

2004-06 Implementation Plan

UNIVERSITY OF WISCONSIN SEA GRANT COLLEGE PROGRAM



2004-06 Implementation Plan

University of Wisconsin Sea Grant College Program

Submitted by Anders W. Andren, Director, November 13, 2003

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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Sea Grant 2004-06 Implementation Plan

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I. Review of Program Strategic Plan

1. Relationship to National Sea Grant Strategic Plan

As outlined in our 2002-06 Strategic Plan and detailed in this document, the 2004-06 Wisconsin Sea Grant program has been developed in accordance with the goals and priorities set forth in the national Sea Grant network's 10 theme areas as well as those established by our parent institution (UW-Madison) (**Appendix A**). These 10 themes constitute the foundation of NOAA Sea Grant's new strategic plan, which was still in draft at the time this implementation plan was prepared. Thus, every project selected for University of Wisconsin Sea Grant's 2004-06 program addresses one or more of the priorities listed in the Sept. 15, 2003, working group review draft of *NOAA Sea Grant Strategic Plan for FY2003-2008 and Beyond: Science for Sustainability in the 21st Century* (**Appendix B**). Our program thus also addresses the strategic goals and priorities of the National Oceanic & Atmospheric Administration (NOAA).

Moreover, our strategic plan takes into account Great Lakes-related issues and priorities identified by various Wisconsin state agencies and constituent groups, and the U.S.-Canadian International Joint Commission, Great Lakes Commission and other relevant regional agencies and organizations. This approach gives our program a national issue-oriented focus while addressing both state and regional issues within the context of our university's priorities and the academic expertise available to us.

Traditionally, the UW Sea Grant program has been organized around the concept of focused research areas—subprograms—and the goals and priorities of these subprograms combined served as the strategic plan for the program. This subprogram approach continues to provide a stable, long-term framework for managing the Wisconsin program today. Recently, however, the national Sea Grant Association and NOAA Sea Grant adopted an issue-oriented thematic approach to enhance the 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 basis for strategic planning at the state, regional and national levels.

Accordingly, the UW Sea Grant program also adopted the theme-area approach, using the same themes as the national Sea Grant program, plus a theme for innovative projects, to strategically organize our 2004-06 program, with the national goal(s) in each theme serving as the starting point for identifying Wisconsin's priorities within that theme. Besides encouraging multidisciplinary research, the thematic approach fosters greater integration of that research with our outreach and education subprograms as well as facilitating the synthesis of our program's efforts at the regional and national levels.

2. Context of Institutional and Territorial Characteristics

Institutional Characteristics

The Wisconsin-Sea Grant program was launched in June 1968. Just four years later, the University of Wisconsin was designated a Sea Grant College in recognition of its "sustained excellence in research, education and public service dedicated to wise use of America's marine resources." In 1978, 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. At the same time, the Sea Grant Institute was created as an academic unit under 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 auspice of the UW-Madison Graduate Schools' new Aquatic Sciences Center.

The director of the UW-Madison Aquatic Sciences Center serves as director of the UW Sea Grant College Program. He reports to the dean of the Graduate School at the UW-Madison (**Appendix C**). Appointed by the chancellor of the University of Wisconsin-Madison, the UW Sea Grant Advisory Council (**Appendix D**) consists of state leaders from academia, state and local government, industry and the public who provide policy guidance within established institutional goals, approves the overall program plan and budget, and participates in program planning and the selection of priorities. The UW Sea Grant Committee on Advisory Services (**Appendix E**) was created in 1992 to provide additional guidance on the direction of the program's outreach efforts.

On a day-to-day basis, the Wisconsin Sea Grant program is managed by UW Sea Grant Institute staff (**Appendix F**). Regular weekly management staff meetings—attended by the Director, Assistant Director for Administration and Information, Assistant Director for Research and Outreach, Finance & Grants Administrator and Information Technology Coordinator and Program Information Specialist—are held to coordinate staff activities and program management. Collectively, this management team has nearly a century of experience in 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 and quarterly meetings of the Advisory Services specialists, and weekly staff meetings of Communications and Information Technology staff. Program managers also conduct biweekly 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.

State support for the University of Wisconsin in general and the UW Sea Grant program traditionally has been strong and is expected to remain so, despite multibillion-dollar state budget deficits that recently forced the state to make a \$250 million cut in the biennial UW System budget. Nonetheless, UW-Madison and UW System support for the Wisconsin Sea Grant program is solid, and Wisconsin'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, such as the sustainable management of economically valuable recreational fisheries, remediation of toxic chemical contamination of the lake's sediments and biota, protecting water quality, and stemming the spread of nonindigenous aquatic nuisance species to the state's 15,000 lakes and other inland waters.

All of the state's coastal communities draw their water from the lakes, and millions of dollars have been spent to prevent them from becoming clogged with zebra mussels. Five of the 43 U.S.-Canadian International Joint Commission (IJC) Great Lakes "Areas of Concern" are located in Wisconsin. More than a dozen large rivers and several smaller tributaries that drain rural, suburban and urban areas contribute significant sediment and contaminant burdens to the nearshore waters of Lake Michigan, which adversely affects the water quality, habitat and biota of both tributary and nearshore water. Beach closings due to bacterial contamination are a growing concern in Wisconsin as well as the rest of the region and nation.

Our state also has some unique issues with regard to a rapidly developing freshwater aquaculture industry, managing some of the last commercial fisheries in U.S. waters of the Great Lakes, and reconciling lakeshore development with changing lake levels and coastal bluff recession problems on both shores of these geologically young lakes.

Wisconsin's population in 2000 was estimated at 5.4 million, more than 37 percent of whom lives in the 11 counties bordering Lake Michigan and Green Bay; less than 2 percent live in the four counties along Lake

Superior. The state's four heavily urbanized, industrialized southeastern coastal counties – Kenosha, Racine, Milwaukee and Ozaukee – are home to about 25 percent of Wisconsin's population and three of the state's largest school systems. These coastal counties and adjacent inland counties have experienced above-average population growth for the last 20 years. The population of the state's Lake Superior coastal counties, on the other hand, grew less than 3 percent during the 1990s. Nevertheless, these four counties have shown steady growth in recreation and tourism businesses directly related to Lake Superior, including commercial fishing, marinas, sailboat and kayak rentals and instruction, charter boat fishing, and tourist support services.

Tourism is a major state industry, and Lake Michigan is a big part of it. Our Lake Michigan coast boasts eight state parks, several state forests, a wealth of public beaches, and 73 lake access points, many with marinas, which draw tourists from Chicago and throughout the Midwest. Lake Michigan supports 240 charter and 51 commercial Wisconsin fishing operations. Sustainability is crucial to the economic viability of these recreational and commercial fisheries, and those on Lake Superior as well.

Nonindigenous species, aquaculture, fisheries sustainability, toxic chemical contamination, water quality and development pressures on coastal watersheds and coastal ecosystems thus continue to be the principal Great Lakes-related concerns in Wisconsin.

A world-class university, the University of Wisconsin-Madison offers unique strengths and research opportunities through its internationally recognized Center for Limnology and the Environmental Chemistry and Technology Program (formerly the Water Chemistry Program). The UW-Madison Biotechnology Center coordinates a multidisciplinary research program involving more than 50 campus units. The UW-Milwaukee Aquaculture Institute and Great Lakes WATER (Wisconsin Aquatic Technology and Environmental Research) Institute provide our program leadership in aquaculture and estuarine/coastal processes research. 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.

3. Mechanisms for the Establishment of Strategic Planning

Although the UW Sea Grant Institute is a unit of UW-Madison, the Wisconsin Sea Grant College Program is UW System-wide and statewide in scope. Representing other units of the university system, state and local government, industry, and the public, the UW Sea Grant Advisory Council (**Appendix D**), along with our Committee on Advisory Services (**Appendix E**), brings a wide variety of viewpoints to the program and helps ensure the program's accountability to faculty, staff and constituents statewide. These two advisory bodies, along with UW Sea Grant staff, are also actively involved in identifying research opportunities and talent.

The program's managers (**Appendix F**) work directly with outreach staff to develop long-range goals and short-term priorities for developing our strategic plan and biennial Request for Proposals (RFP), taking into consideration a mix of local, state, regional and other national priorities in their respective fields of specialization. Our outreach staff members (Advisory Services and Communications) also are involved in a variety of professional associations, advisory boards and committees (**Appendix G**). Our Advisory Services specialists work in partnership with numerous coastal and Great Lakes-related private businesses and organizations as well as municipal, county, state and regional government agencies (**Appendix H**). Together, these outreach specialists serve as a primary mechanism through which the *applied* research needs of resource users and other constituent groups are communicated to the program managers.

Revised and updated every two years in connection with our biennial RFP, our strategic plan is a working document that is constantly evolving. This keeps our program flexible, innovative and responsive, enabling us to adapt quickly to meet changing needs and take advantage of new opportunities.

4. Involvement of Faculty, Staff and Constituents

In preparation for our 2004-06 RFP, UW Sea Grant's 2001-05 Strategic Plan was restructured into a mirror image of Sea Grant's national themes. This process began with moving the goals and priorities from our research, outreach and education subprograms into the national Sea Grant themes. In September 2002, this draft plan was distributed for comment to more than 450 individuals throughout the state and beyond, including key individuals at Wisconsin Department of Natural Resources, Wisconsin Coastal Management Program, Wisconsin Department of Transportation, Trout Unlimited-Upper Midwest, and U.S. Geological Survey, including the USGS Great Lakes Science Center and USGS-Middleton. This distribution also included the UW Sea Grant Advisory Council, the Committee on Advisory Services, current and recent UW Sea Grant project investigators, all UW-Madison department chairs, UW System chancellors and vice/associate/assistant chancellors, and the deans/associate deans and directors at all UW System campuses and nine private institutions.

The draft plan was also reviewed by each of the program's Advisory Services specialists (**Appendix I**), who met with and solicited comments and input from coastal engineering firms, land information officers in 15 coastal counties, the Southeastern Wisconsin Regional Planning Commission, Fox-Green Bay remediation officials, Lake Michigan Fishery Forum members, Great Lakes Commission staff, NOAA's Great Lakes Environmental Research Laboratory, and the U.S. Environmental Protection Agency's Great Lakes National Program Office, among others. A copy of the draft plan and an invitation to submit comments was also placed on the UW Sea Grant Web site.

All comments received were compiled by program management and reviewed by the UW Sea Grant Advisory Council (**Appendix D**) for updating the Wisconsin priorities listed in each national theme. This updated list of priorities then became the program's 2004-06 RFP, reflecting council guidance that the RFP should identify specific high-priority research areas, yet include all priorities identified within each theme area to improve our chances of getting more of the state's best investigators interested in submitting proposals. Four high-priority areas were identified in the 2004-06 RFP: (1) **nonindigenous aquatic nuisance species**, (2) **aquaculture**, (3) **aquatic biotechnology**, and (4) **development of geographic information systems and remote sensing technology for Great Lakes, coastal and ocean applications**.

Our biennial RFPs are widely circulated throughout the Wisconsin academic community. More than 450 copies of the 2004-06 RFP were distributed statewide via both paper and electronic distribution, and it was also posted on the UW Sea Grant Web site. Preproposals were received via electronic submission in mid-December 2002.

The RFP list of priorities was first narrowed down in January 2003, based on the recommendations of our preproposal technical review panel. 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 65 preproposals submitted, 34 were invited to submit full proposals; however, it is UW Sea Grant policy to accept and process all proposals received—with or without submission of a preproposal, and whether or not a proposal has been encouraged.

Prospective investigators were then invited to a proposal writing workshop held Feb. 26, 2003, on the UW-Madison campus at which UW Sea Grant staff presented an overview of the Sea Grant national themes concept and relevant regional and state priorities. To foster collaboration and complementary efforts, the investigators were also given a list of all of our preproposals, classified by theme areas. At the workshop, they were encouraged to meet with the other investigators in those areas with similar research interests as well as with members of our Advisory Services and Communications staff regarding potential outreach activities related to the proposed research.

About the same time, we restructured and updated our strategic plan's administrative goals to parallel the UW-Madison strategic plan, which was revised in early 2003.

A meeting of the Committee on Advisory Services was held May 16 to identify outreach priorities for the coming biennium, and Assistant Director for Research and Outreach met with the Advisory Services staff on

July 9 in Superior, Wis., to update outreach priorities for our strategic plan, taking into consideration the full range of project proposals received to date. The staff also met with Minnesota Sea Grant staff in Duluth on July 10 to discuss possible collaborative outreach efforts. The next step in this strategic planning and program development process occurred in August 19-20, 2003, when the final selection of program priorities was made based on the recommendations of our full-proposal technical review panel, which included our NOAA Sea Grant program officer, followed up with input from the program's outreach and education staff at an implementation planning meeting Aug. 27. Lastly, the draft strategic plan was then forwarded to the NOAA Sea Grant Office for review and comment by our program officer and other NOAA Sea Grant officials. A schematic of this process is presented in **Appendix J**.

As a result of these efforts, 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. Participants in the 2004-06 Wisconsin Sea Grant program will involve 64 faculty, staff and students in 61 departments or units at seven UW System campuses, UW-Extension, Lawrence University and Marquette University, plus the Wisconsin Historical Society, seven units of two state agencies, 14 out-of-state universities, and four units of two federal agencies (**Appendix K**).

Thematic area workshops are held periodically to foster the synthesis of project results and encourage further collaboration among PIs. Depending on the nature of the workshop, participants usually include outreach staff, representatives of resource management agencies and key constituent groups, and, if deemed of sufficient general interest, the general public and news media.

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 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.

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 L**). 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 (**Appendix M**). 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 thematic areas. Dr. Dorn Carlson (our NSGO program officer) 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.

The following sections detail the decision principles implemented in each step in the 2004-06 program development process—principles that will also be used in 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 NOAA, the National Sea Grant College Program, and University of 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 typical 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 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?

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 University of 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 support?
- 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 to solving the problems and exploiting opportunities in resource management or development, or in public outreach on such issues will be employed; 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 Investigators** – 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 area?

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 s/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 2004-06 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 ongoing 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?
- Does the proposed work have the potential to lead to a new thematic area?
- 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 long-term relationships with some of the best scientists Wisconsin has to offer, and 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 2002-06 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 will be used to measure progress in the most significant areas of Wisconsin Sea Grant activity in each theme area:

Aquaculture

- Significant reduction in the adverse effects of stress in aquacultured fish.
- Successful applications of RAS, IAT and broodstock manipulation & development technologies.
- The number of new and alternative aquaculture enterprises developed within the state and region.
- Improvement in the numbers of preservice and placement of in-service Vocational Agriculture teachers providing aquaculture curricula and activities for their students.
- Increasing amounts of aquacultured fish among the seafood consumed in Wisconsin.

Biotechnology

- The number of relative toxicological potency factors determined for chlorinated aromatic hydrocarbons.
- The amount of biotechnological research applied to aquaculture, aquatic nuisance species, fisheries, seafood products and/or water quality problems and issues.

Coastal Communities & Economies

- The application of geographic information systems for Smart Growth planning in Wisconsin coastal watersheds.
- The development and validation of new techniques for economic valuation of Great Lakes resources and their importance to thriving coastal communities and businesses.

Coastal Natural Hazards

- The development of geographic information systems for assessing and reducing natural coastal hazard risks.
- Creation of a Sea Grant outreach program addressing the potential effects of climate change on Great Lakes water levels and coastal structures responding to the NOAA climate change outreach priority.

Digital Ocean/Great Lakes

- The deployment of *in situ* observation technology and satellite-derived imagery in the Great Lakes systems that can deliver real-time data.
- 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 number of research tools and methods incorporated by environmental managers in assessing the nature and extent of chemical, biological, physical and geological changes in the Great Lakes Basin.
- Ability to quantitatively predict zebra mussel impacts on the relationship between primary producers and higher trophic level organisms in Lake Michigan.
- Improvement in the design, function and assessment of coastal habitat rehabilitation and restoration projects.
- Technologies developed for better spatial and temporal characterization of nearshore environments and coastal ecosystem dynamics.

Fisheries

- The number of workshops and collaborations that result in worldwide transfer of university-developed fisheries modeling tools to fisheries managers.
- Identification of the factors preventing the recovery of the yellow perch fishery in Lake Michigan.

Marine & Aquatic Science Literacy

- The amount of Sea Grant information requested and distributed.
- The number of educators who participate in teacher training sponsored or conducted by UW Sea Grant.
- The number of Wisconsin students participating in Madison JASON Project, Sturgeon Bowl/Ocean Science Bowl, Marine Science at Sea, and Sea Grant-sponsored seminars and workshops.

Seafood Science & Technology

- Development of a white perch fishery on Lake Michigan and a potential siscowet (fat trout) fishery on Lake Superior.
- Commercial use of fish oils for making nutraceuticals.

Urban Coast

- Identification of the sources and effects of toxic contaminants in the Great Lakes.
- Identification of the mechanisms, sources and fate of bacterial and viral contamination responsible for beach closings in the Great Lakes and other coastal areas.
- Development of strategies for remediation of harbors, bays and other areas degraded by chemical contaminants and/or nutrient overloading.

Innovative Science & Technology

- Acceptance and incorporation of UW Sea Grant research results on the risks associated with diving into standard safety procedures for professional and recreational divers.

Institutional Milestones

Promote Research

- State-of-the-art research project management and reporting software developed and implemented.
- The number of new faculty hires that are successful in obtaining Sea Grant research funding.
- The number of promising new investigators brought into the program.

- The amount that funding for research is increased.
- 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, Web sites 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.
- The amount that funding for educational efforts is increased.

Accelerate Internationalization

- The number of Canadian and other international partnerships developed in research, outreach and education.
- The number of international conferences (co)sponsored by UW Sea Grant and/or with significant involvement by UW Sea Grant staff, students and/or researchers.
- The amount of "hits" on UW Sea Grant Web sites 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 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.
- Increase in the number of staff and funding for outreach and outreach activities.

Nurture Human Resources

- 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 historically has been organized around seven or eight research-area subprograms and four general support core programs (Administration, Communications, Advisory Services and Education). Since 1996, we have also employed a cross-cutting thematic approach, currently consisting of Sea Grant's 10 national themes. These thematic areas ultimately engage all elements of our program.

The principal personnel for developing and implementing these subprograms and thematic areas are UW Sea Grant management and outreach staff. As described earlier, the development and implementation of our program also depend on input and feedback from our Advisory Council, Advisory Services specialists, Committee on Advisory Services, external technical review panels, our NOAA Sea Grant program officer, and state and regional agencies and constituent groups.

Besides the project principal investigators, the primary personnel for implementing this approach are outreach staff selected to be theme area facilitators in accordance with their area of specialization. (Appendix N). At the workshop for prospective investigators, PIs in the same thematic areas are encouraged to meet and discuss potential outreach initiatives with these facilitators. These coordinators then work with UW Sea Grant program managers and other staff to identify and select appropriate mechanisms for information and technology transfer via presentations to program staff, outreach workshops, scientific conferences, public meetings, news media events, Web sites, 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 (see Appendices J & L). The NOAA Sea Grant Office requires submission of a two-year implementation plan (this document) in connection with each biennial omnibus proposal. Our five-year strategic plan and 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 10 national thematic areas.

The execution of each biennium's projects—along with satisfying the annual and biennial 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 program.

III. Program Implementation

1. Program Elements and Context

The University of Wisconsin Sea Grant College Program for 2004-06 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. Thus, the 10 themes used for organizing our 2004-06 program are the same as those adopted jointly by NOAA Sea Grant and the Sea Grant Association:

- **Aquaculture**
- **Biotechnology**
- **Coastal Communities & Economies**
- **Coastal Natural Hazards**
- **Digital Ocean**
- **Ecosystems & Habitats**
- **Fisheries**
- **Marine & Aquatic Science Literacy**
- **Seafood Science & Technology**
- **Urban Coast**

In addition to these national themes, the Wisconsin Sea Grant program will continue to invite proposals for projects that take advantage of 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 2004-06 addresses one or more theme priorities in the draft NOAA Sea Grant Strategic Plan (**Appendix B**). A matrix of our 2004-06 subprogram projects and the national theme areas is presented in **Appendix O**.

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

The integration of all program elements—research, outreach and education—is achieved through overlaying our traditional subprogram structure with cross-disciplinary theme areas (see **Appendix O**) and the assignment of outreach staff to serve as facilitators for each theme (see **Appendix N**). This integration is further encouraged through thematic area meetings and semiannual outreach workshops.

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

The program for 2004-06 presented herein was unanimously approved at the Sept. 19, 2003, meeting of the UW Sea Grant Advisory Council.

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. This industry has a great potential for growth because of the availability of key resources, including abundant water, land, labor and markets. The most likely candidates for aquaculture expansion in Wisconsin are cool-climate freshwater species. Major obstacles to achieving the potential of aquaculture growth in Wisconsin include the conditioning of these species to intensive culturing, including methods for improving growth, reducing stress and disease, and controlling reproduction. Also needed are the development of improved aquaculture systems and the establishment of various production parameters for these species.

“WATERS 2004-06: Wisconsin’s Aquaculture Technology, Education and Research Services” (Binkowski, A/AS-54). This new Advisory Services project will provide general outreach, specialized workshops and hands-on training on Recirculating Aquaculture Systems (RAS) and other Intensive Aquaculture Technology (IAT), including the development of domesticated brood stocks and advancing RAS technology to support IAT for early life-stage culture, fingerling production and grow-out (i.e., producing market-sized fish). Specific activities will include providing research information and technical on-site advisory services to established aquaculturists, which will include technical assistance on pond management, water quality analysis, broodstock manipulation, animal husbandry practices, feeding techniques for early life-stage culture, etc. The principal investigator (PI) will work continuously with prospective and active local, regional and national aquaculture entrepreneurs, particularly with regional Native American groups interested in IAT. He will also collaborate with the Wisconsin Aquaculture Association during February and March each year to develop the program for the annual state aquaculture conference. In collaboration with UW Sea Grant Communications staff and the North Central Regional Aquaculture Center (NCRAC), the PI and coauthors will produce a technical bulletin regarding the characteristics of wastes and effluents from regional aquaculture facilities and their ecologically sound and beneficial use.

The WATERS project addresses Wisconsin Sea Grant’s primary Aquaculture thematic priority of establishing the biological, physical, chemical, environmental and economic parameters for optimizing the performance of various aquaculture systems. This includes improving fish health, fish feeds, feeding strategies and effluent water quality in RAS/IAT operations. The PI also proposes to develop aquaculture curriculum for Wisconsin students, which addresses a secondary priority of providing aquaculture training and advisory services directed to preservice and in-service instruction for vocational agriculture teachers. The pre-service aquaculture programming will take place during the fall and spring semesters in partnership with the Wisconsin Department of Public Instruction, while the in-service work will take place primarily from mid-June to mid-July in connection with the Wisconsin Association of Vocational Agricultural Instructors (WAVAI) conference.

Advancing aquaculture technology will also contribute to our Fisheries Theme priority of rehabilitating populations of native fish species, particularly lake trout, Great Lakes muskellunge and lake sturgeon. Finally, this proposal fulfills an institutional priority of advancing the Wisconsin and regional economy through outreach and technology transfer to Great Lakes-related businesses and emerging enterprises based on aquatic resources.

In another aquaculture-related outreach activity, Wisconsin Sea Grant’s aquatic nuisance species (ANS) outreach specialist will continue to work with his counterparts in the Michigan, Minnesota, Pennsylvania and Ohio Sea Grant programs to conduct two workshops annually in each state to teach bait producers how to control the spread of ANS in their harvest and stocking activities. The training uses a Hazard Analysis and Critical Control Point (HACCP) approach to identify what steps in the business process can be used to control the spread of ANS, which helps maximize the efficiency of ANS prevention efforts. These workshops are expected to train 10-20 bait producers in Wisconsin and another 40 in the other states during 2004-2005. Partners in this project include state and federal agencies, private hatcheries, fish farms, commercial fisheries and fish veterinarians.

“Tetracycline Antibiotics and Resistance Genes in Aquaculture Environments: Genotypic Diversity and Potential Resistance Reservoirs” (McMahon/Pedersen, R/AQ-40). This new project proposal fell on the borderline in terms of overall project rating, but our reviewers felt it important to first diagnose whether this is a problem in aquaculture activities in the Great Lakes region. Consequently, if money becomes available, we will ask the PIs to pursue selective goals—specifically, to determine the concentrations of antibiotics in waters and sediments associated with aquaculture facilities. If high levels of antibiotics are encountered, we would seek to support work that would examine whether antibiotics use in aquaculture selects for reservoirs of resistance in microorganisms. At the same time, this work would address a Wisconsin Biotechnology Theme priority and complement ongoing work aimed at developing accurate approaches for assessing and predicting environmental risks to fauna and flora exposed to persistent chemical contaminants. It is also an Institutional priority to encourage promising new investigators and underrepresented groups to participate in the UW Sea Grant program.

“Endocrine and Environmental Regulation of Growth in Yellow Perch” (Malison/Barry R/AQ-38). This continuing research project aims 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. It addresses an Aquaculture Theme priority of improving the growth and controlled reproduction of cultured fish by developing biotechnological approaches.

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.

“Effects of Polyhalogenated Aromatic Hydrocarbons on Estrogen Metabolism in Lake Trout” (Barry/Peterson, R/BT-19). PAHs and their hydroxylated metabolites are persistent environment pollutants that are capable of interfering with reproductive and endocrine function in Great Lakes fishes. The goal of this new project is to evaluate the effects these pollutants have on estrogen metabolism in lake trout. Reviewers noted that this proposal has a strong likelihood of success, especially with regard to potential toxicity of PAH oxidation by-products. Panel members ranked it as very good to excellent in terms of scientific merit and highly relevant to our strategic plan.

“Dioxin Developmental Toxicity in Zebrafish” (Peterson/Heideman, R/BT-16). One of the hallmark signs of TCDD (tetrachlorodibenzo-*p*-dioxin) developmental toxicity in fish larvae is edema. At this time it is not clear what organs are targeted and what role the AhR signaling pathway plays. This continuing project seeks to specifically identify the target organs for TCDD in zebrafish embryos. The zebrafish is used as a model because its genome has essentially been mapped, and Dr. Peterson’s research team is experienced in the use of genetic

screens to identify genes with roles in larval development. Results from this effort may eventually provide a general understanding of TCDD toxicity in fish. For example, results may explain why some fish are more sensitive to TCDD than others, and why some fish can develop multigenerational resistance to these contaminants.

“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. That 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. An extremely well-reviewed proposal, the findings from this project should be of value not only in terms of providing detailed knowledge about toxic pathways in fish at the molecular level, but should also enable risk assessment efforts to be more rigorous.

Sea Grant Aquatic Nuisance Species Research Program: “Inhibition of Zebra Mussel Attachment by Bacterial Extracellular Polymers” (Maki, R/BT-18). The PI proposes to isolate and characterize extracellular polymers, produced by certain types of bacteria, that inhibit the attachment of zebra mussels to a solid substrate. These exopolymers will then be tested as an environmentally friendly approach to zebra mussel control. This project was funded through last year’s Sea Grant National Strategic Investments (NSI) competition for ANS research. This project addresses our Biotechnology strategic priority of bioengineering aquatic organisms for new industrial and environmental management applications. It also addresses an Ecosystem & Habitats priority of conducting research on ways to deter and control invasive species.

A proposed new project in Ecosystems & Habitats (**“Quagga Mussel Invasions: Functional Morphology, Biomechanics, Zebra Mussel Displacement and Future Spread,” R/LR-91**) will use 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 argues that it is possible that the functional morphology of the quagga is more plastic than that of the zebra mussel. Determining the genetic controls for mussel habitat preferences within lakes could indicate where mitigation efforts should focus.

If funding becomes available, another proposed new project in the Urban Coast theme (**“Sources and Transport Mechanisms for *Escherichia coli* Contamination at Lake Michigan Beaches and Evaluation of Human Health Risk,” R/MW-89**) 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, which were the most favorably reviewed portions of the proposed work.

An institutional goal in this thematic area over the next two years is to engage and involve Wisconsin’s potent biotechnology community in Sea Grant research on priority topics that could benefit from biotechnological approaches, especially in our Aquaculture, Fisheries, 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 epidemiology study and treatment; and improved biofiltration performance through enhanced nitrifying bacteria production.

Examples in Fisheries include the development of processing methods and new food products utilizing burbot and white perch, and some means of dealing with the nuisance alga *Cladophora* that covers Lake Michigan beaches in 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.

Our Advisory Council endorsed this concept and suggested that it take the form of a workshop for prospective PIs in 2005 prior to the distribution of our 2006-08 RFP.

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.

It is a Wisconsin CC&E Theme priority to apply geographic information systems (GIS) and other state-of-the-art techniques to improve coastal resources management by assisting decision-makers in the wise, science-based planning and development of coastal watersheds and shorelands. Specifically, we will use our "EPA Smart Growth Extension Partnership" (Hurley, A/AS-55) grant to develop tools and techniques for engaging Wisconsin citizens in Smart Growth planning for coastal areas. As part of this effort, our Advisory Services GIS specialist will work with the UW-Madison Land Information & Computer Graphics Facility to develop tools and techniques for enhancing the Community Planning Resource (CPR), a comprehensive Web site created for use by Wisconsin communities to support Smart Growth planning. It also includes development of a planning Web site for a rural coastal jurisdiction that provides access to planning tools and GIS data to support the implementation of their smart growth plan.

"Applications of 'Dynamic and Distributed' GIS and Visualization for Great Lakes Coastal Management" (Ventura, R/NI-33). There are acute needs to develop an ability to assimilate digital spatial data from multiple distributed online sources (local, academic, state, regional, federal data custodians) through Web-based applications, and to enable remote access and real-time integration of these data by multiple users for specific applications, management and educational purposes. This new project addresses those needs with the application of state-of-the-art Geographic Information System approaches; it also addresses an institutional priority of providing research-based expertise to state agencies, educational institutions and the private sector.

In a connected outreach effort, our Advisory Services GIS specialist will demonstrate and publicize the value and usefulness of Web-based GIS for various decision-support applications by conducting 2-4 workshops per year to teach local governments and industries to apply GIS in coastal decision-making. He also plans to develop teaching models/modules for training GIS users. Online records and county-based GIS systems will be integrated as part of this outreach effort.

"Measuring Interrelated Demands for Commercially Caught Fish" (Bishop, R/PS-57). Another Wisconsin CC&E priority is to develop and validate new techniques for economic valuation of Great Lakes resources and their importance to thriving coastal communities and businesses. This new 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 now want to update and expand 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 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.

“Exploring Wisconsin's Great Lakes Schooners: Integrating Underwater Archaeology, Shipwreck Preservation and Public Education” (Broihahn/Karl, C/C-7). This new project addresses a CC&E priority of enhancing public appreciation of Great Lakes and coastal historical and cultural resources by engaging public interest in the archaeological exploration, documentation and preservation of these resources. Most of this well-reviewed project will consist of archaeological field research conducted annually by Wisconsin Historical Society (WHS) staff, while UW Sea Grant's science writer will contribute communications support in the form of news release(s) and other project-related publicity about the archaeological field work and related project activities during summer 2004 and spring of 2005. The PIs will also prepare two shore-side interpretive markers in summer 2004 and during the fall add two more shipwrecks on the project Web site, “Wisconsin's Great Lakes Shipwrecks” (www.wisconsinshipwrecks.org), one of the most popular features on the UW Sea Grant Web site. During winter 2004-05, the project Web site will be enhanced with information from summer field season and other new features. During summer-fall 2005, the PIs will produce three new dive guides and add two more shipwrecks to the project Web site. Besides the WHS, 13 other organizations are cooperating with the PIs on this project.

In a related outreach effort, our Advisory Services GIS 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/circltour).

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 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.

UW Sea Grant will continue to partner with the Wisconsin Academy of Sciences, Arts & Letters to advance the recommendations resulting from the Waters of Wisconsin Summit of 2002 and initiated during the 2003 “Year of Water” observance. We are developing an online database that—for the first time—synthesizes Wisconsin state laws, regulations and policies via a user-friendly, common access point to make this information more readily accessible to interested individuals and assist in identifying gaps in current law.

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.

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 priority in this thematic area is to develop and apply GIS for assessing and reducing natural coastal hazard risks. Specifically, our efforts are directed at (1) improving shoreline mapping and watershed change analysis methodologies; (2) developing, refining and demonstrating coastal community risk and vulnerability assessment methods; and (3) understanding of the magnitude of and trends in intensified shoreland investments and the vulnerability of these investments to coastal storms and extreme lake levels.

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 the U.S. Geological Survey to address such topics as climate change effects on lake levels and floodplain mapping for coastal communities.

We currently have a vacancy for an Advisory Services specialist for our UW-Superior office, our only office in the Lake Superior basin. We have advertised the position to attract a candidate with experience in climate change outreach (a NOAA priority) and/or experience in coastal engineering (due to the recent retirement of that specialist, Philip Keillor), and we hope to fill this position prior to submitting our 2004-06 Implementation Plan. In the interim, we have hired Mr. Keillor on a 20% basis to complete work on two booklets, *Deciding about Sediment Remediation* and *Stabilizing Coastal Slopes on the Great Lakes*, along with fact sheets about working with engineers and contractors on shore protection projects, and the economics of coastal erosion risks to property investments along the Great Lakes.

Deciding about Sediment Remediation has been peer reviewed and revised according to those reviews and was recently published by the U.S. Army Corps of Engineers, with distribution to begin during early 2004. Written for anyone involved in the decision to remediate contaminated sediments (including people without engineering or scientific backgrounds), this book will provide vital step-by-step instructions for planning any actions involving contaminated sediments. Evaluation of the publication will be conducted via self-addressed comment postcards to be enclosed with each copy of the book. Peer review-based revisions are also being made to the three fact sheets: "The Economics of Coastal Erosion Risks to Property Investments along the Great Lakes," "Stabilizing Coastal Slopes on the Great Lakes" and "Working with Engineers and Contractors on Shore Protection Projects." All three fact sheets, intended for owners of property on the shores of the Great Lakes, are expected to be published by mid-2004.

An ongoing Wisconsin outreach priority in this theme-area is to increase public safety through greater awareness of everyday Great Lakes hazards, such as hypothermia, rip currents and navigation hazards posed by low water levels. These will continue in 2004-06 with the distribution of information about these hazards in the form of news releases, fact sheets, and North Carolina Sea Grant's rip current poster and flyers.

In addition, our Advisory Services Marine Safety specialist will continue to conduct accredited boating safety courses for 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. Specifically, he will conduct two to four Boating Safety Classes each winter-spring period from late January up to Memorial Day. 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.

Digital Ocean/Great Lakes 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.

“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 proposal was highly ranked by all reviewers. The objectives of this new project are very much in tune with those of Sea Grant's national Digital Ocean Theme Team: 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.

“Enhanced Experimental Methods for Measuring Inorganic Contaminants in Water Using a Micromachined DC Plasma Instrument” (Anderson/Gianchandani/Zorn, R/MW-85). This continuing project is developing technologies for remote sensors of water quality. Current assessment of water quality requires collection, transport and laboratory analyses. The investigators plan to develop a miniaturized DC argon plasma emission spectrometer that could be inserted in an *in situ* probe for water quality analysis. The successful application of this methodology would allow remote sensing and multielement detection of key water chemistry parameters.

A new project in our Ecosystems & Habitats thematic area (**“Coastal Sediment Resuspension, Transport and Deposition in Great Lakes,” R/EC-9**) will also contribute to this theme area by modeling coastal sediment transport. Most ocean and Great Lakes water circulation models do not include sediment transport, even in coastal waters. Yet, an understanding of these processes is crucial to evaluate the stability of shorelines, the cycling of sediment-associated pollutants and biological productivity. This model limitation exists because we still do not fully understand the response of lake-bottom sediments to wave, turbulence, and circulation motions and energies.

The aforementioned new Advisory Services project in Coastal Communities & Economies (**“Applications of ‘Dynamic and Distributed’ GIS and Visualization for Great Lakes Coastal Management,” R/NI-33**) complements our Digital Ocean/Great Lakes thematic effort in that it also qualifies as an ocean/Great Lakes observation system. A related Wisconsin outreach priority in this theme area is to assimilate digital spatial data from multiple distributed online sources (local, academic, state, regional, federal data custodians) through Web-based applications, and enable remote access and real-time integration of these data by multiple users for specific applications, management and educational purposes. To that end, we have established strong partnerships with two NOAA laboratories. Our outreach staff will be working closely with Great Lakes Environmental Research Laboratory staff to provide an outreach component for their many remote sensing activities, including the adaptation of models for ecological forecasting. Furthermore, our GIS outreach specialist was recently selected to participate in a NOAA Coastal Services Center-funded project, “Developing a Dynamic and Distributed GIS to Support Coastal Management along the Lake Superior Coast of Wisconsin.” This project is aimed at county land management personnel who need to integrate data from disparate sources to better manage this coastal region. This outreach work also addresses an institutional goal of increasing funding for Sea Grant program activities by encouraging staff and project investigators to seek supplemental grants and other funding.

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.

“Quagga Mussel Invasions: Functional Morphology, Biomechanics, Zebra Mussel Displacement and Future Spread” (Lee, R/LR-91). This was one of our highest-ranked proposals, and the proposed work fits perfectly with our strategic objectives in Ecosystems & Habitats. Quagga mussels are likely to displace zebra mussels and spread into the western Great Lakes and Wisconsin waters in the near future. Mitigation strategies require a clear understanding of why quagga mussels may ultimately dominate. It is known that these mussels exhibit a greater shape variation than zebra mussels. The proposed work in this well-reviewed project will examine to what extent phenotypic plasticity in quagga mussels determine their shape.

“Expanding Cattails and Shrinking Sedge Meadows: Reversible?” (Zedler, R/LR-96). Cattails are considered to be an invasive species in Lake Michigan wetlands. Little is known about what happens to native species after cattails have invaded a coastal wetland. Additionally, this proposed new project will try to evaluate the resilience of degraded sedge meadows and predict the degree to which they are restorable. A highly ranked proposal, the proposed work nicely complements our other projects in this high-priority area.

As noted earlier, our ANS priority is also addressed by a new project in Biotechnology (**“Inhibition of Zebra Mussel Attachment by Bacterial Extracellular Polymers,” R/BT-18**) that is being supported with Sea Grant ANS strategic investment funding.

“Sea Grant Non-Indigenous Species (SGNIS) Web Site: Development and Support” (Moy, A/AS-53). Together with Illinois-Indiana Sea Grant, we continue to coordinate the input of new, peer-reviewed information on the Sea Grant Nonindigenous Species (SGNIS) Web site, a project also supported with Sea Grant ANS strategic investment funding. Users from 125 nations have visited the SGNIS Web pages and downloaded nearly 3 million files. About two-thirds of SGNIS users are U.S. residents.

Related outreach work includes a partnership with the U.S. Army Corps of Engineers on improving the Asian carp barrier on the Chicago Ship and Sanitary Canal. Also, our ANS/fisheries and GIS outreach specialists plan to collaborate on developing map-based representations of the spread of ANS in Great Lakes and inland waters. We also plan to expand our ongoing public information campaign with a computer kiosk of ANS information on the Lake Michigan car ferry in a project supported with funding from the U.S. Environmental Protection Agency's Great Lakes National Program Office. We also will continue to produce ANS Attack Packs for K-12 students and nonprofit organizations. These self-contained ANS outreach packs hands-on information and materials regarding the identification of invasive species and how their spread can be prevented.

In 2004-06 we will continue our “Zebra Mussel Watch” campaign as part of our larger ANS effort. 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 ZM cards and other ANS program materials; development of related exhibits and displays for events such as the Wisconsin State Fair; generation of related media coverage via radio and newspaper articles; production of related materials, and marketing and maintenance of a Zebra Mussel Watch Web site.

“Coastal Sediment Resuspension, Transport and Deposition in Great Lakes” (Wu/Hoopes, R/EC-9).

Mentioned earlier in the Digital Ocean/Great Lakes Theme, the ultimate goal of this new project is to develop and validate an *in situ* instrumentation package called Bottom Erosion and Deposition System. This system will simultaneously measure sediment particles associated with wave- and turbulence-induced bottom shear stresses. This system, if successful, should be of immense value to all ocean/Great Lakes observation efforts. The PIs' close working relationship with researchers at NOAA's Great Lakes Environmental Research Laboratory enables us to partner on coordinated field efforts and will not require additional funds for ship time. *In situ*-based measurements of sedimentation and resuspension rates determined by this project will complement both new and ongoing work related to hydrodynamic changes and water circulation modeling.

“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). 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 new 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 in the Great Lakes. The highest-ranked proposal by both peer and technical panel reviewers, this work addresses a Wisconsin Ecosystems & Habitat priority of developing technologies for better spatial and temporal characterization of nearshore environments and coastal ecosystem dynamics. It will also help meet our Innovative Science & Technology priority of quantifying the potential effects of climate change on Great Lakes hydrology and ecosystems.

“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. The goals of this well-reviewed proposal address these high-priority concerns. 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 thematic effort as well as the Fisheries thematic area.

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. Our GIS outreach specialist is working with the River Alliance to use GIS to prioritize dam removal in the Lake Michigan watershed to restore stream habitat. He is also working with Jill Hewitt, a doctoral student at UW-Milwaukee, to use GIS to study the effectiveness of wetland restoration projects in Ozaukee County.

Our habitat restoration outreach specialist will also continue her efforts on the remediation and restoration of the Fox River estuary and Lake Michigan's Green Bay. As an active member of the Green Bay Remedial Action Plan Biota and Habitat Committee, her work is ensuring that nearshore habitat restoration and rehabilitation is included as an important part of the plan, consistent with our priorities in this thematic area. She is assisting the committee, the U.S. Army Corps of Engineers and Brown County Port in designing the restoration of a chain of barrier islands in southern Green Bay, making beneficial use of dredged materials from the navigation channel and helped design habitat enhancement features incorporated into a new marina at the mouth of the Fox River. Finally, she will be conducting biweekly surveys of diving duck use of Green Bay during the 2004 fall migration season to track waterfowl response to changing environmental conditions.

Another outreach priority in this area is to foster increased public understanding and appreciation for Great Lakes ecosystems and habitats. This will be addressed through production of Web sites, including a “State of

the Bay” Web site 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 Department of Natural Resources, 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 and the State of the Lakes Ecosystem reports.

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.

“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 new 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 was highly rated by our review panel and is a natural for addressing one of our four high-priority areas.

“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 well-reviewed proposal will attempt 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 new project will have broad applicability for other lakes as well. The proposed work also addresses a high priority objective in our strategic plan of evaluating the biological and economic impacts of exotic aquatic species on the Great Lakes’ fisheries, and develop scientific approaches to guide control practices for dealing with exotic aquatic species.

“Compensatory and Spatial Dynamics in Great Lakes Food Webs” (Kitchell, R/LR-94). As mentioned earlier in Ecosystems & Habitats, proposed 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.

“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. Stock 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 well-reviewed new project proposal wants 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 great history of working with fisheries managers, and the effort nicely complements work proposed by the Kitchell project. 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.

We will also continue supporting **“Fisheries Extension Enhancement: Great Lakes Fishery Leadership Institute (Wisconsin Share)” (Moy, A/AS-52).** This special Great Lakes Sea Grant Network project is designed to help current and potential Great Lakes fisheries-related organizational leaders learn about Great Lakes biology, ecology, fisheries management, ANS, institutional relationships, political contacts and leadership skills. One of the first in this series of future leaders workshops was held Oct. 4 in Manitowoc, Wis. The daylong workshop attracted 27 participants, including anglers, charter fishing captains and commercial fishers from all four states surrounding Lake Michigan. Similar workshops are being held this fall and winter focusing on each of the Great Lakes and within each state in the Great Lakes Basin. This effort will continue through the fall of 2004.

In outreach related to this theme, our Advisory Services fisheries specialist will continue to chair monthly meetings of the Lake Michigan Fisheries Forum, an advisory body formed by the Wisconsin Department of Natural Resources to address issues related to Lake Michigan fisheries. 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.

Our Advisory Services program is currently among several programs eligible for an additional position through the NOAA Sea Grant’s Fisheries Extension Enhancement for FY04. 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 Department of Natural Resources 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.

The Wisconsin Sea Grant program is proud to co-host the next American Fisheries Society’s annual meeting in August 2004 at the Monona Terrace Community and Convention Center in Madison. Our fisheries outreach specialist has been selected as the local host of the meeting. Meanwhile, we will be publishing the proceedings of *Percis III*, the Third International Percid Fish Symposium held in Madison, July 20-24, 2003, both on CD and, in conjunction with the UW Digital Collections Center, in digital form on the Web. Sponsored in part by UW Sea Grant, this symposium gathered experts in the areas of fisheries management, aquaculture and biology, and the proceedings will make their presentations available worldwide.

It is also a Wisconsin priority in this area to foster better understanding of the historical, cultural, ecological and economic significance of Great Lakes fisheries to Wisconsin, the region and the nation. To that end, we plan to update and electronically publish our award-winning 1986 *Fisheries of the Great Lakes* publication. We will also continue work on a comprehensive database-driven Web site designed for resource managers, students and the public that contains photographs and identification information for every species of fish in the state of Wisconsin.

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 sciences 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.

"Lake Sturgeon Bowl: Wisconsin's Regional Academic Competition for the National Ocean Sciences Bowl, 2004-06" (Duffy/Klump, E/E-47). 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 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 in February at UW-Milwaukee. Participants come from throughout Wisconsin, ensuring that this effort reached students from the inner city to rural, agricultural areas of the state. Our education outreach specialist will also contribute to this effort by coordinating the regional competition and training of teacher-coaches, students and event volunteers, as well as providing scientific expertise on associated field trips. He also serves as a competition official, assists in coordinating the overall event and accompanies the winning team to the national finals and on an associated field trip to a marine site. He also participated in the programming for the educational research cruises aboard the *S/V Denis Sullivan* and the *R/V Neeskay* awarded to other regional teams. 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 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 priority of expanding our educational programs to K-12 students, nontraditional students and the adult public.

"Recent Advances in Limnology and Oceanography Seminar Series, 2004-06" (Berges/Brooks, E/E-48). 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 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.

Another strategic priority in this thematic area is to identify and respond to special Great Lakes, coastal and marine education needs and opportunities. Our water quality outreach specialist will continue to develop and sustain community-based stream monitoring programs for Wisconsin watersheds of Lakes Michigan and Superior. This information will be used by management agencies to identify water quality and stream habitat impairments and their potential causes, to determine the need for more intensive watershed monitoring, and to track changes in response to watershed management programs. She is also assisting the Einstein Project in developing curriculum and water quality monitoring activities for Wisconsin middle schools.

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.

In pursuit of our thematic priority 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, including those of underrepresented groups, to increase their marine/aquatic science literacy. For example, the Lake Sturgeon

Bowl mentioned earlier has had at least one team each year from the Milwaukee Public Schools (large minority population) and we make every effort to recruit schools and teams with minority representation. 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., ANS "Attack Packs") and to students enrolled in UW system science and education programs.

In cooperation with the Wisconsin Department of Natural Resources (WDNR) and Wisconsin Environmental Education Board, we have developed sets of four Great Lakes Park Packs for use by visitors and park naturalists at state park facilities located along the Great Lakes coasts of Wisconsin. The packs have four themes: Great Lakes Challenges; Great Lakes Mysteries; Great Lakes Survival; and Glacial Gifts. A subset of pack materials on fisheries topics has been assembled by DNR staff. These materials are available for use at hatcheries and at regional offices. Each pack contains a series of hands-on family activities that young people can do while visiting the park properties. Packs are signed out at the park office for a limited time of use by the family or group requesting use of the pack. Twenty-five sets have been assembled; 15 sets are currently in use at park properties. Our goal for the next biennium is to develop a teacher guide for each of the packs, in PDF format, with suggested additional resources, teaching strategies and correlation to education standards so teachers could use this information to incorporate the Park Pack activities into their curriculum. Teachers could also arrange to borrow the appropriate pack from a park naturalist during the school year. We intend to have this teacher guide ready prior to the start of the 2004-2005 school year.

Our GIS outreach specialist will develop teaching modules and work with K-12 teachers to introduce GIS to students and explore the development of a graduate course in the Department of Urban and Regional Planning related to the use of GIS in coastal and environmental resource management issues. In addition, he 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. Finally, he will develop 3-D visualization tools for educating citizens about Great Lakes bathymetry and underwater features.

We will also continue to develop and maintain a variety of Web sites on Great Lakes-related topics specifically for teachers and students, including updating our "Migratory Birds" Web site. We will also complete work on the "Interactive Fish Identification and Bioenergetics Lab," a comprehensive database-driven Web site 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.

The "Interactive Fish Identification and Bioenergetics Lab" Web site and desktop software are being developed in partnership with the WDNR and the Center for Limnology (CFL) at UW-Madison. The site is already being used extensively by resource managers at the WDNR and students in undergraduate classes at the CFL. We expect data and photographs to be available for every species of fish in the state by the early months of 2004, and we hope to be able to publicize the site for the fishing season of 2004. The CFL is also producing a compact disk version of the fish identification Web site for use in the 2004 Great Lakes Fisheries Leadership Institutes.

As mentioned earlier in the Coastal Communities & Economies theme, UW Sea Grant will continue to develop and promote "Wisconsin's Water Library," a special project 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 explore 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. It will 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 Web sites. It will also link to appropriate *Littoral Drift* newsletter articles and "Earthwatch Radio" scripts when possible. This project also meets the Coastal Communities & Economies priority of initiating outreach on Great Lakes issues.

Another priority is to encourage strategic partnerships with other state, regional and national education efforts. Our plans in this area include making the international Project JASON programming available annually to

Wisconsin teachers and students, including participating in teacher training on a national level, providing teacher training at the local level, hosting live JASON broadcasts for the Madison area, and delivering Sea Grant and JASON-related science content to middle schools students and teachers worldwide via the Web.

In addition, our education outreach specialist will continue to develop, direct and teach courses in partnership with organizations such as PIER Wisconsin, UW Great Lakes WATER Institute, UW-Stevens Point, Schlitz Audubon Nature Center and UW-Milwaukee's Department of Geosciences and Office of Overseas Programs & Partnerships. These include:

- **Great Lakes Ecology Workshop, UW-Stevens Point**—This is a two-day workshop involving about 30 educators held at Great Lakes WATER Institute and PIER Wisconsin, with instructional cruises aboard the *R/V Neesky* and the *S/V Denis Sullivan*. Our education outreach specialist plans to offer, or participate in, at least one such course each summer during 2004-06.
- **Aquanaut Program, UW-Milwaukee Department of Curriculum & Instruction and Great Lakes WATER Institute**—This workshop provides hands-on opportunities for teachers to use the latest technology, such as remotely operated vehicles, to explore Lake Michigan. Workshop materials and shiptime are supported with funding from NOAA's National Undersea Research Program.
- **Marine Science at Sea: A Hands-on Laboratory, UW-Milwaukee Dept. of Geosciences and Office of Overseas Programs & Partnerships**—This laboratory course was piloted in January 2003 aboard the *S/V Denis Sullivan*, operated by PIER Wisconsin, in Florida and Bahamian waters with seven students and a videographer. Students visited four islands in the Bahamas group, sampled a variety of nearshore and open ocean sites, snorkeled on pristine reefs, surveyed reef fish at the Caribbean Marine Research Laboratory, and received formal instruction in the ocean and nautical sciences. The students also became crew of the *Sullivan*, and were involved in all aspects of shipboard activities. By all accounts, it was a life-changing experience for everyone involved. Planning is underway to repeat this course in 2004, with the intent of conducting this course each January as part of the university's Winterim offerings.

An overarching Marine & Aquatic Science Literacy priority is to enhance public awareness and understanding of Great Lakes issues and appreciation for Great Lakes history, culture and resources. This is fulfilled in part by a new project ("**Exploring Wisconsin's Great Lakes Schooners: Integrating Underwater Archaeology, Shipwreck Preservation and Public Education**," C/C-7), described earlier in Coastal Communities & Economies, and a continuing project, "**Earthwatch Public Service Radio Program**" (Hoops, C/C-2). 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 Great Lakes, coastal and 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 2004-06 is to expand the Internet functions of the Earthwatch Radio project to include online distribution of audio to radio stations and to develop material for use on the radio project's Web site to complement the audio programming on a regular basis.

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. We now have permission from AGS to digitize their maps and create a Web-based product of this exhibit. The Web site will include an adult study guide featuring map-by-map descriptions, historical essays as well as a bibliography.

We will also fulfill this priority through exhibits and displays as participants in "UW Day" at the Wisconsin State Fair and "UW-Madison on the Road" statewide outreach program events. Our water quality outreach specialist annually 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 provides a course on Wisconsin's water resources for the Institute for Learning in Retirement at UW-Green Bay.

During 2004-06, we plan to develop a state-of-the-art, Web-based Media Center to enable the Communications staff to compose and post press releases and other public relations materials via a Web interface easily accessible to the media. We will also maintain and enhance our Publications Store, which is a state-of-the-art public site for the distribution of Sea Grant publications as well as the management of our inventory, and redesign the UW Sea Grant Web site to be more user- and topic-oriented while continuing to meet W3C accessibility requirements.

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 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.

“Use of Fish Oil for Enzyme-Mediated Production of Value-Added Food Products Containing Omega-3 Fatty Acids” (Hill, R/AQ-39). This was one of the highest-rated projects in the last biennium's competition. The PI is evaluating the technical and economic feasibility of using omega-3 fatty acids, occurring naturally in fish oils, to obtain value-added acylglycerols for use in the formation of nutraceuticals. The process of utilizing lipase-mediated reactions offers significant potential for formulating nutraceutical food products with value-added triacylglycerols, such as infant and geriatric formulae, dairy spreads, salad dressings and frozen desserts. A U.S. corporation and a company in Barcelona, Spain, have expressed interest in employing this technology.

Another 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 2004, our fisheries outreach specialist will continue working with the Wisconsin Department of Natural Resources and Green Bay commercial fishers to 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.

We also plan to collaborate with Minnesota Sea Grant and Lake Superior commercial and tribal fishers to conduct some workshops during 2004 on possible uses and markets/interest for creating a commercial siscowet (fat trout) fishery on Lake Superior.

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.

“Factors Regulating the Interactions of Trace Metals and Aquatic Organisms in Watersheds of the Great Lakes” (Armstrong/Shafer, R/MW-86). This continuing project builds on previously funded research by applying low-level trace metal analytical methods to better understand biological uptake of metals from contrasting watersheds of the Great Lakes. Armstrong's laboratory at the UW Environmental Chemistry and Technology Program has been a leader in field and laboratory methodologies for low-level trace metals. In this project, the investigators will perform direct metal bioassay experiments to better apply the Biotic Ligand Model to natural systems. UW Sea Grant-supported research by Armstrong in the Microcontaminants & Water Quality Subprogram has led to the development of techniques that have allowed his research group to recently secure projects from both the U.S. Department of Defense and the U.S. Environmental Protection Agency.

“The Importance of Trophic Level and Carbon Source as Factors Affecting the Accumulation of PCBs in the Lake Michigan Food Web” (Bootsma/Aldstadt, R/MW-87). Another continuing project, this work couples low-level contaminant analyses with innovative stable isotopic analyses to better understand trophic transfer and toxin bioaccumulation. The investigators suggest that differences in food web structure—particularly the invasion of nonindigenous species in Lake Michigan—may have altered carbon and contaminant transfer. Models describing accumulation of PCBs and other contaminants as a function of carbon source and trophic level will allow managers from state and federal agencies to predict contaminant accumulation as a function of altered nutrient regimes, continued establishment of recent species, and the invasion of new species.

“Methylmercury Production and Transfer to Benthic Food Webs in Nearshore and Wetland Environments of Southern Lake Superior (Wiener/Rolfhus/Haro, R/EC-8). This third continuing project, a component of our Estuarine & Coastal Processes Subprogram, addresses the route of entry of the bioaccumulative form of mercury (methylmercury) into the food web of Lake Superior. The investigators propose that coastal wetlands are key sites for the conversion of inorganic mercury to methylmercury and for direct entry of the methylated form to invertebrates and fishes inhabiting these zones. Given the mercury consumption advisories for nearshore Wisconsin waters of Lake Superior, understanding the routes of entry is critical. As state and federal agencies propose stricter rules regarding mercury emissions, this study should provide valuable information for modeling efforts projecting responses to decreases in atmospheric deposition of this contaminant.

“Sources and Transport Mechanisms for *Escherichia coli* Contamination at Lake Michigan Beaches” (McLellan, R/MW-89). This proposed new 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. As mentioned in our Biotechnology thematic area, this project is in the category of “support if funds are available.” 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. We definitely view this topic as an emerging field for Sea Grant research in our region, and our Advisory Council urged the UW Sea Grant program to address this issue. A few of the objectives of this project were very well reviewed, so we will try to fund selected objectives if funds become available during the next fiscal biennium. Supporting this project would also fulfill an institutional priority of encouraging promising new investigators (especially those from underrepresented groups) to participate in the UW Sea Grant program.

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.

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

As noted in Ecosystems & Habitats, our water quality outreach specialist addresses issues related to remediation and restoration, including dissemination of information on PCBs in the Fox River and Green Bay, Lake Michigan, assisting in national Sea Grant Nonpoint Education for Municipal Officials efforts, and in educating, training and engaging students and adults in volunteer monitoring of sensitive Great Lakes tributaries. In addition to distributing fact sheets, she has organized public forums and seminars to inform the public about the distribution and mass of PCBs in Green Bay and the ecological and economic benefits of remediation and restoration actions. In 2004, UW Sea Grant will assist the USEPA in organizing a state meeting to announce the results of the Lake Michigan Mass Balance Study.

In connection with the findings of a terminating UW Sea Grant contaminants research project, the UW Sea Grant Communications staff plans to develop a question-and-answer fact sheet about polybrominated diphenyl ethers (PBDEs) in the Great Lakes and initiate a general 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 this UW Sea Grant research has helped show—that PBDEs are accumulating where they should not. The investigators have 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 report 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.

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.

“Improving Safety and Cost Effectiveness in Scuba Diving” (Dueland/Lehner, R/NI-32). 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 wish to extend 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. Related to this research, we also plan to explore with the PIs ways to conduct outreach to divers on the risks of DON.

A new project discussed in Ecosystems & Habitats (**“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**), addresses a topic that has implication for water quality, biological and climate change studies and thus helps satisfy the Wisconsin priority in this thematic area of quantifying the potential effects of climate change on Great Lakes hydrology and ecosystems.

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 inter- and intra-basin 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 work with our NOAA Sea Grant program officer to convene a Technical Advisory Team to recommend ways that we might improve our aquaculture research and outreach program during 2004.

- *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 2004, we will 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 2005, we will provide partial support for 9-12 graduate students and 3-5 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 2004-06, UW Sea Grant will also provide ship time support for field work for the following research and outreach projects: "Coastal Sediment Resuspension, Transport and Deposition in Great Lakes" (R/EC-9); "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); "The Importance of Trophic Level and Carbon Source as Factors Affecting the Accumulation of PCBs in the Lake Michigan Food Web" (R/MW-87); "Exploring Wisconsin's Great Lakes Schooners: Integrating Underwater Archaeology, Shipwreck-Preservation and Public Education" (C/C-7), and "Advisory Services: Program Coordination and Field Offices" (A/AS-1).

- *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 2004-06 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 proposals and reports, and an interactive project budget management system. In 2004-06 we will 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 2004-06, if funding becomes available through an increase in UW Sea Grant base funding, we intend to fund two proposals submitted by new members of the UW-Madison faculty—"Tetracycline Antibiotics and Resistance Genes in Aquaculture Environments: Genotypic Diversity and Potential Resistance Reservoirs" (McMahon, R/AQ-40) and "Sources and Transport Mechanisms for *Escherichia coli* Contamination at Lake Michigan Beaches" (McLellan, R/MW-89).

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

All PIs are routinely encouraged to seek supplemental funding and/or in-kind support for their research 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.

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

Examples of such leverages for 2004-06 include the proposed continuation of the ANS-"Babe Winkelman's Good Fishing" syndicated television program collaboration, the Great Lakes Sea Grant Network's HACCP baitfish ANS and Great Lakes Fisheries Leadership Institute (A/AS-52) projects, and the water policy database project with the Wisconsin Academy of Sciences, Arts & Letters and several other partners (see **Appendix H**). 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 has a long-range information technology strategy and 2004-06 implementation plan and will be monitoring success toward objectives through achievement and documentation of milestones.

- *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, Web sites, news releases, newsletter, video and television programming. Our 2004 plans include the development of several new Web-based applications. An Intranet Calendar will allow Sea Grant staff to easily post announcements and other program-specific information to the public Web site calendar through the submission of Web-based forms. 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. In addition, we will be exploring replacing or supplementing our existing newsletter with an online version and/or periodic publications (hard copy and/or digital version) focusing on Sea Grant research, education and outreach.

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 2004-06, 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 & outreach will conduct annual visits with Wisconsin state and federal legislators. In 2004, we will produce and distribute to interested individuals as well as the general public copies of our 2004-06 Program Directory and program fact sheets, as well as copies of our 2003 annual progress report, 2002-06 Strategic Plan and 2004-06 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 2004-06, Wisconsin Sea Grant will provide support to 49 graduate and undergraduate students in 19 departments on seven campuses who participate in the program's 33 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 two to three graduate and undergraduate students as student science writers on the "Earthwatch Radio" project annually, as well as project assistants on the SGNIS Web site project, various GIS projects, information technology support and other projects as they develop.

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

During 2004-06, we will provide funding each year for four post-doctoral students to work on Sea Grant projects.

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

In 2004-06, 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.*

UW-Madison graduate student Colleen Corrigan (M.S., Conservation Biology) has been selected for NOAA Sea Grant's 2004 Dean John Knauss Marine Policy Fellowship Program, so UW Sea Grant will provide supplementary support for her one-year appointment in the U.S. Fish & Wildlife Service's Division of Federal Program Activities. UW Sea Grant will likewise provide support for any Wisconsin students similarly chosen during 2005-06.

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

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 out of the UW-Madison Water Resources Library.

During 2004-06, we will partner with UW-Madison Digital Collections Center to investigate digitizing the proceedings of recent UW Sea Grant conferences (Percis III and Argentum I-V) to make them freely available worldwide on the Web. We will also investigate low-cost methods of distributing Sea Grant publications and educational materials statewide using the Wisconsin Libraries' Delivery Network. This will include using public libraries to distribute free Sea Grant materials to the public.

In addition, we'll explore replacing the Water Resources Library's monthly *Recent Acquisitions* list with a periodic digital publication focusing on a Great Lakes issue of Wisconsin importance for those interested in learning more about a subject. The proposed publication will be available on the Web and distributed via email. It will consist of a short description of the problem, books or other documents available through the library, and a few highly reliable Web sites. It will also link to appropriate *Littoral Drift* newsletter articles and "Earthwatch Radio" scripts when possible.

"Wisconsin's Water Library" (aqua.wisc.edu/waterlibrary) is an outreach project of the UW Water Resources Library designed to make library resources available to all Wisconsin residents. The library also has a Web site (wri.wisc.edu/library) that offers services available only to UW System faculty, staff and students. To avoid any confusion between the two, we will redesign the Water Resources Library Web site to clarify that persons associated with the UW System should use that site.

To improve access to Great Lakes information for K-8 teachers and students, we will use a "Friends of UW-Madison Libraries" grant to develop a Kids and Teachers section for the "Wisconsin's Water Library" Web site, which will consist of books online and available for checkout through the library, plus a few highly trustworthy and fun Web sites. This project includes the development of a Web site attractive to kids and useful for teachers in connection with the annual Madison JASON project.

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

We will strive to continue to increase the number of teams participating in the Lake Sturgeon Bowl, Wisconsin's regional academic competition for the National Ocean Sciences Bowl, during 2004-06, with an emphasis on increasing participation by teams from the Milwaukee Public Schools system and other schools with large numbers of underrepresented students.

We will provide partial funding for the "Recent Advances in Limnology and Oceanography Seminar Series, 2004-06" (E/E-48) at UW-Milwaukee. Open to the public, attendance at each lecture in past years has typically ranged from 25 to 50 people.

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. Two international conferences in which UW Sea Grant staff have leading roles during 2004-06 are the American Fisheries Society International Conference to be held in 2004 and the 2004 and 2006 International Conference on Mercury as a Global Pollutant.

- *Build knowledge with Great Lakes and aquatic sciences 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 2004-06, 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.*

We will also continue to lead or participate in Great Lakes Sea Grant Network outreach projects, such as the baitfish HACCP project and various other regional ANS outreach activities. During 2004-06, our GIS outreach specialist will use supplemental funding from the NOAA Coastal Services Center to develop a dynamic and distributed GIS to support integrated coastal management along the Lake Superior coast of Wisconsin. We will also begin conducting outreach with USEPA "Smart Growth" Extension funding via NOAA Sea Grant (A/AS-55). Our ANS outreach specialist has obtained funding from the USEPA Great Lakes National Program Office to create an interactive kiosk on invasive species for placement during 2004 on the new Lake Michigan car ferry that carries about 100,000 passengers between Manitowoc, Wis., and Muskegon, Mich., over a six-month period 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 also conduct ecological

forecasting outreach in collaboration with NOAA's Great Lakes Environmental Research Laboratory. Lastly, we will seek funding from non-Sea Grant sources to support continuation of the highly successful relationship with "Babe Winkelman's Good Fishing" television program initiated with the award-winning ANS project, "Using Mass Media to Inform Anglers about Invasive Species" (A/AS-47).

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

As detailed earlier in the Marine & Aquatic Sciences Literacy Theme, our education outreach specialist will continue to develop, direct and teach courses in connection with the "Lake Sturgeon Bowl" regional competition for the national Ocean Science Bowl, Great Lakes Ecology Workshop and Aquanaut Program. He also intends to help plan and lead the "Marine Science at Sea" course, a hands-on laboratory course aboard the *S/V Denis Sullivan*, operated by PIER Wisconsin, in Florida and Bahamian waters, with the intent of conducting this course each January as part of UW-Milwaukee's Winterim offerings.

We will expand our "Earthwatch Radio" Web site 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 2004-06 is to expand the Internet functions of the Earthwatch Radio project to include online distribution of audio to radio stations.

In 2004, we will promote Wisconsin's Water Library by a mass mailing and other outreach methods to reach citizens at the local level who are interested in learning more about Wisconsin's Great Lakes issues. We will attempt to increase book circulation statistics and Web hits by 200%.

In partnership with the international JASON Project, in summer 2004 (as noted earlier in the Marine & Aquatic Science Literacy Theme) we will be completely redesigning and updating our Web site "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 are beginning the study of 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 2005 with the redesign and update of our Web sites on Great Lakes Fish.

During 2004-06, we will redesign the public Sea Grant Web site to be more user-friendly and topic-oriented while at the same time conforming with university and W3C accessibility standards.

During 2004-06 we will continue to maintain and enhance our online Publications Store, which features Sea Grant publications and fact sheets.

- *Advance the Wisconsin and regional economy through outreach and technology transfer to Great Lakes-related businesses and emerging enterprises based on aquatic resources and 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: "WATERS 2004-06: Wisconsin's Aquaculture Technology, Education and Research Services" (A/AS-54), "Applications of 'Dynamic and Distributed' GIS and Visualization for Great Lakes Coastal Management" (R/NI-33) and "Exploring Wisconsin's Great Lakes Schooners: Integrating Underwater Archaeology, Shipwreck Preservation and Public Education" (C/C-7). Another exceptional outreach effort that will continue during the next biennium is the Lake Michigan Fisheries Forum, chaired by our fisheries outreach specialist, which is described in the 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 G). It is even one of the criteria in annual performance reviews and evaluation for promotion of all academic staff members. During 2004-06,

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 science outreach at UW System institutions and other public and private Wisconsin colleges and universities statewide.*

We will continue to actively encourage outreach project proposals and collaborations in connection with our biennial omnibus proposal process and 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 2004-06, 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 competitively in accordance with market data. Proper procedures will be followed to ensure qualified candidates from diverse backgrounds are notified of 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 with written activities reports required. In addition, throughout the year, professional development will be encouraged and supported.

To meet our priority of recruiting and retaining outstanding, 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.

In 2005-06, as a measure of the success of our efforts in the area of graduate students, a survey will be conducted. 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.

All managers and supervisors will be required to take one course a year on effective management of people and processes as well as attend university training programs offered throughout the year on maintaining harassment-free workplace as well as diversity awareness seminars. A staff member in the institute will serve as first step in grievance procedures for classified staff and the overall department contact for sexual harassment concerns. 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. Flexible working schedules will be provided for employees seeking academic degrees. 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.

We anticipate that a new Lake Superior outreach specialist will be hired shortly. They 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 has written criteria for annual merit and promotion evaluations. These will be distributed to all professional staff during January of each year. At that time staff members are required to submit written annual activities reports and are also offered an opportunity for an 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 2004-06 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. All professional staff will be required to write quarterly activities reports, which will be shared with all program managers. Twice a year joint meetings of program management and outreach staff will be held in order to update each other on activities and plan for joint projects.

3. Our Evaluation Process: How We Will Measure Success

Our 2002-06 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 asked to submit a brief annual report summarizing the progress made on their projects during that time, which are compiled for developing our program's required 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 (a.k.a. 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 monthly *Littoral Drift* newsletter is conducted every four years. 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 assistant director for administration and information. Use of our World Wide Web sites are monitored monthly through analysis of WebTrends® computer statistical logs.

All new special, non-core 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

As shown by outreach staff memberships and service on a variety of committees, professional associations, and advisory boards (**Appendix G**)—along with our planned outreach partnerships with numerous local, state, regional and national agencies and organizations (**Appendix H**)—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, U.S.-Canadian International Joint Commission.

UW Sea Grant staff and researchers are also actively involved in a variety of both Great Lakes and national Sea Grant network efforts. Notable collaborations continuing into 2004-06 include a joint research effort with the Michigan and Illinois-Indiana Sea Grant programs on the collapse of Lake Michigan's yellow perch fishery (supported with our Sea Grant regional collaborations set-aside funds), the Great Lakes Sea Grant Network baitfish HACCP training project, Great Lakes Fisheries Leadership Institutes, and a leadership role in the ongoing development of the Sea Grant Non-Indigenous Species (SGNIS) Web site, among others. A new collaboration with Minnesota Sea Grant planned for 2004 is to explore the potential for developing a commercial siscowet (fat trout) fishery on Lake Superior.

Great Lakes Sea Grant Network directors meet on a regular basis and chair the network on a rotating basis. The network's Advisory Services and Communications meet for an outreach workshop every 18 months. During 2001, this workshop was hosted for the first time by the Pennsylvania Sea Grant project, and the 2003 workshop was held in Burlington, Vt., in connection with New York Sea Grant's recently created Lake Champlain project.

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 assistant director for research & outreach (Hurley) is cochairing the 2006 International Conference on Mercury as a Global Pollutant, the assistant director for administration & information (Reeb) currently serves as SGA representative on the NOAA Sea Grant Program Information Work Group, our program information specialist (Wittman) is chair of theme team communicators, and the program's "Earthwatch Radio" producer (Hoops) serves as chair of the Sea Grant communicators' national Radio Task Group. Wittman and our Water Quality & Habitat Restoration outreach specialist (Harris) serve on both the national and regional Ecosystems & Habitats Theme teams. Harris is also on the Coastal Communities & Economies Theme Team and past president of the International Association for Great Lakes Research. Our ANS specialist (Moy) cochairs the Chicago Sanitary-Ship Canal Fish Barrier Advisory Panel, chairs the Asian Carp Rapid Response Team and the Great Lakes Panel on Invasive Species' Research Coordination Committee, and is president of the American Fisheries Society's Introduced Fish Section.

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 facilitators (**Appendix N**) 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 2004-06, tentatively in the Biotechnology and Aquaculture themes.

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 2004-06 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 and other special funding opportunities. PIs of proposals that deal with topics of NOAA Sea Grant National Strategic Investments (e.g., Aquatic Nuisance Species, Oyster Disease and National Marine Aquaculture competitions) are encouraged to submit them for those competitions. Two new ANS proposals (**R/BT-18** and **A/AS-53**) are being funded this way. Additionally, we will use our **Coastal Community Development** funds to support **R/NI-33** and the closely related activities of our Advisory Services GIS outreach specialist (**A/AS-1**).

We also routinely seek grants and funding from a variety of other campus, state, regional and national sources of support for our programs and special initiatives.

3. How We Will Synthesize, Package and Disseminate Results

As described earlier, our theme-area facilitators 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, theme-area meetings and outreach workshops, one-to-one assistance and hands-on training, presentations at professional associations and service clubs, media relations, publications, our "Earthwatch Radio" program, the World Wide Web, 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 bimonthly newsletter and other program reports, news releases, "Earthwatch" radio programs, Web sites 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 the 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. The Communications Office helps PIs 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. When requested, the Communications staff also helps 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 periodic theme-area briefings involving project investigators and UW Sea Grant outreach and management staff. Each member of our Advisory Services and Communications staff is assigned to one or more theme areas, and each is also assigned to track the progress of individual projects within those thematic areas (Appendix N). Our 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 also serve as a reporting and project evaluation mechanism for program management. Outreach staff use the results presented at these meetings to develop or enhance their work plans. We plan to continue holding such workshops on at least an annual basis during the next biennium.

During 2002-04, we established 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, Web sites, workshops, public presentations, etc. During 2004-06, we will explore with our Advisory Council and PIs the idea of requiring participation in this outreach program as a condition of receiving UW Sea Grant support.

One of our top priorities for the synthesis and dissemination of UW Sea Grant project results during the coming biennium will be to implement a program management accountability system. We will continue to actively develop a distributed database that will provide a wealth of up-to-date, easily accessed information about our program that will enable us to enhance our grants management capabilities, do a better job of tracking and documenting project results and greatly increase the availability of project information for program managers, NOAA Sea Grant, interested researchers, UW Sea Grant outreach personnel and the interested public.

V. Nationalization of the Implementation Plan

1. Program Elements with National and Regional Application

Elements of the 2004-06 UW Sea Grant program that have national application are shown in the appended matrix (**Appendix O**) that shows the correlation of each UW Sea Grant project for the next biennium to each national Sea Grant theme, which were used to structure the NOAA Sea Grant Strategic Plan for FY2003-08 (**Appendix B**). These are further articulated in UW Sea Grant's 2002-06 Strategic Plan.

Besides addressing the national priorities of the NOAA and NOAA Sea Grant strategic plans, the 2004-06 Wisconsin Sea Grant program also will benefit a wide range of priorities and users at the local, state and regional levels. The following sections detail the applicability of each individual Wisconsin Sea Grant project in each national Sea Grant theme.

Aquaculture

“WATERS 2004-06: Wisconsin’s Aquaculture Technology, Education and Research Services” (Binkowski, A/AS-54) – 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 of the 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 project is focused on coldwater fishes, such as perch and walleye. The market for these in the Midwest is predicted to grow substantially because of the high quality of their flesh.

“Endocrine and Environmental Regulation of Growth in Yellow Perch (Malison/Barry, R/AQ-38) – This 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 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.

Biotechnology

“Dioxin Developmental Toxicity in Zebrafish” (Peterson/Heideman, R/BT-16) – TCDD developmental toxicity in fish that culminates in larval mortality is a serious concern. It can lead to recruitment failure and a reduction in wild populations of fish species, like lake trout, that are particularly sensitive to TCDD. Identifying TCDD target organs that lead to edema and generating mutant fish that will allow the identification of a set of genes whose altered expression subsequently could be developed and validated as a biomarker for TCDD-induced larval toxicity in fish and be of practical use in ecological risk characterization to state and federal regulatory agencies. Knowledge in fish larvae of the genes whose altered expression causes TCDD toxicity may explain why larvae of some species of fish are highly sensitive to TCDD-induced mortality, whereas other species are not. Knowledge about this set of genes may provide insight into how some populations of feral fish

develop resistance to TCDD toxicity after multigenerational environmental exposures to TCDD and related compounds.

One of the high-priority areas in our national effort is "Marine Environmental Biotechnology." Specifically, there is an acute need to develop sensitive and accurate means of predicting impacts of stressors on aquatic organisms. This project will contribute to this national priority by developing an understanding of pharmacological effects of a powerful class of toxic chemicals at the molecular level. As a matter of fact, molecular pharmacotoxicology is an exciting new area of research, and the PIs have already contributed a toxicological risk assessment protocol that has been adopted by the international community.

"AhR Signaling in Rainbow Trout and Zebrafish" (Heideman/Peterson, R/BT-17) – The proposed 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 again addresses the area of "Marine Environmental Biotechnology."

Sea Grant Aquatic Nuisance Species Research Program: "Inhibition of Zebra Mussel Attachment by Bacterial Extracellular Polymers" (Maki, R/BT-18) – This project addresses priorities articulated in both the Biotechnology and Ecosystems & Habitats themes. Zebra mussels have drastically impacted the food chain in the Great Lakes. At the same time, there are serious biofouling problems that must be dealt with. This project will advance our understanding of chemical signaling and signal transduction pathways in bacteria as they produce polymers that may be used to prevent biofouling and biocorrosion by zebra mussels. Prevention of biofouling is a national priority.

"Effects of Polyhalogenated Aromatic Hydrocarbons on Estrogen Metabolism in Lake Trout" (Barry/Peterson, R/BT-19) – Polyhalogenated aromatic hydrocarbons, and their hydroxylated metabolites, are persistent environmental pollutants capable of interfering with reproductive and endocrine functions in Great Lakes fishes. Many of these compounds can act as environmental estrogens and disrupt physiological function in estrogen-responsive sites, such as the reproductive organs, liver and neuroendocrine centers. Very little is known about the mechanisms of action of these compounds. The proposed work will try to identify the exact location of the binding site(s) of these compounds in lake trout, a top predator in the Great Lakes food chain.

This project will contribute to Sea Grant's national theme objective that seeks to develop molecular biological techniques to assess the effects of endocrine disruptor contaminants.

Coastal Communities & Economies

"Applications of 'Dynamic and Distributed' GIS and Visualization for Great Lakes Coastal Management" (Ventura, R/NI-33) – This project will help support comprehensive land use planning decisions for the unique conditions of coastal areas by using pilot projects and demonstrations with regional planning commissions and local governments (county, municipal, tribal and town) in selected jurisdictions along Wisconsin's Lake Michigan and Lake Superior coasts. This should result in more effective use and care of coastal resources in Wisconsin and provide a model for using GIS in managing other coastal areas.

One of Sea Grant's national objectives in this theme focuses on expanding scientific understanding of the function, biodiversity and economic importance of our coasts. More than half of the people in the United States live within 50 miles of a coast, and the coastal population continues to grow faster than inland populations. This is also true for the Great Lakes, where more than 30 million people live within its watershed. Nationally, Sea Grant supports research that develops tools for science-based information that will enable environmental managers to predict changes in coastal ecosystems and habitats. This research project will enable Sea Grant to produce technologies that can be transferred to local, regional and national coastal communities planning efforts.

"Measuring Interrelated Demands for Commercially Caught Fish" (Bishop, R/PS-57) – The goal of this project is to improve methods to evaluate commercial fish harvests in a multiple-species framework that recognizes how different species are related in the market place. 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 that will examine these issues on a national scale.

We are funding one new Communications project, **"Exploring Wisconsin's Great Lakes Schooners: Integrating Underwater Archaeology, Shipwreck Preservation and Public Education"** (Broihahn/Karl, C/C-7), the fifth 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.

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.

Coastal Natural Hazards

Despite the recent retirement of our 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. Last year, 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. 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. Also, we will continue to maintain our advisory Web site on Great Lakes water levels. In partnership with the NOAA Great Lakes Environmental Research Laboratory, we will provide outreach on current climate change models and potential effects on water levels in the lakes.

Digital Ocean

"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 proposed work 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.

"Enhanced Experimental Methods for Measuring Inorganic Contaminants in Water Using a Micromachined DC Plasma Instrument" (Anderson/Gianchandani/Zorn, R/MW-85) – The proposed

microfabricated DC argon plasma emission spectrometer in this continuing project would significantly reduce the costs associated with environmental sampling. Since the sample analysis is conducted *in situ*, the sample contamination effects also would be greatly reduced. A long-range outcome of this project might be a functional microfabricated DC plasma spectrometer (made from either nontoxic or biodegradable components) that can be deployed in a manner that provides large-scale environmental monitoring directly from research laboratories continents away. This has direct application in supporting the goal of the national Digital Ocean theme.

Ecosystems & Habitats

“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 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.

“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 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 add to our national effort on research and outreach activities 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.

“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 project is designed to guide the development of efforts directed toward more effective management of predator-prey interactions in fish populations. The PI will develop 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 stated 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.

“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 project will enable resource managers to better understand factors responsible for the transport and ultimate fate of contaminants in our nation’s estuaries.

“Coastal Sediment Resuspension, Transport and Deposition in Great Lakes” (Wu/Hoopes, R/EC-9) – An understanding of the coastal processes responsible for the resuspension, transport and deposition of sediments is crucial to evaluate the stability of shorelines, the cycling of pollutants and biological productivity. Most lake hydrology and water quality models do not incorporate viable sediment transport segments. This is in large part due to our lack of real-time data on the behavior of suspended sediment in lakes. This project is designed to overcome this shortcoming by deploying an *in situ* system capable of measuring in real time the flux of suspended sediments on the bottom of Lake Michigan.

This project will address national priorities articulated both in our Digital Ocean/Great Lakes and Ecosystems & Habitats themes. The ability to use an *in situ* observation system for measuring the behavior of suspended sediments will enhance our understanding of sedimentation and resuspension events in lakes and estuaries. Coupled with current and temperature data, such a capability will elevate our capability to accurately model the transport and fate of a large number of water quality parameters.

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 nuisance species (ANS) research and outreach accessible via the Internet, while maintaining high scientific standards, directly enhances the management, control and prevention of ANS throughout the continent and beyond. Over the past year, the Sea Grant Non-Indigenous Species (SGNIS) Web site was accessed nearly 3 million times, including nearly a million times by people in 125 other countries.

This 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.

Fisheries

“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 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 our 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.

“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 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 related to exotic invaders.

“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 will estimate 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 project will develop and test a fish population estimation technique in cooperation with U.S. Fish & Wildlife Service scientists.

Innovative Science & Technology

“Use of Fish Oil for Enzyme-Mediated Production of Value-Added Food Products Containing Omega-3 Fatty Acids” (Hill, R/AQ-39) – Lipase-mediated reactions can be employed to modify naturally occurring fats and oils. The resulting products can be used in formulating nutraceutical food products with important beneficial physiological implications. Potential delivery vehicles for the value-added triacylglycerols include infant and geriatric formulae, parenteral emulsions for intravenous feeding, dairy spreads, salad dressings and frozen desserts.

This supports strategic priorities for NOAA Sea Grant action in both the Biotechnology and Seafood Science & Technology themes.

“Improving Safety and Cost Effectiveness in Scuba Diving” (Dueland/Lehner, R/NI-32) – This 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.

The PIs are working with the U.S. Navy, diving interest groups in Japan and recreational diving organizations to assure that existing diving tables reflect ongoing work as it relates to improving safety for governmental, commercial and recreational divers.

Marine & Aquatic Science Literacy

“Lake Sturgeon Bowl: Wisconsin’s Regional Academic Competition for the National Ocean Sciences Bowl, 2004-06” (Duffy/Klump, E/E-47) – 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. The purpose of the bowl is to foster 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.

“Recent Advances in Limnology and Oceanography Seminar Series, 2004-06” (Berges/Brooks, E/E-48) – This project will help support a popular 30-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 discussion about the problems among scientists, policymakers and citizens.

“Earthwatch Public Service Radio Program” (Hoops, C/C-2) – This project was praised in the 2001 Program Assessment Team’s report on the Wisconsin Sea Grant program, and the Earthwatch project proposal for 2002-06 was highly ranked in peer reviews. In addition to supporting UW Sea Grant strategic goals and

Marine & Aquatic Science Literacy priorities, this project will provide significant support to the national network's strategic communications efforts as well.

Urban Coast

“Methylmercury Production and Transfer to Benthic Food Webs in Nearshore and Wetland Environments of Southern Lake Superior (Wiener/Rolfhus/Haro, R/EC-8) – This interdisciplinary study will increase our knowledge of sources and processes that lead to methylmercury contamination of recreational fishes in southern Lake Superior, providing information to facilitate identification of potential approaches for reducing exposure to this highly toxic contaminant. This project will also support education and research training for one graduate student and two undergraduate students.

One of the major objectives of the national Urban Coast Theme Team is to delineate sources and transport mechanisms of toxic contaminants. Mercury is a global contaminant, and the level of mercury contamination in lake sediments of continental USA has increased four- to six-fold as compared to mercury deposition before the mid-1800s. The exact pathway that this anthropogenic fraction takes in the observed build-up of mercury concentrations in fish remains to be elucidated.

“Factors Regulating the Interactions of Trace Metals and Aquatic Organisms in Watersheds of the Great Lakes” (Armstrong/Shafer, R/MW-86) – It is now well known that toxic metals in the environment occur in many different physical and chemical forms. It also appears that different types of watersheds deliver metals with characteristic physicochemical forms. The behavior of metals in aquatic systems depends on these physicochemical forms, including their toxicities. The PIs have developed state-of-the-art techniques for determining colloid-associated fractions of a number of metals in aquatic systems and studying the effect of the different metal forms on aquatic organisms. This project will provide basic information to risk assessment paradigms, an important objective for the Urban Coast Theme.

“The Importance of Trophic Level and Carbon Source as Factors Affecting the Accumulation of PCBs in the Lake Michigan Food Web” (Bootsma/Aldstadt, R/MW-87) – Because exotic species invasions and associated changes in trophic structure are likely to be ongoing processes in Lake Michigan and the other Great Lakes, general models that describe the accumulation of PCBs and other contaminants as a function of carbon source and trophic level will allow state and federal managers (DNR, USEPA, NOAA) to predict potential changes in food web contaminant accumulation that will result from altered nutrient regimes, the continued establishment of recent species and the invasions of new species.

“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) will go in 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 the indicator tests for *E. coli* takes from 24 to 48 hours to develop. This project will examine the mechanisms that generate elevated beach pathogen levels in the absence of obvious sources, a common situation for most beaches. This project thus addresses a national high priority objective regarding nonpoint-source pollution.

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

Implementation of the UW Sea Grant 2004-06 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 B**) as well as the strategic goals of relevant national and regional agencies and the priorities of various scientific organizations that were considered in developing and updating UW Sea Grant's 2002-06 strategic plan.

This plan will reach potential users directly through the dissemination of more than 100 printed copies to UW Sea Grant staff and field offices, our advisory group members, various Wisconsin university administrators, NOAA Sea Grant and other NOAA officials, and Sea Grant directors nationwide. Our 2004-06 implementation plan will also be made available to all interested persons via CD and the UW Sea Grant Web site.

3. Suggested National or Regional Efforts to Implement Results

National

- Encourage the national/international adoption of the relative potency factors (RPFs) being developed in our Biotechnology Theme as a standard for toxic contaminant assessments (R/BT-16, -17).
- 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 terminating project R/LR-82.
- Dissemination of UW Sea Grant diving physiology and panic research results to the national/international diving community (R/NI-32).
- Publication and distribution of the proceedings of *Percis III*, the third international symposium on perch held in July 2003 in Madison, Wis.
- Offer other Sea Grant programs the opportunity to join us in 2005-06 in conducting a survey of former Sea Grant-supported graduate students, including information on their postgraduation activities and the value of their Sea Grant experience in advancing their careers.
- Offer an adaptation of our iPRO (Interactive Project Reporting Online) system as a means to develop an online national database of impacts and results.

Regional

- Extension of Wisconsin dynamic and distributed GIS for coastal management and comprehensive land use planning to other Great Lakes states (R/NI-33).
- Regionwide distribution of the Aquaculture Best Management Practices manual being developed in R/AQ-37.
- Extension of Wisconsin's Great Lakes shipwrecks, maritime/water trails outreach projects to other Great Lakes states (C/C-7).
- Regional dissemination of information regarding the possible contamination of Great Lakes fish with polybrominated diphenyl ethers in connection with terminating project R/MW-83.

APPENDIX A

University of Wisconsin-Madison Strategic Priorities, 2003

I. PROMOTE RESEARCH

- Refresh physical and financial resources, faculty and staff, and technical infrastructure
- Expand and invigorate research and educational opportunities for students
- Expand the application and benefit of research

II. ADVANCE LEARNING

- Build community through residential education and an active engagement with the out-of-classroom learning environment
- Encourage leadership through service, research and individual creativity
- Meet the needs of non-traditional students and promote lifelong learning
- Use technology as an instrument of contemporary and multidisciplinary learning
- Complement scientific literacy through the arts and humanities

III. ACCELERATE INTERNATIONALIZATION

- Continue to offer excellence in area and international studies
- Expand the reach of the university through global knowledge transfer
- Expand collaborations with public and private sectors of international communities

IV. AMPLIFY 'THE WISCONSIN IDEA'

- Vigorously share advances in science and knowledge with the people of the state, the nation and the world.
- Expand university-state relationships in a way that reflects the new global economy

V. NURTURE HUMAN RESOURCES

- Build a welcoming, inclusive, engaged community
- Increase involvement in governance among all campus communities
- Promote and develop leadership training opportunities
- Enhance diversity among students, faculty, and staff
- Diminish social reliance on alcohol or other potentially destructive influences

APPENDIX B

National Sea Grant Theme Priorities *NOAA Sea Grant Strategic Plan for FY2003-08 and Beyond:* *Science for Sustainability in the 21st Century* (Working Group Review Draft, Sept. 15, 2003)

AQUACULTURE

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

BIOTECHNOLOGY

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

COASTAL COMMUNITIES & ECONOMIES

- Strengthening coastal planning
- Resource valuation
- Constructing indicators of sustainable development
- Educating coastal planners
- Building leadership
- Developing decision support systems
- Revitalizing communities

COASTAL NATURAL HAZARDS

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

DIGITAL OCEAN

- Focusing on coastal areas
- Preparing for extreme events
- Passive acoustics in fisheries
- Supporting offshore industry

ECOSYSTEMS & HABITATS

- Reducing 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

- Creating and sustaining effective marine and aquatic science-based educational programs
- Cultivating Sea Grant leadership in marine and aquatic sciences education communities
- Supporting the use of marine and aquatic sciences content and examples in science and mathematics teaching and standardized testing
- Expanding professional development opportunities for all educators
- Engaging underrepresented populations in Sea Grant efforts

SEAFOOD SCIENCE & TECHNOLOGY

- Ensuring seafood safety
- Ensuring seafood quality
- Improving processing technology
- Expanding supplies and markets

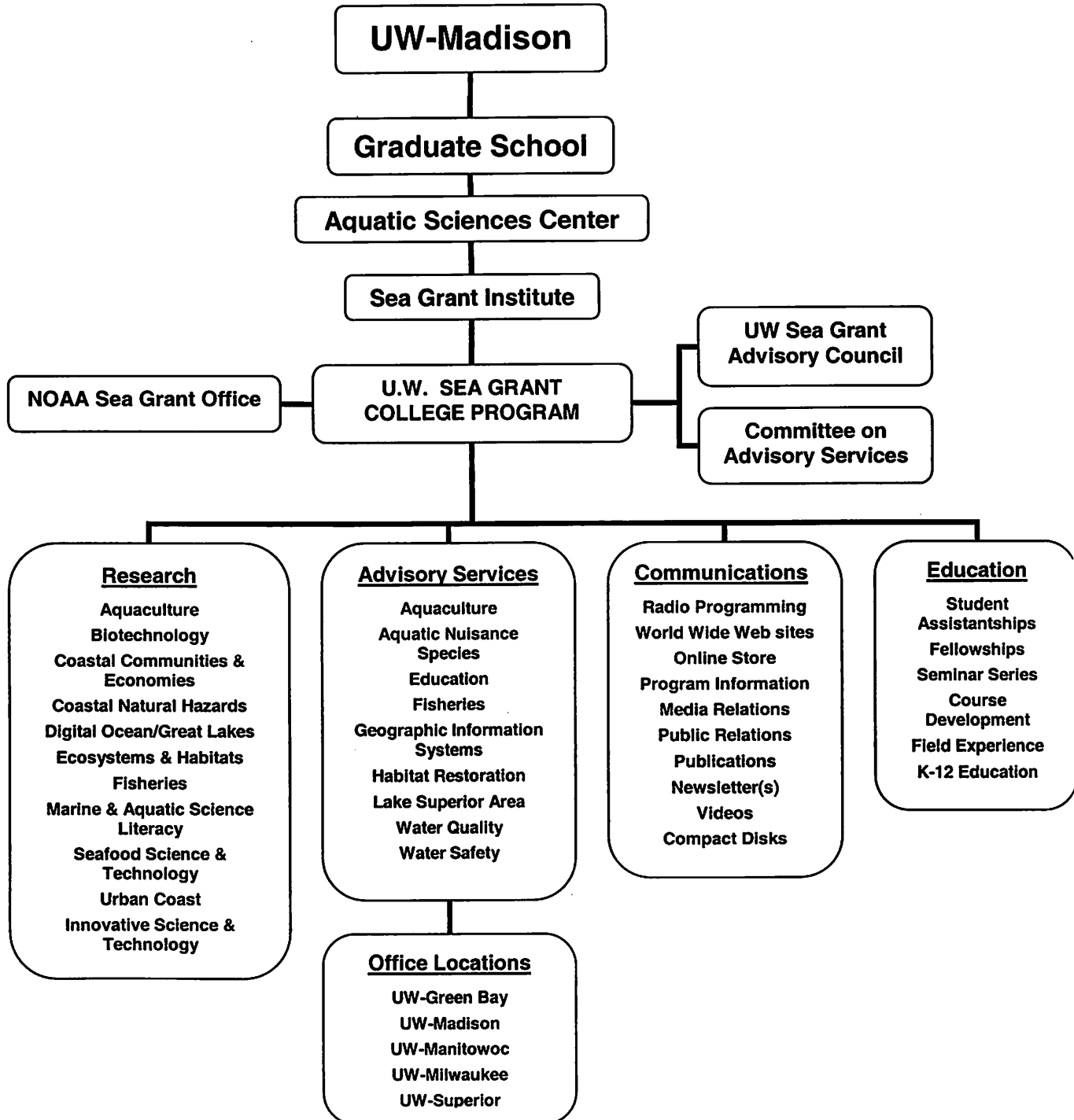
URBAN COASTS

- Reducing nonpoint-source pollution
- Enhancing port and harbor operations
- Managing coastal operations

APPENDIX C

Organizational Chart

University of Wisconsin Sea Grant College Program



APPENDIX D

Advisory Council

University of Wisconsin Sea Grant College Program

ANDERS W. ANDREN (*ex officio*)

Director, Aquatic Sciences Center
Sea Grant Institute
Water Resources Institute
Professor, Environmental Chemistry &
Technology Program
University of Wisconsin-Madison

RICHARD R. BURGESS

Professor, Oncology
McArdle Laboratory
University of Wisconsin-Madison

BEVERLY A. FRENCH

Partner, Orde Advertising, Inc.
West De Pere, Wisconsin

FRANCES C. GARB

Senior Academic Planner, Office of
Academic Affairs
University of Wisconsin System
Madison, Wisconsin

HALLETT J. "BUD" HARRIS (*chair*)

Professor Emeritus, Natural & Applied Sciences
University of Wisconsin-Green Bay

REINHOLD HUTZ

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

LEE KERNEN

Citizen representative
Madison, Wisconsin

DEA LARSEN CONVERSE

Chief, Wisconsin Coastal Management Program
Madison, Wisconsin

REUBEN H. LORENZ

Citizen representative
Madison, Wisconsin

LARRY J. MACDONALD

Owner, Apostle Islands Outfitters & General Store
Mayor of Bayfield
Bayfield, Wisconsin

JOHN J. MAGNUSON

Professor Emeritus, Zoology
Center for Limnology
University of Wisconsin-Madison

KEVIN MCSWEENEY

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

DAVID T. MICHAUD

Principal Scientist, Environmental Department
Wisconsin Electric Power Company
Milwaukee, Wisconsin

NATHANIEL E. ROBINSON

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

DANIEL O. TRAINER

Professor Emeritus, Wildlife
Dean Emeritus, College of Natural Resources
University of Wisconsin-Stevens Point

LINDA L. WEIMER

Vice President for University Relations
University of Wisconsin System
Madison, Wisconsin

APPENDIX E

Committee on Advisory Services *University of Wisconsin Sea Grant College Program*

CARMEN AGUILAR (*Scientist*)
Great Lakes WATER Institute
Milwaukee, Wis.

KAREN GREEN (*Education*)
Metropolitan High School
Milwaukee, Wis.

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

JOHN LACENSKI (*Water Safety*)
Boating Law Administrator
Wisconsin Department of Natural Resources
Madison, Wis.

DAVID LEE (*Coastal GIS*)
Bayfield City Land Information Office
Washburn, Wis.

TERRY LYCHWICK (*Fisheries/NIS*)
Northeast Region (Lower Fox) District Office
Wisconsin Department of Natural Resources
Green Bay, Wis.

ANGIE TORNES (*Recreation*)
Rivers, Trails and Conservation Assistance
National Park Service
Milwaukee, Wis.

DAVE WENTLAND (*Coastal Engineering*)
Coastal Planning and Design
Green Bay, Wis.

JOHN WOLF (*Aquaculture*)
Alpine Farms
Sheboygan Falls, Wis.

APPENDIX F

Program Management Team *University of Wisconsin Sea Grant College Program*

DIRECTOR
ANDERS W. ANDREN

ASSISTANT DIRECTOR FOR ADMINISTRATION & INFORMATION
MARY LOU REEB

ASSISTANT DIRECTOR FOR RESEARCH & OUTREACH
JAMES HURLEY

*FINANCE AND GRANTS ADMINISTRATOR
& INFORMATION TECHNOLOGY COORDINATOR*
DANIEL MARKLEIN

PROGRAM INFORMATION SPECIALIST
STEPHEN WITTMAN

APPENDIX G

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
 University of Wisconsin System
 Northern Wis. Aquaculture Demonstration Center
 Executive Committee
 Program/Facilities Committee
 World Aquaculture Society
 U.S. Chapter

HARRIS (*Water Quality & Habitat Restoration*)

Bay-Lake Regional Planning Commission
 Harbor Council
 Door Co. Beach Monitoring Advisory Committee
 Great Lakes Beach Association
 Lower Green Bay and Fox River Remedial Action Plan
 Biota & Habitat Committee
 Science & Technical Advisory Committee
 International Association for Great Lakes Research (*past president*)
 Outreach Committee
 Lake Michigan LaMP (Lakewide Management Plan) Forum
 Lake Michigan Monitoring & Research Coordination Council
 Lower Fox River Partnership
 Sea Grant Association
 Coastal Communities & Economies Theme Team
 Ecosystems & Habitats Theme Team
 Wisconsin Department of Natural Resources
 Water Body Use Designation Technical Advisory Committee
 Wisconsin Academy of Science, Arts and Letters
 Waters of Wisconsin Advisory Committee
 Year of Water Coordinating Committee (*chair*)

HURLEY (*Advisory Services Program Leader*)

2004 International Conference on Mercury as a Global Pollutant steering committee
 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
 Sigma Xi
 Societas Internationalis Limnologiae
 Universities Council on Water Resources
 USEPA STAR Proposal Evaluation Panel
 Wisconsin Coastal Management Council

LUBNER (*Marine Safety and Education*)

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
 Education Committee
 National Marine Educators Association
 United States Power Squadrons (*honorary*)
 Wisconsin Assn. for Environmental Education (*life*)
 Wisconsin Historical Society
 Wisconsin Marine Historical Society
 United States Coast Guard
 Marine Safety Office
 Milwaukee-Eastern Wisconsin Area Committee
 United States Coast Guard Auxiliary
 National Staff
 Branch Chief for Technical Research
 Vessel Examination Department
 Public Education Officer – Flotilla 56, Milwaukee
 Operations Officer – Flotilla 56, Milwaukee

Wisconsin Boating Safety Advisory Council
Wisconsin Lake Schooner Education Association
Field Learning on Lake Michigan Planning Group
Onboard Educators Training Planning Group

HART (Geographic Information Systems)

American Planning Association
American Institute of Certified Planners
Coast GIS '03 Conference Executive Committee
Coastal Management Journal Board of Editors
Committee on State Cartography
Kewaunee/Bay Lake Regional Planning Commission
Wisconsin Land Information System Node Project
NOAA Coastal Services Center
Coastal GeoTools Program Committee
Urban and Regional Information Systems Association
Wisconsin Coastal Management Program
Natural Hazards Advisory Committee
Wisconsin Land Council
Land Use Element Guide Team
Wisconsin Land Information Association
Land Use Task Force
Wisconsin Land Information Board
Elevation Data Task Force

MOY (Fisheries and Nonindigenous Species)

American Fisheries Society
2004 AFS Meeting (*general chair*)
Canadian Aquatic Resources Section
Introduced Fish Section (*president*)
Wisconsin Chapter (*president*)
International Association for Great Lakes Research
Chicago Sanitary and Ship Canal Dispersal Barrier
Advisory Panel (*cochair*)
Asian Carp Rapid Response Team (*chair*)
Minnesota Asian Carp Barrier Committee
Great Lakes Fishery Commission
Lake Michigan Committee
Great Lakes Panel on Invasive Species
Research Coordination Committee (*chair*)
Lake Michigan Fisheries Forum (*chair*)
Green Bay Fisheries Research Group
Wisconsin Commercial Fisheries Task Force
Wisconsin Aquaculture Industry Advisory Council
Invasive Species Summit Steering Committee

Communications

HOOPS (Radio Producer / Earthwatch radio project)
National Association of Science Writers
Council for Advancement and Support of Education
Sea Grant Communicators National Steering Committee
Radio Task Group (*chair*)

KARL (Science Writer / shipwrecks project)
University of Wisconsin-Madison
Campus Communicators
Wisconsin Underwater Archaeology Association

LADWIG (Science Editor)

Association of Women in Communications
Madison chapter
Board of Directors
National Association of Science Writers
University of Wisconsin-Madison
Campus Communicators

SAVOY (Librarian)

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

WHITE (Publications Editor / Great Lakes fishes project)

Native Fish Conservancy
University of Wisconsin-Madison
Campus Communicators

WITTMAN (Program Information Specialist / Communications Manager)

Agricultural Communicators in Education
American Association for the Advancement of Science
Great Lakes Communicators
Great Lakes Sea Grant Network
Regional Ecosystems & Habitat Theme Team
Sea Grant Association
National Ecosystems & Habitats Theme Team
Sea Grant Communicators National Steering Committee
Theme Team Communicators (*chair*)
University of Wisconsin-Madison
Campus Communicators
Chancellors Office & Wisconsin Alumni Association
"UW-Madison on the Road" Outreach Committee

YAO (Designer / Art Director)

American Institute of Graphic Arts
Design Madison

APPENDIX H

Outreach Projects Partnerships, 2004-06

University of Wisconsin Sea Grant College Program

Aquaculture-WATERS project

- Aquaculture development organizations (state aquaculture associations, etc.)
- North Central Regional Aquaculture Center
- Prospective and active local, regional and national aquaculture entrepreneurs
- Regional Native American Groups interested in aquaculture
- Vocational Agriculture Educators
- Wisconsin Aquaculture Association, Inc.
- Wisconsin Department of Public Instruction

Aquanaut program

- NOAA National Undersea Research Program
- UW Great Lakes WATER Institute
- UW-Milwaukee Department of Curriculum & Instruction

ANS Workshops-Baitfish HACCP project

- Commercial fishers
- Michigan Sea Grant College Program
- Ohio Sea Grant College Program
- Pennsylvania Sea Grant Project
- Private hatcheries and fish farms
- State fish veterinarians
- U.S. Fish & Wildlife Service
- University of Minnesota Sea Grant College Program
- Wisconsin Department of Agriculture, Trade & Consumer Protection
- Wisconsin Department of Natural Resources

Great Lakes Ecology workshop

- PIER Wisconsin
- UW-Stevens Point
- UW Great Lakes WATER Institute

Great Lakes Fisheries Leadership Institutes project

- Charter captains
- Great Lakes Fishery Commission
- Great Lakes fishing clubs
- Great Lakes State Agencies (departments of natural resources, etc.)
- Trout Unlimited
- U.S. Fish & Wildlife Service
- U.S. Geological Survey

Great Lakes Park Packs project

- Friends of the State Parks
- State park facilities located along the Great Lakes coasts of Wisconsin
- Wisconsin Coastal Management Program
- Wisconsin Department of Natural Resources
- Wisconsin Environmental Education Board

Interactive Fish Identification and Bioenergetics Lab Web site and software project

- UW-Madison Center for Limnology
- Wisconsin Department of Natural Resources

Lake Michigan Fisheries Forums

- Area businessmen
- Charter fishing captains
- Environmentalists
- Lake Michigan commercial fishers
- Lake Michigan recreational fishers
- Sport fishing groups
- Stream fishermen
- U.S. Fish & Wildlife Service
- Wisconsin Department of Natural Resources

Lake Sturgeon Bowl

- Consortium for Oceanographic Research & Education
- Great Lakes WATER Institute
- UW-Milwaukee
- 20-24 Wisconsin high schools

Madison JASON Project, 2004

- JASON Foundation for Education
- Abbotsford School District
- Beaver Dam Middle School
- Blair-Taylor Elementary School
- Cherokee Heights Middle School
- Columbus Middle School
- Fox Prairie Elementary School
- Randall Elementary School
- Sacred Hearts School
- Sandhill School
- Westside Christian School
- Windsor Elementary School
- Aldo Leopold Nature Center
- Bethel Horizons Nature Center
- Henry Vilas Zoo
- MacKenzie Environmental Education Center

- Olbrich Botanical Gardens
- UW Arboretum
- UW-Madison Elvehjem Museum of Art
- UW-Madison Geology Museum
- UW-Madison Water Resources Library

Marine Safety program

- Boy Scouts of America (Milwaukee)
- Recreation departments of Greenfield and Wauwatosa
- U.S. Coast Guard Auxiliary
- U.S. Power Squadrons

Marine Science at Sea: A Hands-on Laboratory

- PIER Wisconsin
- UW-Milwaukee Department of Geosciences
- UW-Milwaukee Office of Overseas Programs & Partnerships

PERCIS III Conference Proceedings CD

- University of Wisconsin Digital Collections Center

Siscowet fishery project

- Lake Superior Commercial fishers
- Lake Superior tribal fishers
- University of Minnesota Sea Grant College Program

State of the Bay Web site project

- Green Bay Metropolitan Sewerage District
- Science and Technical Advisory Committee, Lower Green Bay-Fox River Remedial Action Plan
- UW-Green Bay
- Wisconsin Department of Natural Resources

Wisconsin's Water Library project

- Friends of UW-Madison Libraries
- UW Extension
- UW-Madison Cooperative Children's Book Center
- UW-Madison Water Resources Institute
- Wisconsin Academy of Sciences, Arts and Letters
- Wisconsin Department of Natural Resources
- Wisconsin Department of Public Instruction Division for Libraries, Technology & Community Learning

- Wisconsin teachers, home schoolers and school librarians
- UW-Madison libraries
- UW-Madison Water Resources Library
- Wisconsin Libraries' Delivery Network
- Wisconsin public libraries

Wisconsin Water Policy Inventory Project

- UW-Extension
- UW-Madison Department of Urban & Regional Planning
- UW-Madison Water Resources Institute
- UW-Madison Water Resources Library
- Wisconsin Academy of Sciences, Arts & Letters
- Wisconsin Department of Natural Resources

White perch fishery project

- Green Bay commercial fishers
- Green Bay region universities
- Wisconsin Department of Natural Resources

Wisconsin's Great Lakes Shipwrecks project

- Apostle Islands National Lakeshore, National Park Service
- City of Port Washington, Wis.
- City of Superior, Wis.
- City of Washburn, Wis.
- Door County Maritime Museum, Sturgeon Bay, Wis.
- Great Lakes Information Network, Great Lakes Commission
- Great Lakes Shipwreck Research Foundation
- Maritime Preservation & Archaeology Program, Wisconsin Historical Society
- PIER Wisconsin, Milwaukee
- Program in Maritime Studies, East Carolina University, Greenville, N.C.
- Sink the Straits/Neptune's Nimrods Dive Club
- UW-Milwaukee Great Lakes WATER Institute
- Wisconsin Coastal Management Program
- Wisconsin Department of Natural Resources
- Wisconsin Department of Transportation

APPENDIX I

Advisory Services Specialists

University of Wisconsin Sea Grant College Program

AQUACULTURE

FRED BINKOWSKI
Aquaculture Institute
UW-Milwaukee

LAKE SUPERIOR SPECIALIST

T.B.A.
UW-Superior

FISHERIES & NONINDIGENOUS SPECIES

PHILIP MOY
UW-Manitowoc

MARINE SAFETY & EDUCATION

JAMES LUBNER
Great Lakes WATER Institute
UW-Milwaukee

GEOGRAPHIC INFORMATION SYSTEMS

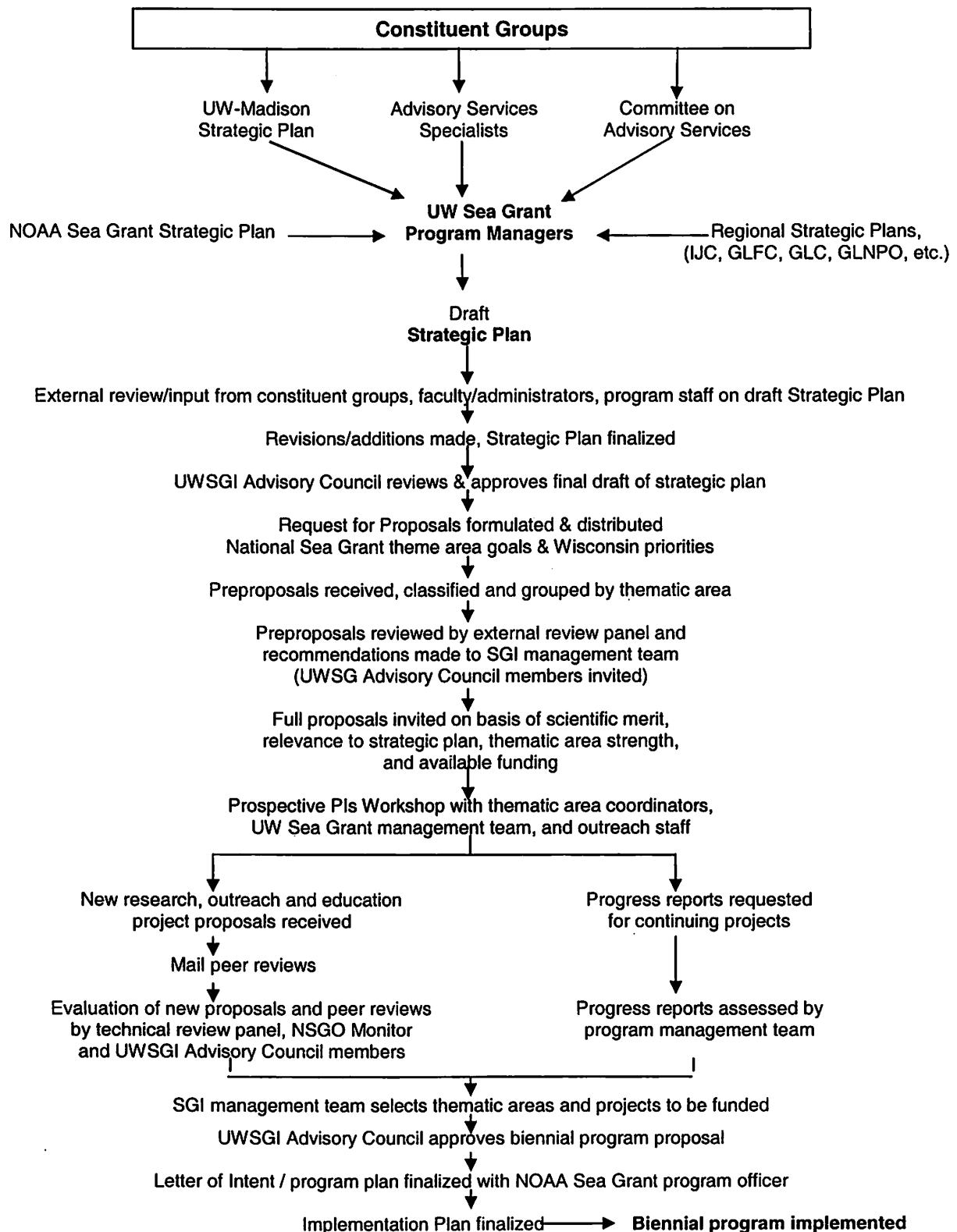
DAVID HART
Sea Grant Institute
UW-Madison

WATER QUALITY & HABITAT RESTORATION

VICTORIA HARRIS
UW-Green Bay

APPENDIX J

Program Management Decision Process



APPENDIX K**Participating Institutions and Departments, 2004-06***University of Wisconsin Sea Grant College Program***Harvard Medical School**

Anesthesiology

Lawrence University

Biology

Marquette University

Biological Sciences

Michigan State University

Michigan Sea Grant College Program

North Carolina State University

North Carolina Sea Grant College Program

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 AgencyOffice of Policy, Economics and Innovation
Office of Wetlands, Oceans and Watersheds**U.S. Geological Survey**Great Lakes Science Center
Water Resources Division**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

University of North CarolinaNorth 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
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
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
Medical School
Molecular Environmental Toxicology Center
Oceanography & Limnology Graduate Program
Radiology and Nuclear Medicine
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
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-Stevens Point
College of Natural Resources

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
Maritime Preservation and Archaeology Program

APPENDIX L

2004-06 Omnibus Proposal Preparation Schedule
University of Wisconsin Sea Grant College Program

2002

Spring/Summer	Strategic Plan revised/updated with input from advisory committees, constituent groups and program staff.
October 8	UW Sea Grant Advisory Council meeting to review and approve Strategic Plan and RFP 2004-06.
October 22	Deadline for submission of annual progress reports.
October 22-30	Annual progress reports reviewed and assessed.
November 4	Request for Proposals distributed.
December 9	Deadline for submission of preproposals.
December 20-31	Preproposals distributed to management staff, review panel members and UW Sea Grant Advisory Council members.

2003

January 14-15	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 26	Prospective PIs Workshop with thematic area coordinators, UW Sea Grant management team and 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 1	Deadline for submission of new proposals.
May 19 – June 15	New proposals peer reviewed via online electronic review system on UW Sea Grant Web site.
August 19-20	Review of new proposals by technical review panel, NOAA Sea Grant's Wisconsin Program Officer and UW Sea Grant Advisory Council members.
September 19	UW Sea Grant Advisory Council meeting to review and approve 2004-06 program and budget.
October 10	Director's Letter of Intent submitted to NOAA Sea Grant program officer.
Early October	2004-06 UWSG program plan finalized with NOAA Sea Grant program officer.
October 15	Deadline for submission of annual progress reports.
Late October	Annual progress reports reviewed and evaluated.
Mid-November	Acceptance letters with unofficial budgets and nonacceptance letters sent to all PIs.
November 14	Deadline for submission of signed omnibus institutional proposal and 2004-06 Implementation Plan to NOAA Sea Grant program officer.

APPENDIX M

External Technical Review Panels, 2003 *University of Wisconsin Sea Grant College Program*

Preproposal Review Panel Members, Jan. 14-15, 2003

- Dr. HALLET J. "BUD" HARRIS, Professor Emeritus, Natural & Applied Sciences, UW-Green Bay
- Mr. CARLOS FETTEROLF, (former) Sea Grant National Review Panel / Great Lakes Fishery Commission (retired), Ann Arbor, Mich.
- Mr. LEE KERNEN, member, SGI Advisory Council / WDNR (retired), Madison, Wis.
- Dr. KEVIN MCSWEENEY, Professor, Soil Science & Environmental Studies, UW-Madison
- Dr. CARL RICHARDS, Director, University of Minnesota Sea Grant College Program, Duluth, Minn.

Full Proposals Review Panel Members, Aug. 19-20, 2003

- Dr. DORN CARLSON, Wisconsin Program Officer, NOAA Sea Grant Office, Silver Spring, Md.
- Dr. EDWARD CHESNEY, Louisiana Universities Marine Consortium, Chauvin, La.
- Dr. WILLIAM DOUCETTE, Utah Water Research Laboratory, Utah State University, Logan, Utah
- Dr. GARY FAHNENSTIEL, Lake Michigan Field Station, NOAA Great Lakes Environmental Research Laboratory, Muskegon, Mich.
- Dr. HOWARD KATOR, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Va.
- Dr. ZHANJIANG "JOHN" LIU, Dept. of Fisheries and Biotechnology Laboratory, Auburn University, Auburn, Ala.
- Dr. CARL RICHARDS, Director, University of Minnesota Sea Grant College Program, Duluth, Minn.

APPENDIX N

Theme Area Facilitators

University of Wisconsin Sea Grant College Program

Aquaculture

Aquaculture Specialist (Binkowski) and Radio Producer (Hoops)

Biotechnology

Assistant Director for Research & Outreach (Hurley) and Program Information Specialist (Wittman)

Coastal Communities & Economies

Nonindigenous Species Specialist (Moy) and Science Writer (Karl)

Coastal Natural Hazards

Marine Safety Specialist (Lubner) and Science Editor (Ladwig)

Digital Ocean

Geographic Information Systems Specialist (Hart) and Science Writer (Karl)

Ecosystems & Habitats

Habitat Restoration Specialist (Harris) and Communicator (Wittman)

Fisheries

Fisheries Specialist (Moy) and Publications Editor (White)

Innovative Science & Technology

Lake Superior Area Specialist (TBA) and Science Editor (Ladwig)

Marine & Aquatic Science Literacy

Education Specialist (Lubner), Art Director (Yao) and Assistant Director for Administration & Information (Reeb)

Seafood Science & Technology

Aquaculture Outreach Specialist (Binkowski) and Radio Producer (Hoops)

Urban Coast

Water Quality Specialist (Harris) and Science Writer (Karl)

APPENDIX O

Matrix of 2004-06 Subprogram Projects and National Themes
University of Wisconsin Sea Grant College Program

Theme Subprogram	Aquaculture	Biotechnology	Coastal Communities & Economies	Coastal Natural Hazards	Digital Ocean/ Great Lakes	Ecosystems & Habitats	Fisheries	Innovative Science & Technology	Marine & Aquatic Science Literacy	Seafood Science & Technology	Urban Coast
Aquaculture & Seafood Technology	R/AQ-38	R/AQ-40**								R/AQ-39	
Biotechnology		R/BT-16 R/BT-17 R/BT-18* R/BT-19*				R/BT-18*					
Estuarine & Coastal Processes					R/EC-9*	R/EC-9* R/EC-10*					R/EC-8
Living Resources						R/LR-91* R/LR-94* R/LR-96*	R/LR-92* R/LR-93* R/LR-94* R/LR-95*				
Microcontaminants & Water Quality		R/MW-89**			R/MW-85 R/MW-88*						R/MW-86 R/MW-87 R/MW-89**
New Initiatives			R/NI-33*					R/NI-32*			
Policy Studies			R/PS-57**								
Advisory Services	A/AS-1: Binkowski A/AS-54*	A/AS-1: Hurley	A/AS-1: Hart A/AS-52 A/AS-55*	A/AS-1: Hart L Superior specialist	A/AS-1: Hart	A/AS-1: Harris, Moy, Hart A/AS-53	A/AS-1: Moy A/AS-52	A/AS-1: Hart L Superior specialist	A/AS-1: Lubner	A/AS-1: Moy	A/AS-1: Harris Hurley
Communications			C/C-7*						C/C-2 C/C-7*		
Education									E/E-47* E/E-48*		

KEY TO MATRIX

* = New Projects

** = If Funding Becomes Available

AQUACULTURE

- R/AQ-38 — Endocrine and Environmental Regulation of Growth in Yellow Perch
- R/AQ-39 — Use of Fish Oil for Enzyme-Mediated Production of Value-Added Food Products Containing Omega-3 Fatty Acids
- *R/AQ-40 — Tetracycline Antibiotics and Resistance Genes in Aquaculture Environments: Genotypic Diversity and Potential Resistance Reservoirs

BIOTECHNOLOGY

- R/BT-16 — Dioxin Developmental Toxicity in Zebrafish
- R/BT-17 — Ahr Signaling in Rainbow Trout and Zebrafish
- *R/BT-18 — Inhibition of Zebra Mussel Attachment by Bacterial Extracellular Polymers (*NSI project*)
- *R/BT-19 — Effects of Polyhalogenated Aromatic Hydrocarbons on Estrogen Metabolism in Lake Trout

ESTUARINE & COASTAL PROCESSES

- R/EC-8 — Methylmercury Production and Transfer to Benthic Food Webs in Nearshore and Wetland Environments of Southern Lake Superior
- *R/EC-9 — Coastal Sediment Resuspension, Transport and Deposition in Great Lakes
- *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

LIVING RESOURCES

- *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?

MICROCONTAMINANTS & WATER QUALITY

- R/MW-85 — Enhanced Experimental Methods for Measuring Inorganic Contaminants in Water Using a Micromachined DC Plasma Instrument
- R/MW-86 — Factors Regulating the Interactions of Trace Metals and Aquatic Organisms in Watersheds of the Great Lakes
- R/MW-87 — The Importance of Trophic Level and Carbon Source as Factors Affecting the Accumulation of PCBs in the Lake Michigan Food Web
- *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

POLICY STUDIES

- **R/PS-57 — Measuring Interrelated Demands for Commercially Caught Fish (*NCSG project*)

NEW INITIATIVES

- *R/NI-32 — Improving Safety and Cost Effectiveness in Scuba Diving
- *R/NI-33 — Applications of "Dynamic and Distributed" GIS and Visualization for Great Lakes Coastal Management

ADVISORY SERVICES

- A/AS-1 — Advisory Services: Program Coordination and Field Offices (core project)
- *A/AS-52 — Great Lakes Fisheries Leadership Institute
- *A/AS-53 — Sea Grant Non-Indigenous Species (SGNIS) Web Site: Development and Support (*NSI project*)
- *A/AS-54 — WATERS 2004-06: Wisconsin's Aquaculture Technology, Education and Research Services
- *A/AS-55 — EPA Smart Growth Extension Partnership

COMMUNICATIONS

- C/C-2 — Earthwatch Public Service Radio Program (core project)
- *C/C-7 — Exploring Wisconsin's Great Lakes Schooners: Integrating Underwater Archaeology, Shipwreck Preservation and Public Education

EDUCATION

- *E/E-47 — Lake Sturgeon Bowl: Wisconsin's Regional Academic Competition for the National Ocean Sciences Bowl, 2004-06
- *E/E-48 — Recent Advances in Limnology and Oceanography Seminar Series, 2004-06

NOT SHOWN

- C/C-1 — Communications (core project)
- E/E-1 — Special Marine Education Programs (core project)
- M/SGA-1 — Program Development (core project)
- M/SGA-2 — Program Management (core project)
- M/SGA-3 — Ship Time in Support of Sea Grant Research Projects (core project)