, and this study aims to identify key developmental steps that are affected by xenobiotics. This project addresses a national theme of assessing the threats to aquatic life posed by parasites and chemical or pathogenic contamination of the Great Lakes and other aquatic ecosystems.

“Sources and Transport Mechanisms for *Escherichia coli* Contamination at Lake Michigan Beaches” (McLellan, R/MW-89) – Beach closings are a major problem in the United States. The Beaches Environmental Assessment and Coastal Health Act of 2000 (BEACH 2000) went into effect in 2005. In this effort, the U.S. Environmental Protection Agency is directed to publish performance

criteria for pathogens and pathogen indicators for our nation's beaches. However, there are a number of obstacles that remain for the act to be of real use for our nation's beach users. Little is known about the exact nature and sources of beach pathogens, and indicator tests for *E. coli* take from 24 to 48 hours to develop. This continuing project is examining the mechanisms that generate elevated beach pathogen levels in the absence of obvious sources, a common situation for most beaches. This work thus addresses a national high priority objective regarding nonpoint-source pollution.

Innovative Science & Technology

“Improving Risk Estimation, Safety and Cost-Effectiveness in Scuba Diving” (Dueland/Lehner, R/ST-1). This new project's findings will improve diving safety by educating divers, dive instructors, educational and consulting organizations such as PADI, NAUI and DAN about decompression and related diving health risks. Recommendations derived from this research will offer practical approaches for reducing the risk of decompression injury in recreational, scientific and commercial diving. Based on the results of their previous Sea Grant-supported research, the PIs will work with the UW Sea Grant Communications Office on a major outreach effort during 2006-08 to alert seafood and other scuba divers to the risks of disabling dysbaric osteonecrosis, a result of inadequate decompression practices, in cooperation with Puerto Rico Sea Grant College Program, Divers Alert Network, the NOAA Diving Program and the national scuba diving industry. The PIs will also continue to work with the U.S. Navy, diving interest groups in Japan and recreational diving organizations to assure that existing diving tables reflect the latest research results as it relates to improving safety for governmental, commercial and recreational divers.

2. Implementation Plan Relationship to National Needs and How It Reaches Users

Implementation of the UW Sea Grant 2006-08 program, as described in the previous section, addresses almost all of the national Sea Grant theme priorities identified in the national Sea Grant strategic plan (see Appendix A) as well as the strategic goals and priorities of regional and national agencies, scientific organizations and other constituents that were considered in developing and updating UW Sea Grant's strategic plan.

In addition to being accessible on the UW Sea Grant website, this plan will reach potential users directly through the dissemination of more than 100 printed copies to UW Sea Grant staff and field offices, members of our advisory groups, various Wisconsin university administrators, NOAA Sea Grant and other NOAA officials, and Sea Grant directors nationwide. Our 2006-08 implementation plan will also be made readily available to all interested persons via CD and the UW Sea Grant website.

3. Suggested National and Regional Efforts to Implement Results

National

- Encourage the national/international adoption of the toxic equivalency factors (TEFs) being developed in our Biotechnology Theme as a standard for coplanar aromatic hydrocarbons and other toxic contaminant assessments (**R/BT-17, R/BT-20, R/BT-21**).
- Free, global accessibility via the Internet to the fish bioenergetics technology developed with UW Sea Grant support for predictive modeling applications and improving fisheries management worldwide in connection with completed project **R/LR-82**.

- Dissemination of UW Sea Grant diving physiology research results to the national/international diving community (**R/ST-1**).
- Publication and dissemination of information regarding the nonpoint sources and transport mechanisms that generate elevated levels of *E. coli* and other beach pathogens (**R/MW-89, R/UC-2**).
- National/international publicity and publication of a policy-relevant declaration of the present state of scientific knowledge regarding the atmospheric sources, public health risks and societal consequences of global mercury pollution based on the consensus reached by some 800 scientists at the 8th International Conference on Mercury as a Global Pollutant in 2006 in Madison, Wisconsin (**A/AS-1, C/C-1**).
- Nationally publicize the “Interactive Fish Identification and Bioenergetics Lab” educational website and market the software CD to educators, fisheries managers, anglers and other interested individuals throughout the Upper Midwest and beyond (**C/C-1**).

Regional

- Extension of Wisconsin GIS and other geospatial technologies for coastal management and comprehensive land use planning to other Great Lakes states (**R/DO-1, R/NI-33, A/AS-1**).
- Regionwide marketing and distribution of two recent UW Sea Grant publications entitled *Aquaculture Effluents and Waste By-Products: Characteristics, Potential Recovery and Beneficial Reuse* and *Best Management Practices for Aquaculture in Wisconsin and the Great Lakes Region* (**A/AS-54, R/AQ-37, A/AQ-1**).
- Extension of Wisconsin’s Great Lakes shipwrecks, maritime/water trails, and Great Lakes Circle Tour coastal access guide projects to other Great Lakes states (**C/C-7, C/ML-1, A/AS-1**).
- Regional dissemination of information regarding the possible contamination of Great Lakes fish with polybrominated diphenyl ethers in connection with completed project **R/MW-83** (**C/C-1**).
- Generate awareness among port, dock and marina operators regionwide regarding the problem of the accelerated freshwater corrosion seen in the Duluth/Superior harbor as well as the deteriorating timber piles and crib structures observed at many of Wisconsin’s major ports as a result of prolonged low water levels in the upper Great Lakes (**A/AS-1**).
- Actively participate in and contribute to the five-year *Great Lakes Center for Ocean Science Education Excellence* (COSEE) project to deliver a regionally coordinated, teacher-oriented program directed at linking university researchers with the teaching community, including tribal educational institutions and K-12 public and private educators throughout the region (**A/AS-1, E/E-1**).
- Provide Great Lakes property owners, coastal facility managers, and local, state and regional decision makers with comprehensive, scientifically sound, nonadvocate information and technical guidance on the likely consequences of climatic change in connection with our outreach and education initiative on the potential effects of regional climatic change on coastal communities in Wisconsin and elsewhere around the Great Lakes (**A/AS-1**).
- Prioritize Wisconsin research and outreach needs for restoring and protecting its Great Lakes resources and work with the Council of Great Lakes Governors to help ensure that these needs are incorporated in the Great Lakes Regional Collaboration’s strategic plan for Great Lakes restoration and protection. (**M/SGA-2, A/AS-1, C/C-1**).

APPENDIX A

National Sea Grant Theme Priorities

*NOAA Sea Grant Strategic Plan for FY2003-08 and Beyond:
Science for Sustainability in the 21st Century*

AQUACULTURE

- Culture system technology development
- Nutrition and feeds
- Genetics of cultured species
- Health and disease
- Stock enhancement
- Public policy and law
- Socioeconomic issues

AQUATIC INVASIVE SPECIES

- Aquatic ecosystem and economic impacts
- AIS biology for prevention and control
- Safer and more effective control strategies
- Less expensive and more effective prevention strategies

BIOTECHNOLOGY

- Marine natural products
- Biomolecular processes discovery
- Marine environmental biotechnology
- Marine resource management
- Seafood safety and processing

COASTAL COMMUNITIES & ECONOMIES

- Strengthen coastal planning
- Resource valuation
- Construct indicators of sustainable development
- Educate coastal planners
- Build leadership
- Develop decision support systems
- Revitalize coastal communities

COASTAL NATURAL HAZARDS

- Reduce the loss of life and property
- Weather-related hazards
- Earthquakes and tsunamis
- Shoreline change

DIGITAL OCEAN

- Focus on coastal areas
- Prepare for extreme events

- Passive acoustics in fisheries
- Support offshore industry

ECOSYSTEMS & HABITATS

- Reduce stresses on coastal ecosystems
- Invasive species
- Coastal watersheds
- Conserving and restoring coastal habitats

FISHERIES

- Partnering to improve fisheries management
- Caring for people
- Better understanding of fish biology and behavior
- Balancing needs with technology
- Predicting effects

MARINE & AQUATIC SCIENCE LITERACY

- Create and sustain effective marine and aquatic science-based educational programs
- Cultivate Sea Grant leadership in marine and aquatic sciences education communities
- Support the use of marine and aquatic sciences content and examples in science and mathematics teaching and standardized testing
- Expand professional development opportunities for all educators
- Engage underrepresented populations in Sea Grant efforts

SEAFOOD SCIENCE & TECHNOLOGY

- Ensure seafood safety
- Ensure seafood quality
- Improve processing technology
- Expand supplies and markets

URBAN COASTS

- Reduce nonpoint-source pollution
- Enhance port and harbor operations
- Coastal operations management

APPENDIX B

UW-Madison Strategic Goals & Initiatives, 2005-06

(revised August 2005)

I. PROMOTE RESEARCH

- Enhance research/educational experiences for students
- Increase resources and improve infrastructure for research/creative work
- Apply research and education for economic development and benefit of society

II. ADVANCE LEARNING

UNDERGRADUATE EDUCATION

- Facilitate students in developing a foundation of knowledge, skills, creativity and love of learning to serve them throughout their lives
- Integrate learning throughout the undergraduate experience
- Create a learning environment that responds to students' diverse needs and backgrounds
- Assist students in preparing for citizenship in a diverse and global world
- Help faculty and professional staff improve their ability to provide first-rate education

GRADUATE & PROFESSIONAL EDUCATION

- Assure that graduates have the set of skills appropriate for the challenges and evolving needs of their early careers
- Explore multidisciplinary research and education programs
- Identify and recruit a diverse and stellar graduate and professional student body
- Improve academic and student support services for graduate and professional students

LIFELONG LEARNING

- Expand continuing professional education programs
- Broaden learning opportunities for personal development and enrichment
- Enhance educational services to nontraditional students throughout their lifetimes
- Foster the academic development of precollege youth

III. ACCELERATE INTERNATIONALIZATION

- Maintain national leadership in area and international studies
- Strengthen campus alliances to promote international education for the professions
- Adopt a model of collaborative learning and build knowledge with partners here and abroad
- Promote multicultural understanding through expanded overseas experiences and new international learning opportunities for the campus community

IV. AMPLIFY 'THE WISCONSIN IDEA'

- Advance Wisconsin's and the global economy
- Address societal issues through multidisciplinary approaches
- Foster technology transfer, e-learning and other distance learning
- Increase lifelong learning opportunities

TECHNOLOGY TRANSFER

- State-university partnership to develop critical mass for growing technology transfer in Wisconsin

V. NURTURE HUMAN RESOURCES

STUDENTS

- Enhanced first-year experience
- Improved services and information to students
- Increased recruitment and retention of students of color
- Integrated in- and out-of-classroom learning
- Student leadership and governance
- A more welcoming and inclusive environment
- Resource development and stewardship

EMPLOYEES

- Promote respect and the practice of civility in the workplace
- Promote excellence through diversity
- Support work-life balance
- Encourage ongoing learning and leadership development opportunities for all employees
- Develop a culture of service excellence

PROFESSIONAL DEVELOPMENT

- Build a professional development culture where ongoing learning for all staff and faculty is expected and supported
- Increase the capacity for all faculty and staff to create workplace conditions that foster individual and organizational success

APPENDIX C

Outreach Staff Memberships

(Advisory Boards, Committees and Professional Associations)

University of Wisconsin Sea Grant College Program

Advisory Services

BINKOWSKI (*Aquaculture / Seafood Technology*)

American Fisheries Society
Fish Culture Section
Early Life History Section
Great Lakes Fishery Commission
Lake Michigan Technical Committee
Yellow Perch Task Group
Natl. Assn. of State Universities & Land Grant Colleges
Comm. on Food, Environ. & Renewable Resources
Section of Fish and Wildlife Resources
North Central Regional Aquaculture Center
Technical Committee Extension Subcommittee
University of Wisconsin Cooperative Extension Service
World Aquaculture Society
U.S. Chapter

HARRIS (*Water Quality / Habitat Restoration*)

Baird Creek Preservation Foundation
Bay-Lake Regional Planning Commission
Harbor Council
Watershed Academies
Door County Beach Monitoring Advisory Committee
Fox-Wolf Basin Advisory Council
Fox-Wolf Strategic Data Acquisition Task Force
Fox River Monitoring Project
Great Lakes Beach Association
Great Lakes Regional Collaboration
Sustainable Development Strategy Team
Ecosystems and Habitat Strategy Team
International Association for Great Lakes Research
Outreach Committee
Institute for Journalism & Natural Resources
Lake Michigan LaMP (Lakewide Management Plan) Forum
Lake Michigan Monitoring Coordination Council
Lower Fox River Partnership
Lower Green Bay and Fox River Remedial Action Plan
Science & Technical Advisory Committee
Biota & Habitat Work Group
NOAA Great Lakes Environmental Research Laboratory
Harmful Algal Blooms Network
Sea Grant Association
Coastal Communities & Economies Theme Team
Ecosystems & Habitats Theme Team
The Nature Conservancy
Green Bay Ecological Assessment Science Advisory
Team
Upper Green Bay Basin Partnership

U.S. Army Corps of Engineers-Detroit
Planning Division
U.S. Fish & Wildlife Service
Great Lakes Ecosystem Basin Team
UW-Extension Basin Educators
UW-Green Bay Learning in Retirement Program

HART (*Geographic Information Systems*)

American Planning Association
American Institute of Certified Planners
Coastal Management Journal Editorial Board
Committee on State Cartography
Great Lakes Regional Data Exchange '05 Conference,
Conference Planning Committee
NOAA Coastal Services Center
Coastal GeoTools '05 Conference Program Committee
The Coastal Society
Urban & Regional Information Systems Association
Wisconsin Coastal Management Program
Natural Hazards Work Group
Coastal & Estuarine Land Conservation Plan
Wisconsin Land Information Association
Board of Directors
Coordinate Systems Task Force

HURLEY (*Assistant Director for Research & Outreach*)

2006 International Conference on Mercury as a Global
Pollutant (*cochair*)
American Chemical Society
American Society of Limnology and Oceanography
American Water Resources Association
Wisconsin Chapter
CALFED Proposal Evaluation Panel
Canadian Mercury Network (COMERN)
Scientific Advisory Panel
National Institutes for Water Resources (NIWR)
Competitive Grants Program
Peer Reviews and Panels Coordinator
Sea Grant Extension Leaders Assembly
Executive Committee Member at Large
Sea Grant Communicators Liaison
Sigma Xi
Societas Internationalis Limnologiae
Universities Council on Water Resources
USEPA STAR Proposal Evaluation Panel
Wisconsin Coastal Management Council

LUBNER (*Education Coordinator / Marine Safety*)

Great Lakes Educators of Marine & Aquatic Science
 International Association of Theoretical & Applied
 Limnology
 International Association for Great Lakes Research
 Lake Sturgeon Bowl (regional site of the National Ocean
 Sciences Bowl)
 Planning and Implementation Task Group
 Education Committee
 Milwaukee County Emergency Government
 Local Emergency Planning Committee (*1st vice-chair*)
 Community Right-To-Know Subcommittee (*chair*)
 Milwaukee River Basin Partnership
 Executive Committee
 Science, Research & Regulation Self-Managed Action
 Team (*co-chair*)
 National Marine Educators Association
 Sea Grant Education Steering Committee (*2006-07 chair*)
 United States Coast Guard
 Milwaukee-Eastern Wisconsin Area Committee
 United States Coast Guard Auxiliary
 National Staff
 Division Chief for Technical Support
 Vessel Examination Department
 Public Education Officer – Flotilla 56, Milwaukee
 Operations Officer – Flotilla 56, Milwaukee
 Wisconsin Assn. for Environmental Education (*life*)
 Wisconsin Boating Safety Advisory Council
 Wisconsin Historical Society
 Wisconsin Marine Historical Society

MOY (*Fisheries / Aquatic Invasive Species*)

American Fisheries Society
 Canadian Aquatic Resources Section
 Introduced Fish Section (*past president*)
 Parent Society Meeting Oversight Committee (2005-06)
 Wisconsin Chapter
 Chicago Sanitary and Ship Canal Dispersal Barrier
 Advisory Panel (*co-chair*)
 Asian Carp Rapid Response Team (*chair*)
 Fox River Navigation System Authority
 Aquatic Invasive Species Committee
 Great Lakes Fishery Commission
 Lake Michigan Committee
 Great Lakes Panel on Invasive Species
 Research Coordination Committee (*chair*)
 Great Lakes Regional Collaboration AIS Team
 Waterways and Canals Committee (*chair*)
 Green Bay Fisheries Research Group
 International Association for Great Lakes Research
 Lake Michigan Fisheries Forum (*chair*)
 Minnesota Asian Carp Barrier Committee
 Wisconsin Commercial Fisheries Task Force
 Wisconsin Aquaculture Industry Advisory Council
 U.S. Fish & Wildlife Service
 Asian Carp Management Working Group

Communications

HOOPS (*Radio Producer / Editor*)

Council for Advancement & Support of Education
 National Association of Science Writers
 Sea Grant Communicators National Steering Committee
 Radio Task Group (*chair*)

KARL (*Science Writer*)

UW-Madison Campus Communicators
 Wisconsin Academy of Sciences, Arts and Letters
 Wisconsin Underwater Archaeology Association

SAVOY (*Librarian*)

American Water Resources Association
 National Groundwater Association
 North American Lake Management Society
 Online Computer Library Center
 Special Libraries Association
 UW-Madison Special Campus Libraries Group
 Water Environment Federation

SCHMITT (*Science Writer*)

National Association of Science Writers
 UW-Madison Campus Communicators

WHITE (*Publications Editor*)

Native Fish Conservancy
 UW-Madison Campus Communicators

WITTMAN (*Communications Manager*)

American Association for the Advancement of Science
 Association for Communication Excellence
 Great Lakes Sea Grant Network Ecosystems & Habitats
 Theme Team
 Sea Grant Association-NOAA Sea Grant Aquatic Invasive
 Species Theme Team
 UW-Madison Campus Communicators
 UW-Madison Chancellors Office-Wisconsin Alumni
 Association “UW-Madison on the Road” Outreach
 Committee

YAO (*Designer / Art Director*)

American Institute of Graphic Arts
 Design Madison
 University and College Designers Association
 Wisconsin Organization for Asian Americans

APPENDIX D

Wisconsin's Great Lakes Restoration and Protection Priorities

University of Wisconsin Sea Grant College Program

According to more than 200 citizens participating in three focus-group style workshops held in 2004 at Duluth, Green Bay and Milwaukee, the five most important priorities for Wisconsin waters of Lake Superior and Lake Michigan and the specific actions needed to address them are:

- 1. Ensure the sustainable use of water resources while confirming state authority over the use and diversions of Great Lakes waters (*Lake Michigan-Green Bay*)**
 - Affirm state/local sovereignty regarding Great Lakes water
 - Pass laws to require water conservation
 - Guarantee adequate groundwater replenishment within the Great Lakes watershed
 - Ensure return of water to basin
 - Establish specific goals or objectives for reductions in storm water runoff
 - Educate the public on significance of water cycle, recharge areas, aquifers, watershed and groundwater
- 2. Control pollution from diffuse sources into water, land and air (*Lake Michigan-Green Bay*)**
 - Focus on land use as a way to improve water quality in the Great Lakes
 - Adopt a watershed approach and halt nonpoint-source pollution and wetland loss
 - Establish environmental regulations that can be implemented and enforced
 - Promote groundwater replenishment
 - Fund long-term monitoring to ensure that problems are actually being solved (accountability)
 - Educate the public about the effects of fertilizer and pesticide use and runoff from residential and agricultural properties on coastal water quality
- 3. Stop the introduction and spread of nonindigenous aquatic invasive species (*Lake Michigan*)**
 - Strengthen local and federal invasive species laws and regulate aquaria trade
 - Fully fund and maintain permanent barriers on the Chicago Sanitary & Ship Canal
 - Regulate ballast water and implement technologies to prevent the introduction of AIS
 - Improve AIS identification, response plans and assessments of economic/ecological costs
- 4. Enhance fish and wildlife by restoring and protecting habitats and coastal wetlands (*Lake Superior-Lake Michigan-Green Bay*)**
 - Education about habitat protection and restoration issues is the number one priority
 - Identify important aquatic and coastal watershed habitat in need of conservation, protection and/or restoration, including migratory bird habitat
 - Locate and protect groundwater recharge areas for Great Lakes
 - Apply Coastal Zone Management more broadly within the watershed (beyond the Great Lakes coast)
 - Coordination of programs among jurisdictions is essential to success
 - Improve planning and enforcement of local land-use policies with a focus on long-term watershed/ecosystem protection
- 5. Adopt sustainable use practices that protect environmental resources and enhance the recreational and commercial value of our Great Lakes (*Lake Superior*)**
 - Define "sustainable use" and provide for a comprehensive growth management strategy that protects the Lake Superior basin
 - Economic valuations must include ecological considerations and value sustainability
 - Provide incentives for best management practices to address watershed and coastal development issues at the local level

APPENDIX E

Theme Area Coordinators

University of Wisconsin Sea Grant College Program

Aquaculture

Aquaculture Specialist (Binkowski)

Aquatic Invasive Species

Aquatic Invasive Species Specialist (Moy)

Biotechnology

Assistant Director for Research & Outreach (Hurley)

Coastal Communities & Economies

Geographic Information Systems Specialist (Hart)

Water Quality Specialist (Harris)

Coastal Natural Hazards

Coastal Engineering Specialist (Clark)

Digital Ocean

Geographic Information Systems Specialist (Hart)

Ecosystems & Habitats

Habitat Restoration Specialist (Harris)

Fisheries

Fisheries Specialist (Moy)

Innovative Science & Technology

Assistant Director for Research & Outreach (Hurley)

Marine & Aquatic Science Literacy

Education Specialist (Lubner)

Seafood Science & Technology

Aquaculture Specialist (Binkowski)

Fisheries Specialist (Moy)

Urban Coast

Water Quality Specialist (Harris)

APPENDIX F

Participating Institutions and Departments, 2006-08

University of Wisconsin Sea Grant College Program

Harvard Medical School

Anesthesiology

Lawrence University

Biology

Los Alamos National Laboratory

Nuclear Weapons Technology/
Simulation & Computing Office

Marquette University

Biological Sciences

Michigan State University

Michigan Sea Grant College Program

North Carolina State University

North Carolina Sea Grant College Program
Agricultural & Resource Economics

The Ohio State University

Ohio Sea Grant

Penn State University-Erie

Pennsylvania Sea Grant Project

Plattsburgh State University of New York

Lake Champlain Sea Grant

Purdue University

Illinois-Indiana Sea Grant College Program

U.S. Environmental Protection Agency

Great Lakes National Program Office
Office of Policy, Economics and Innovation
Office of Wetlands, Oceans and Watersheds

U.S. Geological Survey

Great Lakes Science Center
Water Resources Division
Lake Michigan Ecological Research Station

University of Illinois-Urbana

Illinois-Indiana Sea Grant College Program

University of Michigan

Michigan Sea Grant College Program

University of Minnesota

Sea Grant College Program
Soil, Water & Climate
BioTechnology Institute

University of North Carolina

North Carolina Sea Grant College Program
Agricultural & Resource Economics

University of Notre Dame

Biological Sciences

University of Puerto Rico

Anesthesiology

University of Vermont

Lake Champlain Sea Grant Extension Project

University of Wisconsin-Extension

University of Wisconsin-Green Bay

Chemistry
Natural & Applied Sciences
Public & Environmental Affairs
Sea Grant Advisory Services

University of Wisconsin-La Crosse

Biology
Chemistry
River Studies Center

University of Wisconsin-Madison

Agricultural and Applied Economics
Animal Sciences
Aquaculture Program
Aquatic Sciences Center
Biochemistry
Biometrics
Biotron
Botany Dept. and Arboretum
Center for Limnology
Chemical Engineering
Civil & Environmental Engineering
College of Agricultural & Life Sciences
College of Engineering
College of Letters & Science
Diving Physiology Laboratory
Electrical & Computer Engineering
Environmental Chemistry & Technology Program
Environmental Remote Sensing Center
Forest Ecology & Management
Gaylord Nelson Institute for Environmental Studies
Genetics
Graduate School

Hospital & Clinics
Land Information & Computer Graphics Facility
Libraries
Medical School
Molecular and Environmental Toxicology Center
Oceanography & Limnology Graduate Program
Radiology and Nuclear Medicine
School of Library and Information Studies
School of Natural Resources
School of Pharmacy
School of Veterinary Medicine
Sea Grant Institute
Sea Grant Advisory Services
Soil Science
Statistics
Surgical Sciences
Urban and Regional Planning
Water Resources Institute
Water Resources Management Program
Water Science & Engineering Laboratory
Wildlife Ecology
Zoology

University of Wisconsin-Manitowoc

Sea Grant Advisory Services

University of Wisconsin-Milwaukee

Aquaculture Institute
Biological Sciences
Center for Great Lakes Studies
Center for Urban Initiatives & Research
Chemistry
Geosciences
Graduate School

Sea Grant Advisory Services

University of Wisconsin-Oshkosh

Biology
Microbiology

University of Wisconsin-Stevens Point

College of Natural Resources
Dept. of Biology
Wis. Cooperative Fishery Research Unit

University of Wisconsin-Superior

Sea Grant Advisory Services

University of Wisconsin System

Great Lakes Wisconsin Aquatic Technology &
Environmental Research (WATER) Institute

Wisconsin Coastal Management Program

Department of Administration

Wisconsin Department of Natural Resources

Division of Air and Waste
Division of Water
Division of Enforcement and Science
Northern Region
Northeast Region
Southeast Region

Wisconsin Historical Society

Archives Division
Historical Preservation & Public History Division

Wisconsin Libraries' Delivery Network

Wisconsin State Laboratory of Hygiene

APPENDIX G

Outreach Program Partnerships, 2006-08

University of Wisconsin Sea Grant College Program

NEW PROGRAMMATIC INITIATIVES

Climate Change and Coastal Communities

Great Lakes Commission
NOAA Great Lakes Environmental Research
Laboratory
Purdue University Climate Change Research Center
U.S. Army Corps of Engineers
Wisconsin and regional news media and radio stations
Wisconsin Coastal Management Program
Wisconsin Commercial Ports Assn.
Wisconsin Dept. of Natural Resources Climate Change
and Stormwater Management
Wisconsin Dept. of Public Instruction
Wisconsin Harbors and Towns Assn.
Wisconsin regional planning commissions

Coastal Community Development: Planning for Clean Water and Sustainable Communities in Wisconsin's Great Lakes Watershed

Baird Creek Preservation Foundation
Bay-Lake Regional Planning Commission
Brown County Chapter of Wisconsin Home Builders
Association
Brown County Planning Commission
Local government planning staff
Michigan Sea Grant Coastal Communities Specialist
NOAA Coastal Services Center
NOAA Sea Grant Office Coastal Communities
Specialist
Northwest Wisconsin Regional Planning Commission
UW-Extension
UW-Green Bay Lower Fox River Monitoring Project
UW-Madison Dept. of Urban and Regional Planning,
UW-Madison Land Information and Computer
Graphics Facility
Wisconsin Dept. of Natural Resources Land Use Team

Great Lakes Center for Ocean Science Education Excellence (COSEE)

Cooperative Institute for Limnology and Ecosystems
Research
NOAA Great Lakes Environmental Research
Laboratory
U.S. Environmental Protection Agency
U.S. Geological Survey

UW-Milwaukee Great Lakes WATER Institute

Note: At least one informal education facility on each of the Great Lakes has agreed to partner with these efforts, and a number of school districts have committed to assisting in the recruitment of teachers.

NEW OUTREACH PROJECTS

Emerging Issues for Wisconsin Beaches – Pathogens, Harmful/Nuisance Algal Blooms and Public Health

Baird Creek Preservation Foundation
County land & water conservation departments
Great Lakes Beach Association
Great Lakes Sea Grant Network
Local beach managers
NOAA Great Lakes Environmental Research
Laboratory
UW Environmental Remote Sensing Center
UW Great Lakes WATER Institute
Wisconsin Dept. of Natural Resources

Great Lakes Circle Tour Coastal Access Guide

Great Lakes Commission
Public boat launches
U.S. Environmental Protection Agency-Biodiversity
Around the Great Lakes
UW-Green Bay-Wisconsin Breeding Bird Atlas
Wisconsin Bird Conservation Institute-Great Lakes
Birding and Nature Trail
Wisconsin Coastal Management Program
Wisconsin Dept. of Natural Resources-Wisconsin Great
Lakes Beach Health, State Natural Areas
Wisconsin Dept. of Tourism
Wisconsin Dept. of Transportation-Wisconsin Rustic
Roads
Wisconsin Harbor Towns Association
Wisconsin Historical Society-Wisconsin Maritime
Trails Project-Wisconsin Great Lakes Shipwrecks

History of Sturgeon in the Lake Winnebago System

Sturgeon for Tomorrow
Wisconsin Dept. of Natural Resources Bureau of
Fisheries Management & Habitat Protection
Wisconsin Historical Society

Critical Outreach Issues in Great Lakes Fisheries

Apostle Island Sport Fisherman's Association
Commercial fishers in Two Rivers and Sheboygan
Lake Superior researchers in Wisconsin, Minnesota and Michigan
Local anglers, bait shops and marinas in Two Rivers-Manitowoc-Sheboygan area
Michigan Dept. of Natural Resources
Michigan Sea Grant
Minnesota Sea Grant
U.S. Fish & Wildlife Service
U.S. Geological Survey
Wisconsin Dept. of Natural Resources

Merging Mercury Science and Policy

Electric Power Research Institute
Florida Dept. of Environmental Protection
Minnesota Pollution Control Agency
New York State Energy Research & Redevelopment Authority
RMT, Inc.
Tekran, Inc.
Teledyne Leeman Laboratories
United Nations Industrial Development Organization
U.S. Environmental Protection Agency
U.S. Geological Survey
University of Wisconsin-La Crosse

Puerto Rico Diver Safety Outreach

Divers Alert Network
NOAA Diving Program
University of Puerto Rico Sea Grant College Program
University of Puerto Rico Medical School, San Juan

PROGRAM ELEMENT-ADVISORY SERVICES

Coastal Engineering

American Society of Civil Engineers Coastal Practice Committee
Great Lakes Commission
Great Lakes Sea Grant Network (Minnesota and Michigan Sea Grant in particular)
U.S. Army Corps of Engineers
Wisconsin coastal communities
Wisconsin Coastal Management Program
Wisconsin Commercial Ports Association
Wisconsin Dept. of Transportation Harbors & Waterways Program
Wisconsin Harbors and Towns Association
Wisconsin regional planning commissions

Fisheries

Apostle Islands Sport Fisherman's Association
Ashland area sport anglers
Lake Michigan Fisheries Forum
Lake Superior Commercial Fishery Advisory Committee
Local bait shops and marinas
Wisconsin Dept. of Natural Resources

Geographic Information Systems

Bad River and Red Cliff tribal governments
Minnesota Sea Grant
NOAA Coastal Services Center
Ozaukee and Bayfield counties
Wisconsin Coastal Management Program Coastal Hazards Work Group

Great Lakes Recreational Water Safety

U.S. Coast Guard Auxiliary
Wisconsin Dept. of Natural Resources
Wauwatosa Recreation Dept.
Greenfield-Greendale recreation departments
Cudahy Recreation Dept.

Habitat Restoration

Brown County Port Director
Green Bay Remedial Action Plan Biota & Habitat Work Group
Local and state resource management agencies
Marina owners, coastal community officials, planners and developers
Shore property owners
The Nature Conservancy
U.S. Army Corps of Engineers
U.S. Fish & Wildlife Service Great Lakes Basin Ecosystem Team
Wisconsin Dept. of Natural Resources

Water Quality

Baird Creek watershed landowners
Brown County Chapter of Wisconsin Home Builders Association
U.S. Environmental Protection Agency
UW-Extension
UW-Green Bay Learning in Retirement Program

PROGRAM ELEMENT-COMMUNICATIONS

Communications Office

Great Lakes Commission-Great Lakes Information Network
Great Lakes Sea Grant Network (six programs)
Lake Michigan & Lake Superior public beaches and state parks
Lake Superior magazine
National Sea Grant Library
NOAA National Sea Grant Office
NOAA Public Affairs Office
North Carolina Sea Grant
Sea Grant Association
UW-Madison Speakers Bureau
UW-Madison Center for Limnology
UW-Madison Chancellor's Office
UW-Madison University Communications Office
UW-Madison Water Resources Library
Wisconsin Alumni Association
Wisconsin Dept. of Natural Resources
Wisconsin Division of Health
Wisconsin Natural Resources magazine (WDNR)
Wisconsin print and broadcast news media
Wisconsin Trails magazine

Earthwatch Public Service Radio Program

More than 120 radio stations and other broadcasters
UW-Madison Gaylord Nelson Institute for Environmental Studies
UW-Madison Life Sciences Communication Dept.
UW-Madison School of Journalism & Mass Communications

“Wood, Steel and Steam” Shipwreck Archaeology, Preservation and Public Education Project

Wisconsin Dept. of Tourism
Wisconsin Dept. of Transportation
Wisconsin Historical Society-Maritime Preservation & Archaeology Program

Around Lake Superior: A Journey in Time and Place Electronic Publication

Michigan Sea Grant
Minnesota Sea Grant
University of Wisconsin Press
UW-Madison history professor Margaret Bogue

PROGRAM ELEMENT-EDUCATION

Marine Education: From Early Childhood to Retirement

JASON Project
PIER Wisconsin
Schlitz Audubon Nature Center
UW-Madison Center for Limnology
UW-Milwaukee Great Lakes WATER Institute
Wisconsin Alumni Association
Wisconsin Lake Schooner Education Assn.

“Great Lakes, Great Maps” Exhibit & Lectures

Friends of UW-Madison Libraries
UW Digital Collections Center
UW-Madison Memorial Library
UW-Milwaukee Golda Meir Library AGS Collection

APPENDIX H

2006-08 Omnibus Proposal Preparation Schedule

University of Wisconsin Sea Grant College Program

2004

Spring/Summer	Strategic plan revised/updated by constituent groups and outreach staff with input from advisory committees.
October 15	Deadline for submission of annual progress reports.
October 15-25	Annual progress reports reviewed and assessed by program managers.
October 22	UW Sea Grant Advisory Council meeting to review and approve updated strategic plan and 2006-08 Request for Proposals.
November 4	Request for Proposals distributed.
December 13	Deadline for submission of preproposals.
December 20-31	Preproposals distributed to management staff, external review panel members and UW Sea Grant Advisory Council members.

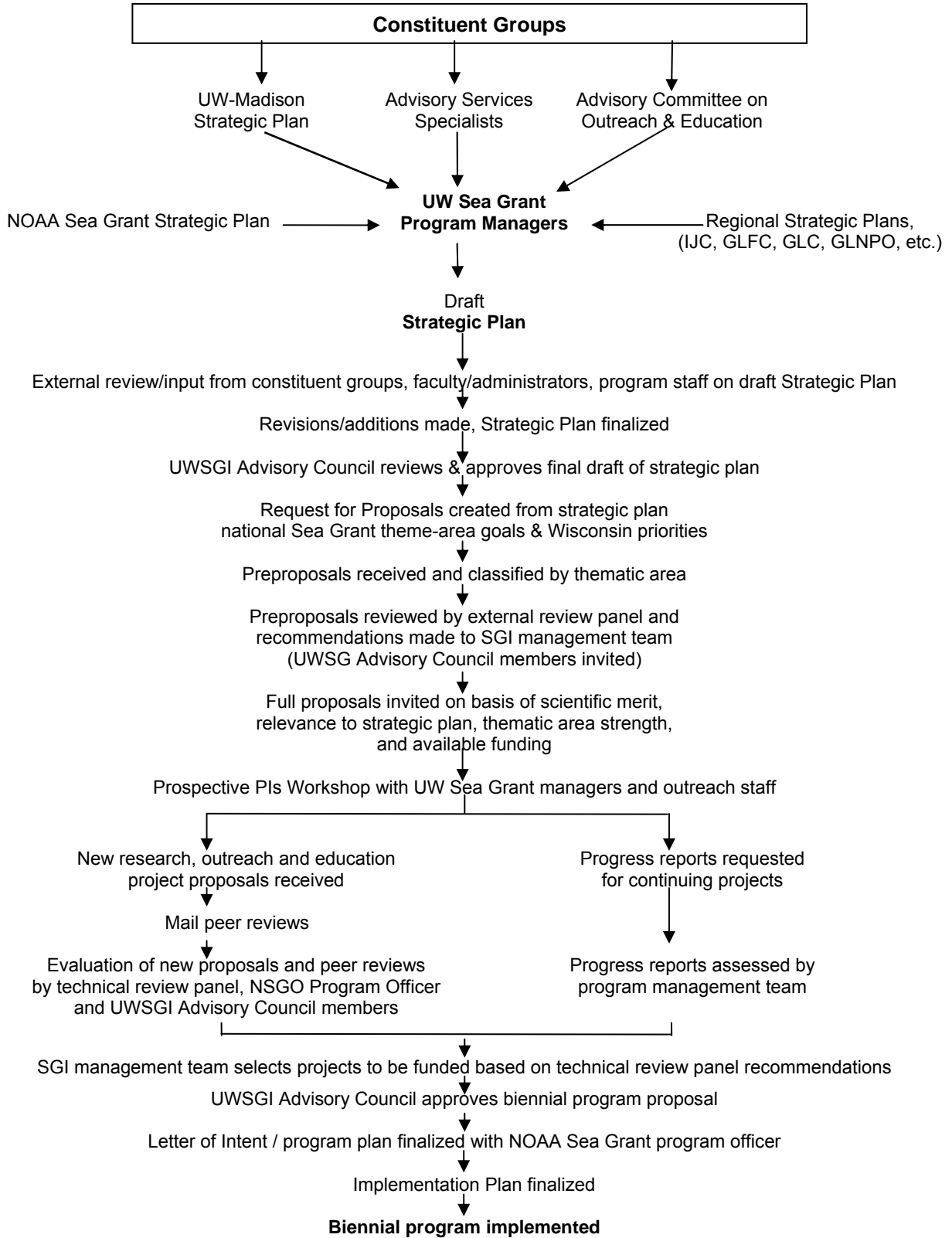
2005

January 11-12	Preproposal screening and selection meetings with management staff, review panel members, UW Sea Grant Advisory Council members and other invited guests.
Late January	Principal investigators (PIs) notified of status of their preproposal(s). Invitations for full proposals and proposal submission guidelines sent to PIs of selected preproposals.
February 23	Prospective PIs Workshop with UW Sea Grant program managers, thematic area coordinators and other outreach staff.
March 7	Follow-up letters sent to prospective PIs of new proposals requesting draft project summaries.
April 14	Deadline for draft project summaries. Draft project summaries sent to NOAA Sea Grant's Wisconsin Program Officer.

May 2	Deadline for submission of new project proposals.
May 5 – June 30	New project proposals peer reviewed via online electronic review system on UW Sea Grant website.
August 23-24	Review of new proposals by technical review panel, NOAA Sea Grant Program Officer and UW Sea Grant Advisory Council members.
October 4	UW Sea Grant Advisory Council meeting to review and approve 2006-08 program and budget.
November 3	Deadline for submission of annual progress reports.
November 4-11	Annual progress reports reviewed and evaluated by program managers.
November 15	Director's Letter of Intent for the biennium submitted to NOAA Sea Grant's Wisconsin Program Officer.
November 16-22	Letter of Intent reviewed and approved by NOAA Sea Grant program officer.
Late November	Acceptance letters with unofficial budgets and nonacceptance letters sent to all PIs.
December 1	Signed omnibus institutional proposal submitted via <i>Grants.gov</i>, and 2006-08 Implementation Plan and 2005 Annual Progress Report submitted to NOAA Sea Grant's Wisconsin Program Officer.

APPENDIX I

Program Management Decision Process



APPENDIX J

Matrix of National Sea Grant Themes-Wisconsin Sea Grant Projects, 2006-08

Program Priority Theme Areas P = Primary Thematic Area A = Associated Thematic Area(s)

PROJECTS	AQ	AI	BT	DO	CC	EH	FI	NH	SS	ST	ML	UC
A/AQ-1	P						A					
A/AS-1	P	P	A	P	A	P	P	P	A	A	P	P
A/AS-53		P				A						
C/C-1	A	A		A	A	A	P	A		P	P	A
C/C-2											P	
C/ML-1					A						P	
E/E-1						A				A	P	
E/ML-1										A	P	
E/ML-2											P	
R/AI-1		P					A					
R/AI-2		P				A	A					
R/AI-3		P				A	A					
R/AQ-38	P		A									
R/AQ-40	P		A									A
R/AQ-41	P		A									
R/AQ-42	P											
R/BT-17			P									
R/BT-20			P									
R/BT-21			P									
R/BT-22			P									
R/DO-1				P	A							
R/EC-10				A		P				A		A
R/EH-1						P	A					
R/EH-2		A				P						
R/FI-1						A	P					
R/LR-91		P				A						
R/LR-92		A				A	P					
R/LR-93		P					A					
R/LR-94						P	A					
R/LR-95							P					
R/LR-96		P				A						
R/MW-88				P		A						
R/MW-89			A			A						P
R/PS-57					P		A					
R/ST-1										P		
R/UC-1			A			A						P
R/UC-2			A									P
R/UC-3						A						P

Key to Matrix

AQ - Aquaculture
AI - Aquatic Invasive Species
BT - Biotechnology
CC - Coastal Communities & Economies
DO - Digital Ocean-Great Lakes Geospatial Technologies
EH - Ecosystems & Habitats

FI - Fisheries
ML - Marine & Aquatic Science Literacy
NH - Coastal Natural Hazards
SS - Seafood Science & Technology
ST - Innovative Science & Technology
UC - Urban Coast

A/AQ-1—Aquaculture Advisory Services for the Great Lakes Region

A/AS-1—Advisory Services: Program Coordination and Field Offices

A/AS-53—Sea Grant Non-Indigenous Species (SGNIS) Web Site: Development and Support

C/C-1—Communications Office and Subprogram Coordination

C/C-2—Earthwatch Public Service Radio Program

C/ML-1—Wood, Steel and Steam: Shipwreck Archaeology, Preservation and Public Education

E/E-1—Special Marine Education Programs

E/ML-1—Recent Advances in Limnology and Oceanography Seminar Series

E/ML-2—Lake Sturgeon Bowl: Wisconsin's Regional Academic Competition for the National Ocean Sciences Bowl

R/AI-1—Impact of the Round Goby on Yellow Perch Recruitment

R/AI-2*—*Cercopagis* Invasion of Lake Michigan: Predictable Responses or "Invasional Meltdown" of the Planktonic Food Web?

R/AI-3*—Reciprocal Spread of Invasive Species in Lake Michigan Coastal Habitats

R/AQ-38—Endocrine and Environmental Regulation of Growth in Yellow Perch

R/AQ-40—Tetracycline Antibiotics and Resistance Genes in Aquaculture Environments: Genotypic Diversity and Potential Resistance Reservoirs

R/AQ-41—Development of Yellow Perch Broodstocks for Selective Breeding

R/AQ-42**—Increasing the Efficiency of Yellow Perch Fingerling Production by Optimizing Pond Trophic Dynamics and Feed-Training Strategies

R/BT-17—AhR Signaling in Rainbow Trout and Zebrafish

R/BT-20—Latent Toxicity in Adult Zebrafish Following Early Life Stage Exposure to 2,3,7,8-Tetrachlorodibenzo-p-Dioxin

R/BT-21—Parallel Toxicogenomic Resources for Zebrafish and Rainbow Trout: Identifying Conserved Molecular Biomarkers of Toxicant Exposure

R/BT-22*—Genomic Approach to Understanding TCDD Toxicity in Zebrafish

R/DO-1—Geospatial Technologies for Land Use Planning in Great Lakes Coastal Communities

R/EC-10—Impact of a Shifting Wind Field over the Laurentian Great Lakes on Accumulation and Resuspension of Sediments in Green Bay, Lake Michigan

R/EH-1—Lake Superior Food Web Dynamics: Modeling at Multiple Scales*

R/EH-2**—Growth and Detachment of *Cladophora* in Lake Michigan

R/FI-1*—Hydrodynamics, Chlorophyll and Larval Fishes

R/LR-91—Quagga Mussel Invasions: Functional Morphology, Biomechanics, Zebra Mussel Displacement and Future Spread

R/LR-92—A Retrospective Analysis of Lake Michigan and Lake Superior Food Webs

R/LR-93—Predicting the Impact of Zebra Mussels on Trophic Transfers in Green Bay: Ecosystem Modeling and Lower Food Web Interactions with Fish

R/LR-94—Compensatory and Spatial Dynamics in Great Lakes Food Webs

R/LR-95—Sustainability of Lake Trout Fisheries in Lake Superior

R/LR-96—Expanding Cattails and Shrinking Sedge Meadows: Reversible?

R/MW-88—LakeSat: Near Real-Time Monitoring of Water Quality in Green Bay and Wisconsin's Lake Michigan Coastal Waters via Satellite Remote Sensing

R/MW-89—Sources and Transport Mechanisms for *Escherichia coli* Contamination at Lake Michigan Beaches

R/PS-57—Measuring Interrelated Demands for Commercially Caught Fish

R/ST-1—Improving Risk Estimation, Safety and Cost-Effectiveness in Scuba Diving

R/UC-1*—Evaluation of the Algal Nuisance *Cladophora* and its Effect on *E. coli* and Beach Closures

R/UC-2**—Development and Application of Molecular-Based Methods for Identifying Sources of Fecal Pollution at Lake Michigan Beaches

R/UC-3**—Ecological Immunology of Amphibians in Stressed Great Lakes Ecosystems

* FY07 Start-Up

** Depending on availability of funding.

Not shown:

M/SGA-1—Program Development (*all themes*)

M/SGA-2—Program Management (*all themes*)

M/SGA-3—Ship Time in Support of Sea Grant Research Projects (*all themes*)

Gone fishing ...