Sea Grant 2000-02 Implementation Plan

UNIVERSITY OF WISCONSIN SEA GRANT COLLEGE PROGRAM

Sea Grant
University of Wisconsin

Implementation Plan for 2000-02

University of Wisconsin Sea Grant Institute

Submitted by Anders W. Andren, Director, November 19, 1999

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Vision Statement

Through its efforts and investments in research, outreach and education, the University of Wisconsin Sea Grant College Program will:

- **Create, integrate, transfer and apply scientific knowledge and new technology that will strengthen U.S. leadership in Great Lakes and marine related industries;**
- **Enhance healthier coastal and Great Lakes ecosystems through improved air and water quality;**
- **Enhance the economic well-being of coastal communities; and**
- **Produce highly qualified professionals and a well-informed citizenry.**

Our Strategic Plan

Strategic planning has always been a fundamental element in the management of the University of Wisconsin Sea Grant College Program. In fact, UW Sea Grant's first director, Robert Ragotzkie, pioneered the now-standard Sea Grant concept of focused research subprograms, and this approach remains the basic foundation of our program's organization and management today. We consider the subprogrammatic approach as a steady, long-term framework that helps us organize the broader aspects of the UW Sea Grant College Program.

The long-range goals and short-term priorities of our subprograms constitute the core of our program strategic plan. These goals and priorities are established with input from our subprogram coordinators, advisory committees, and various constituents and user groups. They incorporate the strategic goals and priorities of the National Sea Grant Office and the National Oceanic & Atmospheric Administration and integrate the issues and priorities of the U.S.-Canadian International Joint Commission.

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

Our subprogram coordinators, who are chosen for their professional competence and leadership ability, assist program management with the planning and development of UW Sea Grant's research, education and outreach subprograms (**Appendix 1**). Our research subprogram coordinators, all tenured faculty, are also chosen on the basis of their standing in the scientific community and their involvement in a variety of state, regional and national

scientific associations, advisory boards and committees (**Appendix 2**). These coordinators serve as scientific advisors for our program and help assure that our *basic* research program goals and priorities reflect those of the leading scientific organizations and key government resource management agencies. Similarly, our eight Advisory Services outreach specialists (**Appendix 3**) work in partnership with numerous private businesses and organizations as well as municipal, county, state and regional government agencies (**Appendix 4**). These staff specialists serve as a primary mechanism through which the *applied* research needs of constituent groups are communicated to program management and our subprogram coordinators. The subprogram coordinators, together with UW Sea Grant staff and the Advisory Council, also are actively involved in identifying research opportunities and talent.

Each coordinator helps Sea Grant staff develop long- and short-range research, outreach and education strategic plans for his/her respective subprogram in accordance with the National Sea Grant Strategic Plan, taking into consideration a mix of local, state, regional and other national priorities. These plans are then subjected to review by Sea Grant clients and advisory groups, such as the UW Sea Grant Committee on Advisory Services (**Appendix 5**), and approved by the UW Sea Grant Advisory Council, which consists of state leaders from academia, state and local government, industry and the public (**Appendix 6**). Finally, the draft strategic plan is then forwarded to the National Sea Grant Office for review and comment by our NSGO Program Officer(s) and other NSGO officials.

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 National Sea Grant Strategic Plan.

Relationship to National Sea Grant Strategic Plan

Every project selected for the University of Wisconsin 2000-02 program fits into one or more National Sea Grant Strategic Plan key action areas, and collectively they address every key action area except "Revitalizing Marine Infrastructure" (see **Appendix 7**).

This selection of projects stem from our program's organization around 10 subprograms, which directly reflect the NSGCP strategic plan's key action areas regarding fisheries, aquaculture, seafood technology, biotechnology, environmental technology, coastal ecosystems, and education and human resources development.

Likewise, the cross-disciplinary thematic areas of our 2000-02 program also directly or indirectly reflect the national strategic plan's Environmental Technology, Commercial Fisheries, Sustainable Aquaculture, Coastal Ecosystems, and Safety at Sea key action areas.

Relationship to State, Regional and National Priorities

The University of Wisconsin Sea Grant research agenda implements a strategic plan that carefully integrates and responds to identified national, regional and state priorities. The primary goal of our efforts is to contribute information for environmental stewardship, assessments and predictions, while at the same time using our resources to enhance both state and national economic competitiveness.

The Great Lakes hold an estimated six quadrillion gallons of fresh water — 20 percent of all the drinkable water on the surface of Earth. Coupled with the region's vast forest, agricultural and mineral resources, the abundant supply of water and cheap transportation afforded by the Great Lakes were major factors in the region becoming the population and industrial core of both the U.S. and Canada. About 50 million U.S. and Canadian citizens live and work in the Great Lakes region today, and half of them depend directly on the lakes for drinking water. The United States' third largest city, Chicago, is located on the shores of Lake Michigan, and the Great Lakes coastal cities of Milwaukee, Detroit, Cleveland and Buffalo each have populations of more than a million people. Ontario, the only Canadian province bordering the lakes, contains a third of Canada's population. Currently, nearly 15 percent of the U.S. population lives in the Great Lakes area.

With the world's potable water supplies dwindling under the pressure of continuing human population growth, this wealth of water is becoming an increasingly valuable national treasure. However, despite their great size, these sweetwater seas have proven to be particularly sensitive to population pressures and the insults of human activities in their watersheds. Outflows from the Great Lakes are relatively small (less than 1 percent per year) in comparison with the total volume of water. Pollutants that enter the lakes — whether by direct discharge along the shores, through tributaries, from land use or from the atmosphere — are retained in the system and become more concentrated with time. While the flushing times of Lakes Huron, Erie and Ontario range from six to 22 years, those of Lakes Michigan and Superior take a century to nearly 200 years, respectively.

With 810 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, and controlling the spread of nonindigenous aquatic nuisance species. It also has some relatively unique needs 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 lakeshores.

The national vision promulgated by NOAA is in harmony with that put forth by a number of state and federal agencies in the Great Lakes Basin. The Great Lakes research community is perhaps one of the most focused "eco-regions" in the nation, thanks in large measure to the coordinating influence of the U.S.-Canadian International Joint Commission (IJC). In fact, the 1972 Great Lakes Water Quality Agreement requires the governments of the United

States and Canada to develop and orient scientific research programs in the Great Lakes Basin in accordance with its principles.

The IJC's adoption in the 1978 Great Lakes Water Quality Agreement of the ecosystem approach for addressing human impacts on the ecosystem of the Great Lakes-St. Lawrence River basin further enhanced the commitment to extensive, coordinated research programs. The ecosystem approach — which is now also being introduced into many other federal efforts — acknowledges that humans are part of the ecosystem and recognizes that the basin is composed of numerous interactive and inseparable elements, including air, water, land and living organisms.

Further, the ecosystem of the basin is considered part of Earth's biosphere that exchanges materials and energy with surrounding parts of the global system. It is implicit in this view that water quality cannot be considered in isolation, since it is intimately connected to large-scale interactions affecting the entire system, such as atmospheric transport of pollutants as well as other global processes. Thus, implementing remedial efforts directed at water quality alone would be analogous to treating a symptom with no regard to the underlying problem. Research, then, provides the necessary information to develop an understanding of ecosystem components and processes, human impacts and resulting deleterious effects, and to develop technology for effective remediation strategies. Responsible and informed policy, which acknowledges economic competitiveness on a global scale, also requires research.

In 1997, the IJC, with input from scientists and research managers from throughout the Great Lakes Basin (including UW Sea Grant staff) reaffirmed that the top priority issues confronting the lakes are:

- **identification and virtual elimination of the input of toxic substances to the lakes;**
- **determining the human and ecosystem health effects of toxic contaminants;**
- **the rehabilitation of degraded Great Lakes habitats, and**
- **the control of nonindigenous nuisance species.**

At the national level, other emerging issues with significant Great Lakes ramifications include the commercial development of aquaculture, the protection of critical fish habitat, marine applications of biotechnology, the effects of global climate change on aquatic systems, biodiversity, and coastal hazards assessment.

The goals and priorities of Wisconsin Sea Grant's research and outreach subprograms over the last 30 years, as today, have been and continue to be strongly influenced by such identified regional and national issues. The long-range goals and short-term priorities of our program's strategic plan thus take into consideration the carefully developed plans and programs of the other Great Lakes Sea Grant programs, and the various state, regional, federal and international organizations that have jurisdiction over the Great Lakes and the nation's marine resources.

Institutional Setting

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

Policy and operational responsibility for the University of Wisconsin Sea Grant College Program was formally transferred to University of Wisconsin-Madison under the University of Wisconsin System General Administrative Policy Paper #23 (GAPP #23) on December 1, 1978. 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.

The director of the UW Sea Grant College Program serves as director of the Sea Grant Institute and reports to the dean of the Graduate School at the UW-Madison (**Appendix 8**). Though the Sea Grant Institute is headquartered on the Madison campus, the Wisconsin Sea Grant College Program is UW System-wide and statewide in scope. More than a half-dozen UW System campuses and other Wisconsin public and private colleges and universities regularly participate in the Wisconsin Sea Grant program. During 2000-02, seven UW System campuses will be participating in the UW Sea Grant program (**Appendix 9**).

Appointed by the chancellor of the University of Wisconsin-Madison, the UW Sea Grant Advisory Council (Appendix 6) provides policy guidance within established institutional goals, approves the overall program plan and budget, and participates in program planning and the selection of subject areas within which project proposals are solicited. Representing other units of the university system, state and local government, industry, and the public, the council brings a wide variety of viewpoints to the program and helps ensure the our program's accountability to users and participants. The University of Wisconsin Sea Grant Committee on Advisory Services (Appendix 5) was created in 1992 to provide additional guidance on the direction of the program's outreach efforts. A similar advisory panel on communications is currently being formed.

On a day-to-day basis, the Wisconsin Sea Grant program is managed by UW Sea Grant Institute staff. Regular weekly management staff meetings — attended by the Director, Assistant Director for Administration and Information Technology, Finance and Grants Administrator, Assistant Director for Advisory Services, Assistant Director for Communications, and Assistant to the Director (**Appendix 10**) — are held to coordinate staff activities and program management. Collectively, this management team has more than a century of experience in the Sea Grant program. The management staff also keeps UW Sea Grant's Advisory Services field offices, campus-based specialists and the Communications Office staff informed both of individual activities and of program developments as a whole.

Financial management is handled through regular meetings of the Director, Assistant Director for Administration, and Finance and Grants Administrator.

A world-class university, the University of Wisconsin-Madison offers unique strengths and research opportunities through its internationally recognized Center for Limnology and Water Chemistry Program, as reflected in our Living Resources and Microcontaminants & Water Quality subprograms. The UW-Madison Biotechnology Center coordinates a multidisciplinary research program involving more than 50 campus units. The Aquaculture Institute and Great Lakes WATER (Wisconsin Aquatic Technology and Environmental Research) Institute at UW- Milwaukee 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, Lawrence University and other Wisconsin campuses add to the wealth of research talent and capabilities of the state.

Home of "The Wisconsin Idea" — the public service concept that the boundaries of the university should extend to borders of the state — UW-Madison has proven to be extremely fertile ground that has enabled the Sea Grant concept to grow and flourish throughout Wisconsin and beyond.

Implementation Plan Development

Selection of Priorities

Development of our biennial implementation plan goes hand-in-hand with the development of our biennial omnibus proposal for funding. In addition to having scientific merit, as determined by 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.

Our selection of implementation plan priorities thus originates with our strategic plan, and yet it is largely determined by available talent, available funding, peer review rankings and the recommendations of our technical review panel. Despite giving special consideration to cultivating promising new talent, we are generally limited by these 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 support has enabled these scientists to have a great impact in the areas of fisheries management, toxic contaminants, aquaculture, diving physiology and, most recently, in Geographic Information Systems.

It must be recognized that the implementation of program priorities and the creation of thematic areas are largely driven by factors beyond the control of program management. The bottom-up nature of the proposal process — the variety and quality of the proposals submitted, the availability and interest of qualified principal investigators, and the results of the peer review process — often limits a program's ability to build coherent research and outreach programs to choosing among equally highly ranked proposals.

Implementation Development Milestones

The University of Wisconsin Sea Grant College Program's proposal and implementation plan development process is a complex but collegial one that involves six separate groups, four of which are within the University of Wisconsin System. These are: (1) the faculty, staff and students of the University of Wisconsin campuses and other private colleges and universities in the state; (2) the Sea Grant Institute; (3) Sea Grant subprogram coordinators; (4) the Sea Grant Advisory Council; (5) the National Sea Grant Office (NSGO), National Oceanic & Atmospheric Administration (NOAA); and (6) a technical review panel and other outside reviewers/advisors. The process involves a sequence of steps or functions that requires more than a year to complete **(Appendix 11).**

Although there is a beginning and an end to the process, it is iterative, with one, several or all of the groups providing feedback to the program planning stage throughout different steps. As the program development and proposal process progresses, the various groups enter and reenter into the decision-making process. This interaction among the various groups provides

not only accountability and an effective system of checks and balances, but also a richness and synergistic effect that adds breadth and vigor to Wisconsin's Sea Grant Program.

After research, education and outreach goals are formulated at the various program and subprogram planning meetings, the UW Sea Grant Institute solicits new project proposals for inclusion in the institutional proposal by means of a "Call for Proposals." This document includes detailed subprogram goal statements and is circulated throughout the University of Wisconsin System and to private colleges and universities in Wisconsin (over 500 copies mailed). It emphasizes that it is the responsibility of interested investigators to contact the appropriate research coordinator and/or the institute director to discuss his/her research ideas prior to submitting a pre-proposal. Faculty members are also invited to submit research ideas on subjects outside the scope of the existing subprograms. Such "new initiatives," as they are called, often bring innovations and new direction to the program.

The "Call for Proposals for 2000-2002" clearly described the Sea Grant mission, the goals and priorities for each subprogram, and the areas of particular interest to the program. It stressed that Lake Superior issues, marine biotechnology, the ecosystem impacts of nonindigenous species, Lake Michigan's yellow perch fishery and sediment remediation problems were high priority. Our 2000-2002 omnibus proposal clearly reflects these interests and priorities.

Each prospective investigator then submitted a brief pre-proposal describing his/her project, including specific objectives and the resources required to carry them out. Institute staff, the subprogram coordinator(s) and Advisory Council members evaluated each pre-proposal on the basis of its relevance to Sea Grant goals, potential applicability to Great Lakes and ocean resources, and its originality and likelihood of success. Given a positive review, prospective investigators were encouraged to submit full proposals. In some cases, prospective investigators were asked to revise their proposal concept before submitting full proposals. While no proposal was rejected at this stage, prospective investigators whose pre-proposals did not meet Sea Grant criteria were not encouraged to submit full proposals. (For the 2000-2002 biennium, 68 pre-proposals were received, 41 [60%] were encouraged, and 41 complete proposals were received.) At this point, all prospective principal investigators were invited to attend a January 1999 workshop in Madison (see Appendix 11) to discuss subprogram priorities, thematic area possibilities, and proposal writing strategies. Principal investigators were also encouraged to study the list of encouraged pre-proposals so that alliances could be formed. Thematic area coordinators were also selected at this workshop.

After submission, full proposals are sent out by the subprogram coordinators and UW Sea Grant staff for national review by experts at other universities, in government laboratories and agencies, in industry and within the University of Wisconsin System. Reviewers are generally chosen from out of state. Most of these reviews were solicited from peers, but user reviews were also solicited for projects that potentially have direct application to resource management or business development. UW Sea Grant administration maintains a reviewer database drawn from suggestions by the PIs and subprogram coordinators, the NSGO, and from the proposers themselves. *Subprogram coordinators do not participate in any way in the review or evaluation of their own proposals*. Each proposal receives from three to five

mail reviews. Each reviewer is provided with "no conflict of interest" information similar to that of other funding agencies such as the National Science Foundation, U.S. Environmental Protection Agency and National Institutes of Health.

As for the preceding biennium, we also conducted an evaluation of all research proposal by an outside technical review panel. The 2000-02 panel consisted of Professor Jerome Nriagu, University of Michigan; Michael Gilbertson, International Joint Commission; Professor Howard Kator, Virginia Institute of Marine Science; and Mr. Carlos Fetterolf, a member of the Sea Grant National Review Panel. The Technical Review Panel meeting was also attended by Dr. Leon Cammen, (NSGO program monitor) and UW Sea Grant Advisory Council members. Recommendations made at this meeting were incorporated into our omnibus proposal decision-making process.

Our four primary criteria for selecting projects for funding were:

- Excellent peer reviews (generally proposals with an average review score of no less than 2 on a 1-5 descending scale);
- Recommendation by the technical review panel;
- Coherent "fit" into a subprogram or thematic area as prescribed by our strategic plan;
- Available funding.

Secondary criteria included the geographic distribution of the investigators, new investigator development and potential for further initiatives. After careful consideration of these criteria (i.e., peer and user reviews, coordinator evaluations, outside reviewers and advisors, individual Advisory Council members and Sea Grant Program staff), the proposed program plan was presented by UW Sea Grant staff to the Advisory Council for its review on October 13. After discussion, the council approved the proposed institutional program and budget for the 2000-2002 biennium.

Due to continuing budget constraints, many full proposals that receive high scientific and overall relevance reviews frequently cannot be included. For the 2000-2002 biennium, 19 of the 41 new proposals submitted to the UW Sea Grant Institute were put in Category 1 ("high priority"). Six proposals were put in Category 2 "fund if dollars are available"). Thus, approximately 28 percent of the original pre-proposal ideas were ultimately accepted for inclusion as new, Category 1 projects in the 2000-2002 program.

We also ranked the Category 2 projects in terms of program priority. We have tried to include as many proposals from this category into the 2000-2002 omnibus proposal as our financial status allowed. That is, given the exact target dollar figure from the NSGO, we examined in detail each proposed project budget in Categories 1 and 2, corrected any mistakes in the budgets submitted by the principal investigators, and negotiated a smaller budget if that was possible without compromising the integrity of the proposed research. We thus determined that we were able to include all Category 1 proposals.

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, national and international marine resource problems and opportunities, and thereby ensure that the program is of exceptionally high scientific quality.

Program Elements and Personnel

Historically, the University of Wisconsin Sea Grant College Program has been organized around seven or eight research-area subprograms and four general support subprograms.

As described earlier, the principal personnel for implementing the subprogram approach consists of UW Sea Grant management staff and unpaid faculty research coordinators who serve as our scientific advisors. It also involves the input of and feedback from our Advisory Council, Advisory Services specialists, Committee on Advisory Services, Technical Review Panel, and other program staff and constituent groups.

However, we feel that a stronger integration of research, outreach and education may be achieved via a thematic area framework. By being issue-oriented rather than subject area-oriented, we feel that this pioneering approach focuses attention on specific problems requiring short-term research and outreach commitments to help us direct the broader, long-term subprogram approach. Pioneering this new program concept with our 1996-98 program, we have continued to build upon and refine it over the last two biennial program funding cycles.

Besides the project principal investigators, the primary personnel for implementing this approach are volunteer thematic area coordinators, who are responsible for planning, coordination and synthesis of results. Based on the preproposals selected for submission of full proposals, the program director presents a selection of current and possible thematic areas at the January meeting of potential PIs, at which PIs in the same thematic areas are encouraged to interact and select a thematic area coordinator. These coordinators then work with UW Sea Grant staff on selecting an appropriate mechanism for information and technology transfer — a presentation to program staff, an outreach workshop, scientific conference, public meeting, news media event, publication, etc.

Time Frame

UW Sea Grant's strategic plan generally operates on a five-year rolling horizon basis, with short-term subprogram priorities updated every two years in connection with the Request for Proposals for developing the program's biennial omnibus proposal submission (*Appendix 11*). The NSGO also requires submission of a two-year implementation plan in connection with each biennial omnibus submission. Both our strategic plan and implementation plans are adjusted to take into account the 2- to 4-year funding cycles for individual projects, outreach programs, and thematic areas. The execution of each biennium's projects, along with satisfaction of the annual and biennial progress reporting requirements and review process, constitute the basic time frame for implementation of the UW Sea Grant strategic plan.

Program Implementation

Program Elements and Context

The University of Wisconsin Sea Grant College Program for 2000-2002 is organized in a manner that is based on its subprogrammatic roots, coupled with a new, issue-oriented thematic area approach that was initiated with the 1996-98 biennial program.

The UW Sea Grant College Program for 2000-2002 is organized around seven research subprograms:

- **Living Resources**
- **Biotechnology**
- **Estuarine & Coastal Processes**
- **New Initiatives**
- **Microcontaminants & Water Quality**
- **Aquaculture & Seafood Technology**
- **Policy Studies**

Our four general program-support subprograms are **Advisory Services, Communications, Education,** and **Program Administration.**

Living Resources Subprogram

The long-range goals and short-term objectives of this subprogram reflect the NSGCP's "Economic Leadership-Commercial Fisheries" strategic action item as well as NOAA's Environmental Stewardship Mission, "Building Sustainable Fisheries." They also incorporate the research needs and goals of the Great Lakes Fishery Commission and U.S. Fish & Wildlife Service-Region 3. Lake Superior is also the focus of the International Joint Commission in that a prototype Lake-wide Area Management Plan is being developed.

We propose to fund three, possibly four, new projects during the next biennium. Three will be additions to our four-year-old **Lake Superior Initiative**, while the fourth will be in the new **Sustainable Fisheries** thematic area. We will also fund two continuing projects, one in each of those thematic areas.

The first, "Dynamics of the Lake Superior Food Web" (Kitchell, **R/LR-82**), was the most highly ranked proposal submitted this year, garnering a perfect score. It will build upon three years of work by the PI in our **Lake Superior Initiative** thematic area, and it specifically addresses our strategic plan objective of delineating food web interactions, which is part of our long-range goal of understanding the processes and mechanisms that structure biological communities. The major objectives of the project are to (1) develop a bioenergetics-based model that integrates temporal and geographic components of variability in food web interactions and expand that to estimate bioaccumulation of contaminants, (2) further

develop the Ecosim model for evaluating the ecological responses to "restoration and rehabilitation" management strategies for now-rare species like walleye, coaster brook trout and lake sturgeon, and (3) develop the Ecospace model for Lake Superior as the basis for evaluating spatial dynamics, such as onshore-offshore interactions and fishery management actions emphasizing protected areas.

The other, "Molecular Genetic Analysis of Lake Trout in Lake Superior and Richard's Reef, Lake Michigan" (Phillips, **R/LR-83**), is also in the **Lake Superior Initiative** thematic area and likewise builds upon and extends prior work by the PI in that area. This project addresses our Living Resources Subprogram strategic goal of accounting for the variability in fish communities and the objective of providing Great Lakes fisheries managers with science-based options for their stocking and harvest decisions. The PI's previous work showed that siscowet and lean lake trout populations in Lake Superior are genetically distinct. "Humpers," the third major morphotype in the lake, are of special interest because they are found on shallow reefs ("humps") surrounded by deep water and are being considered for introduction into the lower lakes including Lake Michigan. Identification of genotypes with increased survival to spawning in Lake Michigan would be helpful for the restoration of lake trout in the lower lakes. Furthermore, the molecular identification technique developed by Professor Phillips has received worldwide attention because of its potential usefulness to differentiate between different fish stocks (for example, stocked from native).

A continuing Year One project and closely related Year Two new project, "Causes and Impediments of Lake Trout Recovery in Lake Superior" (Hansen, **R/LR-77, R/LR-84**), rounds out and complements the other Living Resources projects in our **Lake Superior Initiative** thematic area. The objective is to develop quantitative models that describe the principal mechanisms and impediments driving lake trout restoration in Lake Superior in order to provide Lake Superior fishery managers with tools for estimating harvest quotas and for simulating effects of management strategies. Results from the current project have already influenced the thinking of fish managers in Lake Superior. The new effort will be funded at less than the requested level based upon the comments of reviewers.

We intend to provide a limited amount of exploratory funding for a fourth new Living Resources project, "Population Dynamics and Stock Discrimination of Rainbow Smelt in Lake Michigan" (Hansen/Caporale, **R/LR-85**), as part of the **Sustainable Fisheries** thematic area. This project was quite well reviewed, although the mail reviewers seriously questioned the budget and the technical review panel felt that the project could be funded, but only at a reduced funding level. Another consideration was that one of the PIs is also a promising young faculty member. This initial support is designed to test the methodology and look for evidence of a clear distinction (maximum contrast and managerial relevance) among smelt stocks. Continuation of this effort into the second year of the biennium will depend on whether the findings are conclusive or not.

Another continuing Living Resources project, "Recruitment Mechanisms in Yellow Perch (*Perca flavescens*): Interactions Among Growth, Condition and Predation" (Binkowski, **R/LR-75**), has been incorporated into our new **Sustainable Fisheries** thematic area from the Yellow Perch Initiative.

Microcontaminants and Water Quality Subprogram

The long-range goals of this subprogram are to (1) determine the sources and fate of chemical contaminants in the Great Lakes; (2) assess the threats they pose to human health and aquatic life, and (3) develop technologies and strategies for remediation.

Three, possibly four, new projects in this subprogram will constitute UW Sea Grant's new **Toxics, Toxins and Pathogens** thematic area. A continuing project is part of our **Chemical-Biological Interactions in Aquatic Species (Endocrine Disrupters)** thematic area.

These projects and thematic areas directly address the NSGCP's "Coastal Ecosystem Health and Public Safety" strategic action item of concentrating research on toxic contaminants for gaining a better understanding of how to protect and enhance coastal ecosystem health, and for developing nonpoint-source pollution control programs. This also reflects our own, and NOAA's, "Sustain Healthy Coasts" strategic goal, as well as research needs identified by the International Joint Commission, U.S. Environmental Protection Agency-Region 5 and the Great Lakes National Program Office.

The first, "Speciation and Bioavailability of Metals in the Great Lakes Ecosystem" (Armstrong, **R/MW-80**) received very good peer reviews and was also ranked highly by the technical review panel. Part of our **Toxics, Toxins and Pathogens** thematic area, the project's primary goal is to quantify factors regulating speciation and bioavailability of trace metals in Great Lakes tributaries and thereby provide a basis for assessment and prediction of metal bioavailability in the Great Lakes Basin. This information is essential for a rational appraisal of both the short- and long-term impacts of metal loadings to the Great Lakes. Wisconsin's Department of Natural Resources already has started to use results from Professor Armstrong's laboratory to reevaluate metal discharge standards for the state. Based on previous UW Sea Grant-funded metals research, the PIs recently were awarded a substantial award from the U.S. Department of Defense to examine the fate and effect of metals used as antifouling agents in several major U.S. harbors.

"Reproductive Toxicity of Methylmercury in Fish: Establishing the Relationship between Biomarkers and Reproductive Success" (Sandheinrich/Rada, **R/MW-81**), which also received high marks from peer reviewers, addresses growing concern about mercury pollution. The technical review panel also ranked this project very highly, since very little work to date has addressed mercury's toxic effects in fish. In fact, most work to date on methylmercury toxicity has addressed only mammalian effects. Since mercury advisories in the upper Midwest still are quite common and fish reproductive problems persist in certain areas of the Great Lakes, the technical review panel felt that the potential insight into the mechanisms of toxicity would be particularly useful for dose-response calculations. This project will also be part of our **Toxics, Toxins and Pathogens** thematic area.

A third new project, "Atmospheric Deposition of Water-Soluble Compounds into Lake Michigan" (Schauer, **R/MW-82**), will also be added to our **Toxics, Toxins and Pathogens** thematic area. This project will provide a nice compliment to work in progress on the riverine input of contaminants to the Great Lakes. While estimates of atmospheric inputs to the Great

Lakes are now being made, very little information is available on the nature of this material. In particular, the water-soluble fraction of the atmospherically derived material has not been rigorously quantified for most compounds. The technical review panel also indicated that, with available funding, this project should be ranked highly, since the PI is a promising new faculty member.

If sufficient funding becomes available in Year Two of the biennium, we propose funding another new **Toxics, Toxins and Pathogens** thematic area project, "Polybrominated Diphenyl Ethers: A Global Contaminant of Concern in the Great Lakes" (Sonzogni, **R/MW-83**). Polybrominated diphenyl ethers (BDEs) are chemically similar to polychlorinated biphenyls (PCBs) and dibenzodioxins and, like those compounds, bioaccumulate when introduced into aquatic ecosystems. Unlike PCBs and dioxins, BDEs are being manufactured and used in increasing quantities. Information on the prevalence, transport and fate of BDEs in the Great Lakes is extremely limited, and the goal of this project is to make quantitative assessments of the prevalence, transport and fate of BDEs in the Lake Michigan environment. Although the mail reviews of this proposal generally rated it "only" very good, the technical review panel felt a more thorough understanding of the BDEs in the Lake Michigan ecosystem is needed and unanimously recommended funding it.

A continuing project in this subprogram, "Impact of Contaminants on Sexual Development and Reproduction of Amphibians in Great Lakes Ecosystems" (Karasov, **R/MW-76**), has the objective of developing histological and functional biomarkers for altered sexual development in Leopard frogs (*Rana pipiens*) and determining their sensitivity to endocrine disrupters. Part of our **Chemical-Biological Interactions in Aquatic Species (Endocrine Disrupters)** thematic area, this research will develop biomarkers for reproductive dysfunction in amphibians for use by natural resource managers, and the field tests needed to provide information for remediation in this ecosystem. This is one of the few studies anywhere focusing on endocrine disruption in an ecological context, and probably the only one on amphibians.

Policy Studies Subprogram

Two new Policy Studies projects will be funded during 2000-02: one as part of our **Lake Superior Initiative**, the other as part of our **Sustainable Fisheries** thematic area.

The first, "Recreational Boating and Retirement on the Bayfield Peninsula of Lake Superior" (Heberlein, **R/PS-54**) satisfies three subprogram priorities as developed by the UW Sea Grant planning process: (1) develop new techniques for assessing the economic benefits of Great Lakes resources; (2) explore human dimensions of Great Lakes and marine recreation; and (3) identify economic and social issues in coastal community development. It also addresses NSGCP and NOAA strategic action items regarding well-planned, sustainable coastal community development. As several reviewers pointed out, the proposed work is important in that the proposed methodology can be transferred to any coastal community in the nation. Such a tool will be extremely useful as those communities plan for the future.

"Combining Stated and Revealed Preference Data to Estimate the Economic Value of Recreational Salmon Fishing" (Provencher/Bishop, **R/PS-55**). One of the continuing problems for resource managers is a lack of methodologies for estimating the economic value of recreational and commercial fisheries. Such information is crucial as fish stocks become increasingly manipulated by fisheries managers. The proposed work will combine two classical evaluation methods to estimate the economic value of recreational salmon fishing in Lake Michigan. Results from this study will thus deliver information on the efficacy of the valuation method, which can then be used anywhere, and also give fisheries managers a sense of the aggregated economic value of salmon fisheries in Lake Michigan. A well-reviewed project, the technical review panel also felt the work to be of national importance.

Estuarine & Coastal Processes Subprogram

A continuing and a new project in this research subprogram will contribute to our ongoing **Terrestrial-Aquatic Coupling: Managing for Ecological Stability** thematic area. Impounded river systems are a global phenomenon. The construction of dams has accelerated to more than 900 per year over the last 50 years. These sites receive material that has been transported from the watershed – upland forests, agricultural and urban areas, wetlands, etc. This material will undergo biogeochemical changes as it is transported to, and through, impoundments. The nature of the biochemical changes is poorly understood, although these changes will strongly influence the transport of nutrients, contaminants and pathogens. Since these systems are universal and resource managers will have to answer questions on quantity and quality of riverine discharges, whether to dredge or not, and the overall water effect of varying river flows, the UW Sea Grant program planning process has ranked this area of study as a high priority item.

Algal and bacterial productivity respond to specific biogeochemical forcing indicative of changes in nutrient loading, light and temperature parameters, and to biological mechanisms such as size-selective filter feeding. Resultant changes in dissolved gases, particularly CO_2 and O_2, also give evidence of changes in degradation (heterotrophy) relative to synthesis (autotrophy). "Net Heterotrophy/Autotrophy in Coastal and Offshore Lake Michigan" (Cuhel/Klump/Aguilar, **R/EC-6**) is assessing absolute rates and ratios of autotrophic and heterotrophic activities and their associated dissolved gas signatures in coastal areas of Lake Michigan. This project addresses a program strategic research priority of understanding the impacts of event-driven perturbations on coastal and estuarine ecosystems and the subprogram's long-range goal of increasing our quantitative understanding of the processes that dominate the biogeochemistry of Great Lakes coastal waters.

The new project, "Material Transformations through a Series of Linked Basins in a Great Lakes Land Margin Ecosystem" (Klump/Waples, **R/EC-7**), will employ the determination of empirical mass balances and sediment burial within the pools and reservoirs of the main stem of the Lake Winnebago-Fox River-Green Bay, Lake Michigan, system, with the aim of understanding: (1) the impact of the presence of a series of impoundments or pools within the Green Bay system on increased hydraulic retention, water residence time and apparent water "aging;" (2) the efficiency of mass retention within the land margin, with emphasis on the role of artificial impoundments in trapping biogeochemically important materials; and

(3) the role of land-margin systems, in general, in altering both the quantity and composition of the flux of terrestrially derived material to coastal waters. This project addresses the subprogram research priority of characterizing land-water interactions — as well as the major environmental problem of severe nuisance algal blooms fueled by excessive nutrient inputs, particularly in Lake Winnebago, that is generating a great deal of public concern in the area.

Biotechnology Subprogram

A continuing and a new project are addressing a subprogram research priority of evaluating the mechanisms and sites of action of chemical contaminants, including receptor interactions, and the strategic long-term goal of developing innovative approaches for assessing exposure to, and evaluating the effects of, chemical contaminants. While primarily a regional concern and research priority, these projects reflect the NSGCP's "Coastal Ecosystem Health" strategic goal as well as U.S. Environmental Protection Agency national priorities regarding endocrine disrupters. These projects form the core of UW Sea Grant's **Chemical-Biological Interactions in Aquatic Species (Endocrine Disrupters)** thematic area.

"Developmental Toxicity of Dioxin in Zebrafish" (Peterson/Heideman, **R/BT-12**). Professor Peterson is part of a worldwide effort where the zebrafish has been chosen as a genome model for fish in general. This continuing work is part of an effort that may form the basis for molecular pharmatoxicological efforts in the future.

"Determining the Roles of Multiple Forms of AhR and ARNT of Dioxin Toxicity in Rainbow Trout" (Heideman/Peterson, **R/BT-14**). This project received very high mail review scores and was also ranked highly by the technical review panel. Until recently it was assumed that one form of the AhR exists in fish. The PIs have recently discovered multiple forms in trout and zebrafish. This discovery raises uncertainty about all current risk characterizations of AhR agonists in fish. This is because no one presently knows which forms of AhR mediate the most sensitive signs of dioxin toxicity and through which genes these signs are manifested. It is anticipated that the identification of the multiple forms of AhR will ultimately have significant practical application for those involved in the risk assessment of feral fish populations to low contamination levels of chlorinated coplanar aromatic hydrocarbons.

Aquaculture & Seafood Technology Subprogram

The long-range goals of this subprogram are in complete harmony with those of the NSGCP "Economic Leadership" action areas of Sustainable Aquaculture and Seafood Technology and are closely allied with those of the USDA's North Central Regional Aquaculture Center.

A continuing project, "Use of Fish Oil for the Production of Nutraceuticals Containing Omega-3 and Conjugated Linoleic Acid Residues" (Hill, **R/AQ-34**), pursues a subprogram goal of utilizing seafood by-products and developing new seafood products. The project's objective is to demonstrate the technical feasibility of employing fish oil and corn oil

feedstocks to produce a mixture of acylglycerides enriched in residues of both omega-3 and conjugated linoleic acids (CLA). Because both omega-3 fatty acids and CLA have demonstrated prophylactic medicinal value when utilized as supplements to traditional diets, foods containing residues of these acids represent an attractive marketing opportunity for manufacturers of fish oils. This project is in our **Application of Innovative Technology** thematic area because the biotechnology to be utilized in the production of a nutraceutical oil enriched in omega-3 residues and CLA involves four chemical transformations (and associated separation processes).

The combination of high review scores and recommended research priorities prompted the selection of "Stress and Salmonid Fish: Role of Cortisol Metabolizing Enzymes" (Barry/ Malison, **R/AQ-35**) for funding. Stress can have a major deleterious effect on fish growth, health and survival. This project directly addresses the need for basic information on stress physiology in fish. Our aquaculture research efforts have dedicated considerable time to this phenomenon since stress management will be an important factor in the aquaculture of salmonids, perch and other coolwater fish. Outside reviewers and the technical review panel seem to agree.

As part of the same general research area, and for many of the same reasons, we propose to also fund "Production of Stress-Resistant, Domesticated Yellow Perch for Commercial Aquaculture" (Malison **R/AQ-36**), although at a somewhat reduced level, because of program financial limitations.

New Initiatives Subprogram

The primary goal of this subprogram is to provide Wisconsin's university scientists and engineers an opportunity to undertake original, innovative and sometimes high-risk projects that fall outside our established research subprograms. This represents an extension of the vision and goals for the National Sea Grant Strategic Plan in general, and its "Education & Human Resources" section in particular.

Subprogram research priorities include a focus on the development of state-of-the-art engineering and computer-aided tools for assessing the nature and extent of coastal processes. This is manifested in a continuing project, "Erosion Information System in Support of Coastal Zone Management and Science" (Scarpace/Vonderohe, **R/NI-28**). The objectives of this project are to develop (1) effective, state-of-the-art methodology for estimating and periodically re-estimating recent and long-term coastal bluff recession rates with a minimum amount of uncertainty and error; and (2) a prototype geographic information system (GIS) application and associated databases for coastal bluff recession rate analysis. As such, it falls into our **Applications of Innovative Technology to Aquatic Environments** thematic area. This tool could be immensely valuable to a variety of users, including coastal planners and managers, coastal engineers, coastal and environmental scientists, contractors, and primary and secondary investors in coastal property and their agents. This is in keeping with our strategic priorities, as well as those of the NSGCP and NOAA, regarding coastal hazards and sustainable coastal development.

Initiated with program development funds, "Prediction and Prevention of Stress Responses in Recreational Scuba Divers" (Morgan, **R/NI-29**) builds upon previous UW Sea Grant-supported **Safety at Sea** thematic area research by this PI and aims to provide an objective estimate of adherence and recidivism among recreational scuba divers, which will be useful in quantifying the risk associated with recreational scuba diving. The proposed research also possesses the potential for eventually providing guidelines for use in preventing injuries and fatalities in recreational scuba diving.

The new project in this subprogram, "Decompression Injury and Safety Recommendations in Scuba Diving" (Dueland, **R/NI-30**), also builds on prior UW Sea Grant-supported work by this same PI and is also a part of our **Safety at Sea** thematic area, which obviously supports the NSGCP's strategic "Safety at Sea" action area. The project was highly ranked by both the mail peer reviewers as well as the review panel.

Outreach & Education Subprograms: Special Projects

We also propose to fund the following new projects in our Advisory Services, Communication and Education subprograms during 2000-02. All underwent mail peer review and were highly rated, and each provides high visibility for Sea Grant by serving hundreds, if not thousands, of clients throughout the state, the region, and the nation.

Our continuing outreach and education program core projects (Miller, **A/AS-1**; Wittman, **C/C-1**; Hoops, **C/C-2**; Reeb, **E/E-1**) are midway through their four-year review cycle and will not be described here. However, we still had several core activities reviewed for constructive criticism and input from potential users.

Advisory Services

Providing an outreach component to our **Aquaculture for the Great Lakes Region** thematic area, "WATERS 2000: The Wisconsin Aquaculture Technology, Education and Research Service" (Binkowski, **A/AS-44**) builds on similar work by the same PI last biennium. Project objectives are to provide (1) resource and research information to prospective local, regional, and national aquaculture entrepreneurs; (2) technical on-site aquaculture advisory services; (3) specialized workshops, lectures series, and conferences on aquaculture within the Great Lakes region, and (4) "hands on" training workshops in conjunction with recirculating aquaculture systems and intensive aquaculture technology.

A second new project, "Applications of GIS to Coastal Zone Management: Enhancing Local Capacity" (Ventura, **A/AS-45**), also continues similar work by the PI last biennium and represents an outreach effort in our **Applications of Innovative Technology** thematic area. Its goal is to assist public agencies in land use planning and management decision-making that affect Great Lakes shorelines and water quality using GIS and web technologies. As such, it directly addresses a part of the National Sea Grant "Education & Human Resources-Resource Managers" strategic action area: "Develop programs for local decision-makers that use advance technologies to teach integrated ecosystem management techniques."

Communications

"History beneath the Waves: Learning from Wisconsin's Shipwrecks" (Gray/Karl, **C/C-5**) is the third in a series of highly successful and hugely popular projects on Wisconsin's Great Lakes shipwrecks. Led by the state underwater archeologist, the objectives of this project are to (1) improve the effectiveness and scope of the "Wisconsin's Great Lakes Shipwrecks" Web site in making the results of Sea Grant research on shipwrecks meaningful and accessible to the general public; (2) expand the audience of this information by making it more suitable for use by educators and museums; and (3) foster improved stewardship and protection of Wisconsin's shipwrecks through greater public awareness and appreciation for these resources.

Education

"Recent Advances in Limnology and Oceanography Seminar" (Brooks, **E/E-35**) will help support a popular, 25-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 region, convey new ideas and knowledge necessary to understand and formulate solutions to these problems, and encourage informed discussions about the problems among scientists, policy makers and citizens. Although this proposal was highly rated by reviewers and addresses a subprogram priority area, continuing financial constraints limit us to funding this program at a reduced level ($7,000 per year). Given the modest level of funding, this effort is included in the work plan of the Special Marine Education Programs project (**E/E-1**) rather than as a freestanding activity.

We have maintained this subprogram approach for management purposes. This proposal, however, also includes our cross-cutting thematic approach. This approach is designed to complement the subprogram approach by helping us focus on a number of well-defined issues. We believe that this matrix approach strengthens our ability to effectively integrate research and outreach for synthesis and technology transfer purposes.

Integration of Program Elements: Moving toward Implementation

UW Sea Grant's strategic planning and priority process for the next biennium, which included advice from outside reviewers, arrived at a number of different thematic areas, which are expected to provide specific products and the transfer of information and technology through conferences, meetings and workshops. Unlike the traditional subprogram approach, thematic areas are short-term, issue-oriented efforts that offer Wisconsin Sea Grant and the National Sea Grant College Program a long list of benefits. This concept has been approved by the Sea Grant Association as a means of enhancing the way in which the entire national Sea Grant network operates. Specifically, the thematic areas approach:

- Helps organize all Sea Grant activities under common areas of interest;
- Serves as a method for synthesizing thematic area efforts on a national scale, which will enable programs to be more results-oriented;
- Creates new opportunities and new directions for national initiatives and strategic investments;

- Catalyzes cooperative efforts among individual programs, the NSGO, NOAA and other units of the U.S. Department of Commerce;
- Provides opportunities for cooperative ventures with other agencies;
- Focuses the flow of funds to high-impact areas;
- Provides a forum to consolidate Advisory Services, Communications, Education and research efforts on a national scale;
- Offers a mechanism to further solidify Sea Grant's local, regional and national identity;
- Accommodates an interdisciplinary approach;
- Provides a strategically useful method of providing information to policy-makers;
- Helps communicators disseminate results;
- Assists in the marketing of the Sea Grant program and its products, and
- Facilitates Sea Grant support of state-of-the-art science.

After proposal submission and external reviews of all proposed research and outreach projects, and based on current research activities in the Great Lakes Basin, the following nine thematic areas are the focus of UW Sea Grant program research and outreach for the 2000-02 biennium and beyond:

- **Applications of Innovative Technology to Aquatic Environments**
- **Aquaculture for the Great Lakes Region**
- **Chemical-Biological Interactions in Aquatic Species (Endocrine Disrupters)**
- **Fisheries Sustainability**
- **Lake Superior Initiative**
- **Safety at Sea**
- **Terrestrial-Aquatic Coupling: Managing for Ecological Stability**
- **Toxics, Toxins, and Pathogens**
- **Special Outreach and Education**

A matrix of our proposed 2000-02 projects and these thematic areas is presented in **Appendix 12.** These thematic areas fit closely the program goals put forth in the NOAA and NSGO national strategic plans, as well as the priority issues identified by Sea Grant constituencies, management agencies and governments at the local, state, regional and national level.

Three thematic areas from the 1998-00 biennium — **Yellow Perch Initiative, Nonindigenous Species** and **The Science, Technology and Economics of Water and Sediment Remediation** — will be completed and are not being extended due to the completion of all but one project.

Interaction and Integration with Other Programs

As shown by our coordinators' service on a variety of advisory boards, committees and professional associations (Appendix 2), as well as our Advisory Services partnerships with numerous local, state, regional and national agencies and organizations (Appendix 3), the Wisconsin Sea Grant program interacts and is well integrated with a wide range of other programs, including the NOAA Great Lakes Environmental Research Laboratory, Great Lakes Commission, North Central Regional Aquaculture Center, U.S. Environmental Protection Agency/Great Lakes National Program Office, U.S. Army Corps of Engineers, and U.S.-Canadian International Joint Commission.

UW Sea Grant staff, subprogram coordinators and researchers are also actively involved in a variety of both Great Lakes and National Sea Grant Network efforts. Notable recent collaborations 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) and a leadership role in the ongoing development of the Sea Grant Non-Indigenous Species (SGNIS) Web site, among others.

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 1999, UW Sea Grant joined the rest of the network in a research-outreach partnership workshop with NOAA's Great Lakes Environmental Research Laboratory, and the creation of a Great Lakes Communicators Network.

Wisconsin Sea Grant staff 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, the UW Sea Grant director (Andren) serves as chair of the SGA Program Mission Committee and is a member of the IJC Science Advisory Board. The assistant director for communications (Wittman) is currently the Great Lakes Sea Grant Communications chair and as such serves on the Sea Grant Communicators National Steering Committee, and he is a member of the Great Lakes Commission's Great Lakes Information Network Advisory Board. Also, the program's "Earthwatch Radio" producer serves as chair of the network's Radio Task Group.

Evaluation and Review of Program Progress and Results

Internal monitoring of the program's progress, budget and expenditures is conducted on an ongoing basis by the program's management team (director, three assistant directors and fiscal officer — see Appendix 10). The program management team meets on a weekly basis, and the program's Information Technology group meets every two weeks. A computer-based project database and program management system is being developed to enhance the compilation and access to program data and project results.

Subprogram coordinators regularly meet with project investigators to assess progress within their subprogram, and thematic area coordinators are charged with for planning, coordination and synthesis of results of their respective thematic areas. In addition, we have initiated an ongoing thematic area meetings, workshops and conferences, most organized by our Communications Office staff, to facilitate the transfer of information between researchers and outreach staff and, when appropriate, directly with agency personnel, potential users and the public. Three such thematic area meetings were held in 1999.

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 five years). However, no research or education project is permitted to run more than four years without the proposal being resubmitted for peer review.

For projects scheduled to continue into the next grant cycle, an in-depth progress report detailing progress toward meeting project objectives is required. 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 result of the project. We also require a detailed justification of any major shifts in project emphasis or significant budget changes.

These progress reports are reviewed and evaluated by the appropriate research subprogram coordinator(s) and UW Sea Grant Institute staff before being forwarded to the National Sea Grant Office (NSGO). *Subprogram coordinators do not participate in any way in the progress evaluation of their own proposals.* 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.

A brief annual progress report is required for projects that won't continue into the next grant cycle, 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 through the publication of science journal papers resulting from each project. This is achieved by requesting that all journal publication charges (aka page charges) and article offprint/reprint orders be routed through our Communications Office. This helps ensure that we are informed of all resulting publications, that Sea Grant funding is properly acknowledged, and that copies of the articles are forwarded to appropriate campus libraries, user groups and the National Sea Grant Depository.

Outreach Programs

Per NSGO 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, our research subprogram coordinators, and the NSGO. 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 Advisory Services and Communications staff submit quarterly activities reports to the UW Sea Grant director via the assistant directors for those units, and the director conducts annual performance reviews of all program staff. The assistant director for Advisory Services holds weekly conference calls and makes at least semi-annual visits to UW Sea Grant's four field offices. The Communications staff meets on a biweekly basis.

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 the "Earthwatch Radio Program" is conducted annually 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 via quarterly reports to institute management. Use of our World-Wide Web sites are monitored monthly through analysis of computer statistical logs.

All new special, short-term outreach projects are treated the same as new research and education projects.

Program Revision and Redirection during Implementation

Given the relatively short, two-year duration of our implementation program 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 2000-02 biennium. As in the case of the collapse of Lake Michigan's yellow perch fishery last biennium, we will use our program development and regional collaboration funds to respond to needs 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, that of the NSGO as well.

As a matter of course, we regularly encourage our staff and potential investigators to respond to calls for proposals stemming from the NSGO's National Strategic Initiatives and other special funding opportunities. We routinely seeking grants and funding from a variety of other campus, state, regional and national sources of support for our programs and special initiatives.

Synthesis, Packaging & Dissemination of Results

As described above, our subprogram and thematic area coordinators, and Advisory Services and Communications staff 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 subprogram thematic area meetings/workshops, one-to-one outreach and hands-on training, presentations at professional associations and service clubs, media relations, publications and our "Earthwatch Radio" program, the use of the World Wide Web and other information technology.

During 1999, presentations of project results were organized for the contaminated sediment remediation, safety at sea (scuba diving research) and Lake Superior thematic areas. These 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 a reporting and project evaluation mechanism for program management. We plan to continue holding such workshops on a more-or-less quarterly basis during the next biennium, focusing on the thematic areas ending with this biennial cycle (i.e., the yellow perch and nonindigenous species).

We also have established a one-month research/program assistantship program whereby a graduate student researcher can be supported to work with our Communications and/or Advisory Services staffs to develop appropriate means of preparing, packaging and disseminating research results. Potential products from these collaborations may include journal articles, fact sheets, popular magazine stories, Web sites, workshops, public presentations, etc.

One of our top priorities for the synthesis and dissemination of UW Sea Grant project results during the coming biennium will be the establishment of a program management and project

accountability system, as well as an interactive Web-based online proposal submission and project reporting system, like those currently under development at the Oregon Sea Grant program. We envision 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 great increase the availability of project information for program managers, the NSGO, interested researchers, Sea Grant outreach personnel, and the interested public.

National and Regional Applications and Benefits

Besides addressing the national research, outreach and education priorities of the NSGO and NOAA strategic plans, the 2000-02 UW Sea Grant program will benefit a wide range of users at the local, state and regional level:

Advisory Services Subprogram

A/AS-1 — Users of all types, resource managers, and educators benefit directly from Advisory Services work. Benefits accrue to students taught concepts of limnology and oceanography or global environmental change by educators who previously lacked the knowledge or materials to teach these subjects. They accrue to riparians and managers of the many inland lakes in the region benefiting from the knowledge gained and tools developed through previous Advisory Services work on the zebra mussel invasion. They accrue to riparians who lacked knowledge of the impact of storms and fluctuating lake levels or techniques to protect their investments. They accrue to county residents who have better information and improved access because their county officials were taught to use GIS tools. They accrue to aquaculturalists who now have valuable financial management information and to consumers who are able to purchase fresh farm-raised yellow perch from aquaculturalists assisted by the Aquaculture Specialist.

A/AS-44 — A healthy national aquaculture industry will reduce the need to import fish products and help improve the U.S. trade imbalance. Aquaculture advisory services will assist in the sustained development of this rapidly growing industry and promote further economic development in Wisconsin. Because of the newness of this field there is critical need for practical and up-to-date information on the fundamental principles of animal husbandry, water quality, economics, and engineering. The UW Sea Grant aquaculture advisory service program provides needed information to both practicing and prospective aquaculture entrepreneurs.

A/AS-45 — The coastal zone management issues this project will address in Wisconsin are common throughout the nation. The proposed Web-based implementation will be targeted toward local and regional public agencies but will at the same time provide broad public access to anyone with Internet connectivity.

Aquaculture Subprogram

R/AQ-34 — The biotechnology being developed in this project can be used to produce nutraceuticals containing triacylglycerides in which the fatty acid residues have physiological benefits. Such products can have significant dietary implications for individuals who are at high risk for cardiovascular, cancer or hypertensive problems.

R/AQ-35 — This project directly addresses the need for basic information on stress physiology in fish and has applications for enhancing the growth, health, and reproduction of two salmonid species of great economic importance in the Great Lakes region. The knowledge gained as a result of these studies will be useful for developing low-stress

management practices and will aid in efforts to produce strains of stress-resistant fish. By comparing semelparous and iteroparous salmonids, this study will provide key insights into the mechanism regulating the "programmed death" of Pacific salmon. Such information will be useful for developing methods to keep captive semelparous brood stock alive for successive breeding, which in turn would improve selective breeding programs for aquaculture, enhance commercial egg production, and help preserve endangered salmon stocks.

R/AQ-36 — The technologies developed in this project will lead to improved growth and survival of yellow perch reared under intensive culture conditions. Information on the development of the stress response of yellow perch will be used to produce stress hyporesponsive yellow perch, which will significantly increase the efficiency of yellow perch aquaculture. The stress response of yellow perch should also prove (as in salmonids) to be a useful criteria for genetically selecting stress-resistant (i.e., domesticated) fish.

Biotechnology Subprogram

R/BT-14 — Until recently it was assumed that one form of aryl hydrocarbon receptor (AhR) exists in fish. The investigators' discovery of multiple forms of AhR in trout and zebrafish raises uncertainty about all current risk characterizations of AhR agonists in fish, because it is unknown which form of the AhR mediates the most sensitive signs of dioxin toxicity and through which genes these signs are manifested. This grant is the first step towards obtaining this information. 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.

R/BT-12 — This work will help regulatory agencies make better assessments of the risk that TCDD and related compounds pose to the recruitment of feral fish populations. The many possible complex interactions between different fish species, chemicals, and environmental stresses are far too numerous to be tested. The value of understanding TCDD toxicity at a mechanistic level is that knowledge of the mechanism allows rational predictions about risk factors encountered in the environment that have not been tested in the laboratory. An example of the kind of benefit that mechanism-based research produces is the prediction that TCDD might produce additive toxicity with other factors that increase the load on the circulatory system, such as low dissolved oxygen.

Communications Subprogram

C/C-1 — Information produced by the UW Sea Grant Communications Office is requested and used by government agencies, industries, schools, other universities and the public to make informed decisions about the value, use, management and protection of Great Lakes and marine resources. UW Sea Grant administration and outreach receive professional communications support, including public and media relations, program materials, publications and radio.

C/C-2 — The regional "Earthwatch Radio" program helps generate greater public awareness of Great Lakes and marine resources and of Sea Grant activities. It offers a model for radio and online audio projects at other Sea Grant programs.

C/C-5 — The proposed work will foster preservation ethics regarding Wisconsin's Great Lakes shipwrecks and other submerged cultural resources. It will increase appreciation of the historical significance of the Great Lakes. Educators will find the proposed Web site and CD-ROM more suitable for classroom use with the addition of a historical context and other features. The project will strengthen the economies of coastal communities through tourism of divers and museum visitors. Finally, this work will serve as the foundation of four maritime trails being developed to promote and protect Great Lakes historical resources.

Education Subprogram

E/E-1 — This project provides educational experience and specialized training not regularly provided through participation in research projects. It broadens the perspectives of students through guest speakers, seminars and the like. Sea Grant-supported graduate students have gone on to jobs in the private and public sectors, where they continue to apply the results of Sea Grant research. These graduates are a major national asset to the competitiveness and economic health of this country.

E/E-32 — This Sea Grant Industrial Fellows project will develop and test the effectiveness of a continuous flow, photocatalytic reactor system as a means of removing organic contaminants from drinking water. Successful development of an efficient, ATR-waveguide photocatalytic reactor system would be a major step toward commercial application of this technology in the area of drinking water decontamination.

E/E-35-SE — The beneficiaries of this seminar series are the students and the general public and employees of regulatory and management agencies who are not regularly exposed to new scientific discoveries and informed, open discussion of issues critical to the future sustainability of the Great Lakes ecosystem.

E/E-36 — By supporting Sea Grant Knauss Marine Policy Fellowships, this project will enrich the pool of graduates knowledgeable and interested in marine research and resource management careers. It will expand UW course offering in these fields through shared experiences of the student, and give congressional staffers insight into academic research programs and resource issues pertaining to the Great Lakes and marine resources.

Estuarine & Coastal Processes Subprogram

R/EC-6 — Dramatic changes in coastal zone water clarity and sedimentation characteristics have occurred in Lake Michigan during lake level fluctuations and biological invasions. The extent to which the perturbations influence coastal productivity and biodegradation capacity is of importance in determining causes of poor fisheries recruitment and the proliferation of undesirable species. The extent of capability of the harbor region to remove nutrient inputs from river runoff will provide information of value to upstream management teams. The

influences of inshore biological processes on food availability for larval fish recruitment will also link to ongoing studies in fisheries biology by other Sea Grant investigators.

R/EC-7 — Potential users of information from this project include regulatory agencies within the Green Bay ecosystem, local municipalities, land conservation agencies, and local and regional environmental initiatives. Lake Winnebago and lower Green Bay are hypereutrophic systems with serious water quality problems. Severe nuisance algal blooms fueled by excessive nutrient inputs, particularly in Winnebago, have become a major environmental problem generating a great deal of public concern.

Living Resources Subprogram

R/LR-75 — Uncertainty over the causes of recent declines in yellow perch populations in Lake Michigan clearly show the need for improvements in our understanding of recruitment dynamics. Without this knowledge, effective long-term management of perch populations will continue to be plagued with difficulties. Coupled with information generated through other Sea Grant-sponsored research, the research proposed here will increase our understanding of the mechanisms underlying the current perch decline and identify specific factors that may be limiting recovery, thereby helping managers develop solutions to this serious problem.

R/LR-77— Fishery managers on Lake Superior will be provided with tools for estimating harvest quotas and for simulating effects of management strategies. Short-term predictions will be useful for setting harvest quotas for fisheries. Harvest quotas are needed for managing state and tribal fisheries in Lake Superior, both recreational and commercial, particularly in Michigan and Wisconsin. Negotiations with tribal fishery managers are currently underway in Michigan and will be underway soon in Wisconsin. Long-term predictions will be useful for predicting the effects of proposed management actions. Management actions, such as total allowable catch levels and gear restrictions, need to be evaluated as part of long-term management of fisheries throughout Lake Superior. Agencies that will benefit include the Michigan, Minnesota, and Wisconsin Departments of Natural Resources, the Chippewa-Ottawa Treaty Fishery Management Authority, and the Great Lakes Indian Fish and Wildlife Commission. Each of these agencies has management authority over a segment of Lake Superior and can therefore use the population model to enact fishery management strategies, such as harvest quotas and gear restrictions.

R/LR-82 — Managers (e.g., federal, state, and provincial agencies) charged with restoring sustainable fisheries in Lake Superior will benefit from this research. Our findings will help guide restoration efforts, stocking policies, and the development of efforts directed toward more effective management of bioaccumulation of contaminants derived from predator-prey interactions.

R/LR-83 — State, federal, and tribal agencies involved with the rehabilitation programs for lake trout would be able to manage the recovering lake trout populations in Lake Superior more effectively for sustainable harvest. Identification of genotypes with increased survival to spawning in Lake Michigan would be helpful for the restoration of lake trout in the lower lakes.

R/LR-84 — This project will provide management agencies with a tool for predicting lake trout stock sizes in the short-term and for simulating stock dynamics in the long-term. Short-term predictions will be useful for setting harvest quotas for fisheries. Long-term predictions will be useful for predicting the effects of proposed management actions. Agencies that will benefit include the Michigan, Minnesota, and Wisconsin Departments of Natural Resources, the Chippewa-Ottawa Treaty Fishery Management Authority, and the Great Lakes Indian Fish and Wildlife Commission. Each of these agencies has management authority over a segment of Lake Superior and can therefore use the population model to enact fishery management actions such as harvest quotas and gear restrictions.

Microcontaminants & Water Quality Subprogram

R/MW-76 — This research will develop biomarkers for reproductive dysfunction in amphibians for use by natural resource managers (e.g., WDNR, USFWS, EPA). The field tests will provide information needed for remediation in this ecosystem. The dose-response studies will facilitate prediction of toxicological effects on amphibians at other times and/or other sites. This is one of the few studies anywhere focusing on endocrine disruption in an ecological context and probably the only one on amphibians.

R/MW-80 — These investigators expect to provide a basis for assessment and prediction of metal bioavailability in the Great Lakes Basin. This information is essential for a rational appraisal of both the short- and long-term impacts of metal loadings to the Great Lakes. In addition, the information can be applied to such issues as assimilative capacity of a given watershed and effects of watershed disturbance of metal bioavailability.

R/MW-81— This study (1) will identify potentially detrimental effects of methylmercury on sex hormones, gonadal development and structure, and reproductive success in fish and (2) establish the relationship between methylmercury concentrations in adult fish and potential biomarkers of methylmercury effects on reproduction, thereby establishing linkages between measures of reproductive success that can be measured in the laboratory to biomarkers that can be measured in wild populations of fish. This information will assist fishery managers in assessing the relative effects of contaminants on year-class strengths of wild populations of fish.

R/MW-82 — The results of this study will be used to obtain a broader understanding of the impact of atmospheric contaminants on Lake Michigan. The expected results will also provide insight into control strategies that can be pursued to minimize the impact of air pollution on the Great Lakes. In addition, the measurements obtained will provide a baseline for future planning and monitoring efforts.

R/MW-83 — The proposed work will benefit all parties seeking to improve environmental health by eliminating bioaccumulating contaminants. This work will support efforts outlined by the USEPA, as well as state environmental agencies.

New Initiatives Subprogram

R/NI-28 — This project will develop a comprehensive system design and prototype for a coastal bluff erosion information system. The proposed system will support the accurate measurement and modeling of changes in coastal bluff morphology. When integrated with appropriate geotechnical information, the system will support prediction of such changes. This system will provide information to a variety of users, including coastal planners and managers, coastal engineers, coastal and environmental scientists, contractors, and primary and secondary investors in coastal property and their agents. This project will demonstrate an important use for this system: the identification of erosion risk areas and shoreline recession rates. The system could be integrated with coastal erosion models to provide an interpretive framework for addressing other issues, such as inventorying erosion-related characteristics of shoreline areas, developing and evaluating alternative shoreline protection measures, and preparing a comprehensive shoreline slope stabilization and shoreline erosion management plan.

R/NI-29 — This research will provide an objective estimate of adherence and recidivism, and this information will be useful in quantifying the risk associated with recreational scuba diving. Potential users of this information are diving instructors, professional diving organizations, psychologists and physicians who treat divers, and certification bodies worldwide. The proposed research also possesses the potential for eventually providing guidelines for use in preventing injuries and fatalities in recreational scuba diving.

R/NI-30 — This project's findings will improve diving safety by educating divers, diving instructors, educational organizations (PADI and NAUI), physiologists, dive computer manufacturers, and clinicians about decompression risk. Recommendations derived from this work will provide practical approaches for reducing the risk of decompression injury in recreational, scientific, and commercial diving.

Policy Studies Subprogram

R/PS-54 — Chambers of Commerce, community leaders, entrepreneurial business people, and the Wisconsin Department of Tourism should all find this information useful. Knowing how the lake amenities benefit communities is fundamentally important for rural diversification and for making a smooth transition to a service-based economy.

R/PS-55 — The study will advance recent research on the methods of non-market valuation. It will provide Lake Michigan fisheries managers with an estimate of the economic value of structural changes in the Lake Michigan salmon fishery. It will serve the purpose of developing reliable methods for examining future economic issues concerning Lake Michigan fisheries, such as the value of the recovery of the lake's yellow perch fishery.

APPENDIX 1

Subprogram Coordinators, 1999

LIVING RESOURCES

James F. Kitchell
Center for Limnology
University of Wisconsin-Madison

ESTUARINE & COASTAL PROCESSES

J. Val Klump
Great Lakes WATER Institute
University of Wisconsin-Milwaukee

MICROCONTAMINANTS & WATER QUALITY

David E. Armstrong
Water Chemistry Program
University of Wisconsin-Madison

POLICY STUDIES

Richard C. Bishop
Agricultural Economics
University of Wisconsin-Madison

AQUACULTURE & SEAFOOD TECHNOLOGY

Jeffrey A. Malison
Food Science Department
University of Wisconsin-Madison

Fred P. Binkowski
Great Lakes WATER Institute
University of Wisconsin-Milwaukee

BIOTECHNOLOGY

Richard E. Peterson
School of Pharmacy
University of Wisconsin-Madison

NEW INITIATIVES

Anders W. Andren
Sea Grant Institute
University of Wisconsin-Madison

ADVISORY SERVICES

Allen H. Miller
Sea Grant Institute
University of Wisconsin-Madison

COMMUNICATIONS

Stephen C. Wittman
Sea Grant Institute
University of Wisconsin-Madison

EDUCATION

Anders W. Andren and **Mary Lou Reeb**
Sea Grant Institute
University of Wisconsin-Madison

APPENDIX 2

Subprogram Coordinator Memberships

Advisory Boards, Committees and Professional Associations

American Agricultural Economics Association
American Association for the Advancement of Science
American Chemical Society
American Fisheries Society
Fish Culture Section
American Geophysical Union
American Society for Pharmacology & Experimental Therapeutics
American Society of Limnology & Oceanography
Association for Ecosystem Research Centers
Association of Environmental and Resource Economists
Coastal Management Journal Editorial Board
Coop. Institute for Limnology & Ecosystem Research
Council of Fellows
Estuarine Research Federation
Geochemical Society
Governor's Blue Ribbon Task Force on Aquaculture
Great Lakes Coastal Ocean Processes
EEGLE Project management team
Great Lakes Sea Grant Network
Great Lakes Fishery Commission
Board of Technical Experts
Great Lakes Commission
Great Lakes Information Network Advisory Board
Great Lakes Communicators Network
Great Lakes Research Coordinator
Great Lakes Science Advisory Board-U.S. Section
Great Lakes Sea Grant Network
Green Bay Remedial Action Plan
Science and Technology Advisory Committee
International Association for Great Lakes Research
International Joint Commission
Ecosystems Committee
Science Advisory Board
International Water Resources Association
Marine Affairs/Policy Association
Michigan State Bar Association
Midwest Society of Toxicology
The National Academy of Sciences
Committee on Research & Peer Review for U.S. Environmental Protection Agency
National Marine Educators Association
National Marine Fisheries Service
Ecosystem Principles Advisory Panel
National Research Council
Coastal Oceans Program Panel
National Science Foundation
Coastal Ocean Processes Science Steering Committee
Ecosystems Advisory Panel
Field Stations and Marine Labs Advisory Panel
Graduate Research Traineeships Advisory Panel
Long-Term Ecological Research Advisory Panel
Science and Technology Centers Advisory Panel
National Sea Grant Electronic Task Force
National Toxicology Program
National Undersea Research Program, NOAA
National Institute of Environmental Health Sciences
NIEHS Center, Developmental and Molecular Toxicology, University of Wisconsin
National Toxicology Program
Center for the Evaluation of Risks to Human Reproduction
North Central Regional Aquaculture Center
Technical Committee Research Subcommittee
Technical Committee Extension Subcommittee
Walleye Culture Manual
Walleye Work Group
Yellow Perch Culture Manual
Yellow Perch Work Group
Panel on Economic Valuation of Great Lakes Benefits
Sea Grant Association
Program Mission Committee
Sea Grant Communicators National Steering Committee
Society of Environmental Journalists
Society of Environmental Toxicology and Chemistry
Society of Toxicology
Toxicology and Applied Pharmacology Editorial Board
University of Wisconsin-Madison
Updating "The Wisconsin Idea" Advisory Board
UW-Madison on the Road Committee
University of Wisconsin System
Groundwater Council Research Committee
Wisconsin Aquaculture Association
Wisconsin Aquaculture Industry Advisory Council
Yellow Perch Committee
Environmental Committee
Wisconsin Department of Natural Resources
Fox River Remediation Advisory Team
Phosphorus & Water Quality Technical Committee
Wisconsin Land Information Association
World Aquaculture Society

APPENDIX 3

Advisory Services Specialists

AQUACULTURE

Fred Binkowski
Aquaculture Institute
UW-Milwaukee

BUSINESS

Harvey Hoven
UW-Superior
Superior, Wis.

COASTAL ENGINEERING

Philip Keillor
Sea Grant Institute
UW-Madison

FISHERIES

Philip Moy
UW-Manitowoc

GEOGRAPHIC INFORMATION SYSTEMS

David Hart
Land Information & Computer Graphics Facility
UW-Madison

GLOBAL ENVIRONMENTAL CHANGE EDUCATION

Allen H. Miller
Sea Grant Institute
UW-Madison

MARINE EDUCATION

James Lubner
Great Lakes WATER Institute
UW-Milwaukee

WATER QUALITY

Victoria Harris
UW-Green Bay

APPENDIX 4

Advisory Services Partnerships

Aldo Leopold Center, Madison
Alpine Farms, Sheboygan Falls
American Planning Association
Land-Based Classification Standards Project
Ashland Area Development Corporation, Ashland
Barker's Island Marina, Superior
Bay Area Community Council, Green Bay
Bay Port Aquaculture Systems, Inc., West Olive, Mich.
Bayfield County
Bay-Lake Regional Planning Commission, Green Bay
Bennett Academy of Ski and Scuba, Milwaukee
Boudin's Fisheries Inc., Ashland
Boutin Fishing Company, Bayfield
Brown County
Conservation Alliance
Harbor Commission
Homebuilders Association
Land Conservation Department
Planning Department
Port and Solid Waste Department
Canadian Ministry of Environment
Case Western Reserve University
Department of Geological Sciences
City of Appleton
Department of Utilities, Wastewater Division
City of Ashland
Marina
City of Bayfield
City of Green Bay
Chamber of Commerce
Mayor's Office
Metropolitan Sewerage District
Planning
Public Schools
City of Manitowoc
Public Works Department
City of Milwaukee
Police
Public Schools
City of Superior
City of Washburn
Marina
City of Wauwatosa
Clean Water Action Council
Coastal Planning and Design, Inc., Green Bay
Coastal Services Center, NOAA, Charleston, S.C.
Coastal Zone Foundation
Dean Vegetable Company, Green Bay
Door County
East Central Wisconsin Regional Planning, Oshkosh
Everett Fisheries, Inc., Port Wing
Federal Geographic Data Council
National Shoreline Data Standard Working Group, Bathymetric Subcommittee
Fish Creek Aquaculture Development Center, Ashland
Fishing Charters of Racine, Racine
Fort James Corporation, Green Bay
Fox Cities Convention & Visitors Bureau, Appleton
Fox-Wolf Basin 2000, Green Bay
Freedom High School, Freedom
Friends of the Branch River, Manitowoc
Great Black Creek Fish Company, Black Creek
Great Lakes Commission
Great Lakes Information Network
Great Lakes Fish Distributors
Great Lakes Fishery Commission
Great Lakes Indian Fish and Wildlife Commission, Odanah
Great Lakes Panel on Aquatic Nuisance Species
Great Lakes Sea Grant Network
Great Lakes Sport Fishermen
Green Bay Duck Hunters Association, Green Bay
Halvorson & Son Fisheries, Bayfield
Hamline University, St. Paul, Minn.
Center for Environmental Education
Havenwoods Environmental Awareness Center, Milwaukee
Heart-of-Valley Metropolitan Sewerage District, Kaukauna
Illinois-Indiana Sea Grant Program
Inland Sea Society, Washburn
International Association for Great Lakes Research
International Joint Commission
Great Lakes Regional Office, Windsor, Ontario
John G. Shedd Aquarium, Chicago, Ill.
Kaukauna Electric Commission, Kaukauna
Kenosha Charter Boat Association, Kenosha
Lake Pewaukee Lake District, Pewaukee
Lake Michigan Federation, Chicago, IL
Lake Michigan Lakewide Management Plan Forum
Lake Superior businesses in Wisconsin
110 businesses, Superior to Hurley
Lake Superior herring fishers
10 licensed commercial fishermen
Leech Lake Band of Chippewa, Leech Lake, Minn.
Local Emergency Planning Committee, Green Bay

Lower Fox River Dischargers Association, Green Bay
Lower Green Bay and Fox River Remedial Action Plan, Green Bay
Madeline Island Ferry, Bayfield
Madison Metropolitan School District
Manitowoc County
Land and Water Conservation
Maywood Environmental Center, Sheboygan
McDonald Lumber & Warehousing Co., Green Bay
Medford School District, Medford
Metropolitan Interstate Commission, Duluth, Minn.
Michigan Natural Features Inventory Project
Michigan Sea Grant Program
Michigan State University
Department of Fisheries and Wildlife
Milwaukee County
Community Right-to-Know Subcommittee
Emergency Planning Committee
Minnesota Sea Grant Program, Duluth
Mississippi-Alabama Sea Grant Program
Morey's Fish Company, Motley, Minn.
Neville Public Museum, Green Bay
National Association of State Universities & Land Grant Colleges
National Water Research Institute, Environment Canada, Hamilton, Ontario
Navarino Neighborhood Association, Navarino
North American Lake Management Society
Northern Great Lakes Visitors Center, Ashland
Northland College, Ashland, Wis.
Sigurd Olson Environmental Institute
Northwest Wisconsin Regional Planning Commission, Spooner
Ohio Department of Natural Resources
Thousand Islands Environmental Center, Kaukauna
Oneida Environmental Services Program, Oneida
Outagamie County
Land Conservation
Planning and Zoning
Ozaukee County
Land Information Office
Paragon Aquaculture, Oshkosh
Pewaukee School District, Pewaukee
Pigeon River Priority Watershed WAV, Sheboygan
Purdue University
Racine County
Planning and Zoning
Red Lake Band of Chippewa, Red Lake, Minn.
Rufus King High School, Milwaukee
Sailboats, Inc., Superior
Saint Louis River Remedial Action Plan, Duluth, Minn.
Salmon Unlimited, Racine
Sheboygan County
Land and Water Conservation
Slinger Middle School, Slinger
SODA Farms, Princeton
South Shore Yacht Club, Milwaukee
Southeast Michigan Coalition for Occupational Safety and Health
St. Lawrence River Institute of Environmental Sciences
St. Norbert College, DePere
Benchmarks Project
Project COAST
Ocean Voyagers Program
SUNY Buffalo
Great Lakes Program
Sustainable Green Bay Action Team
Creating a Dialogue/Vision
Creating/Enhancing the Green Infrastructure
Developing a Multi-Model Transportation System
Improving Community Planning and Design
Improving Water Quality
Revitalizing Downtown
Strengthening Intergovernmental Cooperation
Strengthening Neighborhoods and Social Services
Transforming the Economy
Town of Hobart
U.S. Army Corps of Engineers
Chicago District
Detroit District
Sanitary-Ship Canal Barrier Project
U.S. Coast Guard Marine Safety Office, Milwaukee
Eastern Wisconsin Area Committee
U.S. Congress, Representative Mark Green
U.S. Department of Agriculture
Natural Resources Conservation Service
Natural Resources Damage Assessment
North Central Regional Aquaculture Center
(NCRAC)
U.S. Department of Commerce, NOAA
GEWEX Continental-Scale International Project)
Great Lakes Environmental Research Laboratory
National Weather Service
Office of Global Programs
Ohio River Forecast Center
National Undersea Research Program
U.S. Department of the Interior
Bureau of Indian Affairs
Federal Geographic Data Committee
Fish and Wildlife Service, Ashland & Green Bay
Geological Survey
National Park Service, Apostle Islands National Lakeshore, Bayfield
U.S. Environmental Protection Agency, Chicago
Region 5
Great Lakes Region National Program Office
U.S. Navy
Naval Oceanographic & Meteorological Command
University of Michigan
Center for Great Lakes and Aquatic Sciences
Department of Ocean Engineering

University of Wisconsin Colleges
- *Fox Valley*
- *Manitowoc*
- *Marinette*
- *Waukesha*

University of Wisconsin System
- *Great Lakes WATER Institute*
- *Aquaculture Institute*

University of Wisconsin-Extension
- *Area Water Quality Education Specialists*
- *Solid & Hazardous Waste Education Center*
- *Water Action Volunteer Program*

University of Wisconsin-Green Bay
- *Department of Public & Environmental Affairs*
- *Natural and Applied Sciences*
- *Outreach and Extension*

University of Wisconsin-Madison
- *Department of Civil and Environmental Engineering*
- *Environmental Remote Sensing Center*
- *Department of Geology and Geophysics*
- *Institute for Environmental Studies*
- *Land Information & Computer Graphics Facility*
- *State Cartographer's Office*

University of Wisconsin-Milwaukee
- *Aquanaut Program*
- *Center for Great Lakes Studies*
- *JASON Project*

University of Wisconsin-Stevens Point

University of Wisconsin-Superior
- *Center for Economic Development*

Washington Sea Grant Program

Winnebago County
- *Land Conservation Department*

Wisconsin Center for Environmental Education

Wisconsin Commercial Fisheries Association

Wisconsin Conservation Congress

Wisconsin Department of Administration
- *Coastal Management Program*
- *Natural Hazards Advisory Committee*
- *Office of Land Information Services*
  - Wisconsin Land Council Technical Working Group
- *Small Business Clean Air Assistance*

Wisconsin Department of Agriculture, Trade and Consumer Protection
- *Governor's Blue Ribbon Task Force on Aquaculture*
- *Wisconsin Aquaculture Industry Advisory Council*

Wisconsin Department of Commerce

Wisconsin Department of Natural Resources
- *Big Bay State Park*
- *Boating Safety Program*
- *Fishery Management Office*
- *Fox River Remediation Advisory Team*
- *Geographic Management Units*
  - Lower Fox Partnership
  - Door County Stewardship Council
  - Milwaukee River Partnership
  - Lake Superior Partnership
  - Fox-Wolf Basin Partnership
- *Lake Superior Basin Advisory Committee*
- *Lake Superior Management*
- *Nonindigenous Species Task Force*
- *Northeast Region Water Division*
- *Park Naturalists*
- *Shoreland Zoning Unit*

Wisconsin Department of Public Instruction

Wisconsin Department of Transportation
- *Harbor Assistance Program*

Wisconsin Division of Emergency Government

Wisconsin Environmental Education Board

Wisconsin Farm Federation Bureau, Madison

Wisconsin Governor's Northern Office, Hayward

Wisconsin Land and Water Conservation Board

Wisconsin Maritime Museum, Manitowoc

Wisconsin Society of Science Teachers

Wisconsin State Historical Society
- *Marine Archeology Committee*

Wisconsin State Laboratory of Hygiene

Wisconsin State Legislature
- *Sen. Margaret Farrow*
- *Rep. Dan Vrakas*

APPENDIX 5

Committee on Advisory Services, 1999-2002

JOHN WOLF
Alpine Farms
Sheboygan, Wisconsin

DAVID LEE
Land Information Officer
Bayfield County
Washburn, Wisconsin

PAT ZIEGELBAUER
Slinger Middle School
Slinger, Wisconsin

JACK CULLEY
Sailboats, Inc.
Superior, Wisconsin

TERRY LYCHWICK
Northeast Region District Office
Wisconsin Department of
Natural Resources
Green Bay, Wisconsin

ANGIE TORNES
Rivers, Trails & Conservation Assistance
National Park Service
Milwaukee, Wisconsin

JOHN LACENSKI
Boating Law Administrator
Wisconsin Department of
Natural Resources
Madison, Wisconsin

STEVE SKAVORNECK
346 E. Wilson St.
Milwaukee, Wisconsin

DAVID WENTLAND
Coastal Planning and Design, Inc.
Green Bay, Wisconsin

APPENDIX 6

1999 Advisory Council

University of Wisconsin Sea Grant College Program

ANDERS W. ANDREN (*ex officio*)
Professor of Water Chemistry
Director, Sea Grant Institute
Director, Water Resources Institute
University of Wisconsin-Madison

RICHARD R. BURGESS
Professor of Oncology
University of Wisconsin-Madison

ARNOLD L. CLEMENT
Director, Planning & Development Division
Racine County Planning & Development
Sturtevant, Wisconsin

GEORGE EVENSON
Citizen Representative
Sturgeon Bay, Wisconsin

JEFFREY FORAN
Director, Great Lakes WATER Institute
University of Wisconsin-Milwaukee

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

HALLET ("BUD") HARRIS (chair)
Professor Emeritus of Biology
Director, Institute for Land & Water Studies
Natural & Applied Sciences
University of Wisconsin-Green Bay

LEE KERNEN
Citizen Representative
Madison, Wisconsin

REUBEN H. LORENZ
Citizen Representative
Madison, Wisconsin

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

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

DAVID T. MICHAUD
Senior Environmental Scientist
Business Planning
Wisconsin Electric Power Company
Milwaukee, Wisconsin

NATHANIAL E. ROBINSON
Special Assistant to the Secretary
Wisconsin Department of Administration
Madison, Wisconsin

DANIEL O. TRAINER
Professor Emeritus of Wildlife
Dean Emeritus, College of
Natural Resources
University of Wisconsin-Stevens Point

APPENDIX 7

National Sea Grant Strategic Plan Key Action Items Addressed by Wisconsin Sea Grant's Proposed 2000-02 Projects

ECONOMIC LEADERSHIP — Key Action Areas

Commercial Biotechnology

R/AQ-34 — Use of Fish Oil for the Production of Nutraceuticals Containing Omega-3 and Conjugated Linoleic Acid Residues (Hill) *(also Seafood Technology)*

Environmental Technology

R/LR-83 — Molecular Genetic Analysis of Lake Trout in Lake Superior and Richard's Reef, Lake Michigan (Phillips)

R/MW-81 — Reproductive Toxicity of Methylmercury in Fish: Establishing the Relationship between Biomarkers and Reproductive Success (Sandheinrich/Rada)

Commercial Fisheries

R/LR-75 — Recruitment Mechanisms in Yellow Perch (*Perca flavescens*): Interactions among Growth, Condition and Predation (Binkowski)

R/LR-77 — Causes and Impediments of Lake Trout Recovery in Lake Superior (Hansen)

R/LR-82 — Dynamics of the Lake Superior Food Web (Kitchell)

A/AS-1 — Advisory Services: Fisheries Outreach Specialist (Moy)

Sustainable Aquaculture

R/AQ-35 — Stress and Salmonid Fish: Role of Cortisol Metabolizing Enzymes (Barry/Malison)

R/AQ-36 — Production of Stress-Resistant, Domesticated Yellow Perch for Commercial Aquaculture (Malison)

A/AS-44 – WATERS 2000: The Wisconsin Aquaculture Technology, Education and Research Service (Binkowski)

Seafood Technology

R/AQ-34 — Use of Fish Oil for the Production of Nutraceuticals Containing Omega-3 and Conjugated Linoleic Acid Residues (Hill)

Coastal Business Development

A/AS-1 — Advisory Services: Business Outreach Specialist (Hoven)

Coastal Community Development

R/PS-54 — Recreational Boating and Retirement on the Bayfield Peninsula of Lake Superior (Heberlein)

Revitalizing Marine Infrastructure

(no project)

COASTAL ECOSYSTEM HEALTH AND PUBLIC SAFETY — Key Action Areas

Healthy Coastal Ecosystems

R/MW-76 — Impact of Contaminants on Sexual Development and Reproduction of Amphibians in Great Lakes Ecosystems (Karasov)

R/MW-80 — Speciation and Bioavailability of Metals in the Great Lakes Ecosystem (Armstrong)

R/MW-82 — Atmospheric Deposition of Water Soluble Compounds into Lake Michigan (Schauer)

R/MW-83 — Polybrominated Diphenyl Ethers: A Global Contaminant of Concern in the Great Lakes (Sonzogni)

R/BT-12 — Developmental Toxicity of Dioxin in Zebrafish (Peterson/Heideman)

R/BT-14 — Determining the Roles of Multiple Forms of AhR and ARNT in Dioxin Toxicity in Rainbow Trout (Heideman/Peterson)

A/AS-1 — Advisory Services: Water Quality Outreach Specialist (Harris)

Coastal and Great Lakes Habitats

R/EC-6 — Net Heterotrophy/Autotrophy in Coastal and Offshore Lake Michigan (Cuhel/Klump/Aguilar)

R/EC-7 — Material Transformations through a Series of Linked Basins in a Great Lakes Land Margin Ecosystem (Klump/Waples)

A/AS-1 — Advisory Services: Nonindigenous Species Outreach Specialist (Moy)

Sustainable Development

R/PS-55 — Combining Stated and Revealed Preference Data to Estimate the Economic Value of Recreational Salmon Fishing (Provencher/Bishop)

R/NI-28 — Erosion Information System in Support of Coastal Zone Management and Science (Scarpace/Vonderohe)

Coastal Hazards

A/AS-1 — Advisory Services: Coastal Engineering Outreach Specialist (Keillor)

Safety at Sea

R/NI-29 — Prediction and Prevention of Stress Responses in Recreational Scuba Divers (Morgan)

R/NI-30 — Decompression Injury and Safety Recommendations in Scuba Diving (Dueland)

A/AS-1 — Advisory Services: Marine Safety Outreach Specialist (Lubner)

EDUCATION AND HUMAN RESOURCES — Key Action Areas

Scientists and Engineers

E/E-1 — Special Marine Education Programs (Reeb)

E/E-32 — Industrial Fellowship: ATR-Based Photocatalytic Drinking Water Systems (Anderson)

E/E-35 — Recent Advances in Limnology and Oceanography Seminar (Brooks)

E/E-36 — Dean John A. Knauss Marine Policy Fellowship (Reeb)

Resource Managers

A/AS-45 — Applications of GIS to Coastal Zone Management: Enhancing Local Capacity (Ventura)

Technical Training

A/AS-44 – WATERS 2000: The Wisconsin Aquaculture Technology, Education and Research Service (Binkowski)

Precollege Education

A/AS-1 — Advisory Services: Education Outreach Specialist (Lubner)

E/E-1 — Special Marine Education Programs-Madison JASON Project (Reeb)

Informal Education

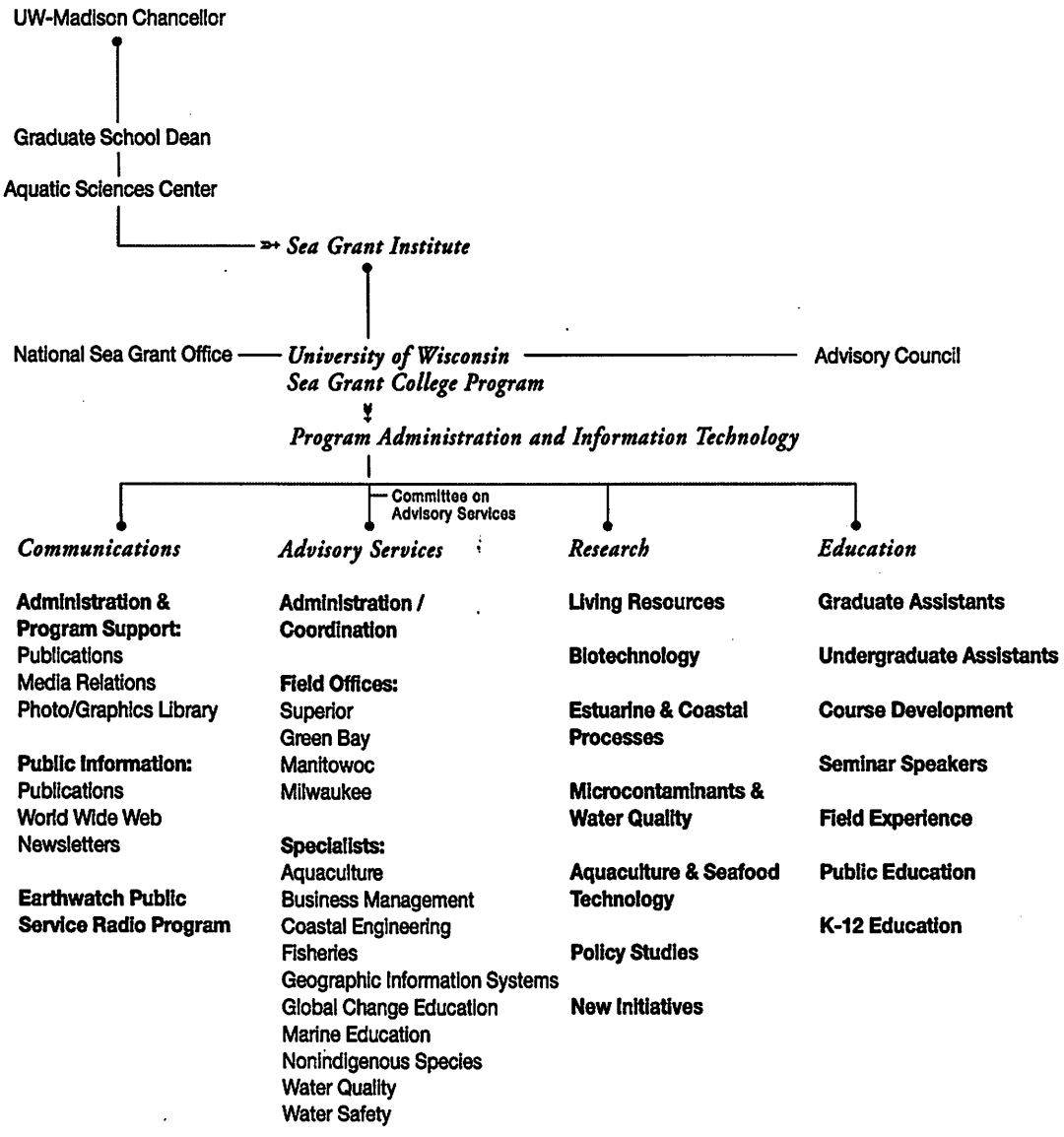
C/C-1 — Communications Office (Wittman)

C/C-2 — Earthwatch Public Service Radio Program (Hoops)

C/C-5 — History beneath the Waves: Learning from Wisconsin's Shipwrecks (Gray/Karl)

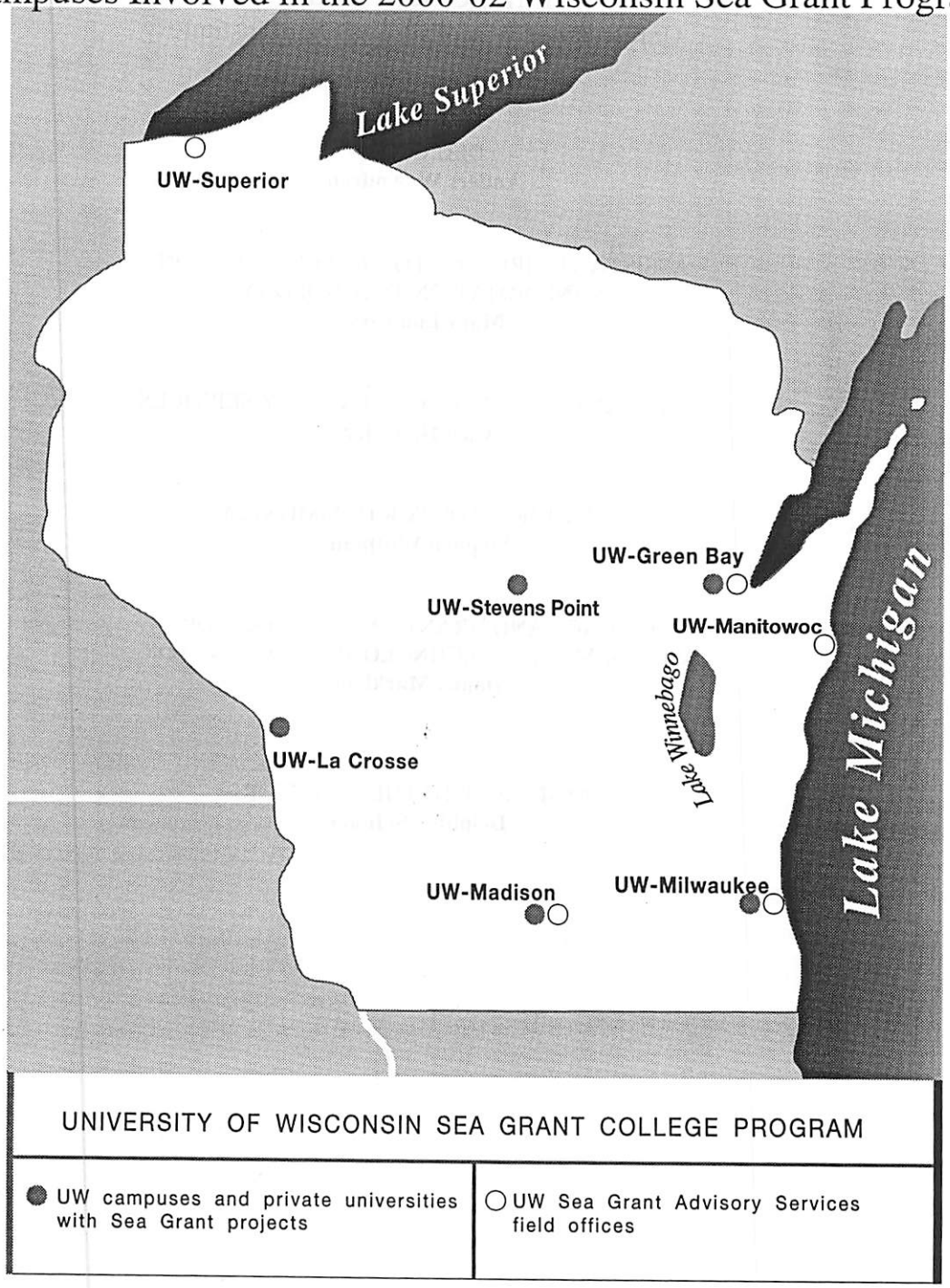
APPENDIX 8

Organizational Chart



APPENDIX 9

Campuses Involved in the 2000-02 Wisconsin Sea Grant Program



APPENDIX 10

Management Team
University of Wisconsin Sea Grant Institute

DIRECTOR
Anders W. Andren

ASSISTANT DIRECTOR FOR ADMINISTRATION
& INFORMATION TECHNOLOGY
Mary Lou Reeb

ASSISTANT DIRECTOR FOR ADVISORY SERVICES
Allen H. Miller

ASSISTANT DIRECTOR FOR COMMUNICATIONS
Stephen Wittman

FINANCE AND GRANTS ADMINISTRATOR
& INFORMATION TECHNOLOGY COORDINATOR
Daniel Marklein

ASSISTANT TO THE DIRECTOR
Delphine Skinner

APPENDIX 11

2000-2002 Omnibus Proposal Preparation Schedule

University of Wisconsin Sea Grant Institute

1998

October — Subprogram coordinators update long-range goal statements.

October 21 — Request for Proposals distributed.

December 1 — Deadline for submission of preproposals.

December 4-7 — Preproposals distributed to subprogram coordinators (coordinators contact thematic area leaders, if appropriate).

December 9-15 — Preproposal screening and selection meetings with subprogram coordinators, UW Sea Grant Advisory Council members and other invited guests.

December 16-21 — Principal investigators (PIs) notified of status of their preproposal(s). Invitations for full proposals and proposal submission guidelines sent to PI of selected preproposals.

1999

January 26 — Overview and question-and-answer meeting with potential PIs.

March 15 — Follow-up letter sent to potential new PIs requesting draft project summaries.

April 26 — Deadline for draft project summaries. Draft project summaries sent to NSGO.

May 3 — Draft project summaries sent to subprogram coordinators along with instructions for peer review, including sample cover letter and necessary forms (review/ranking, conflict of interest, etc.).

May 4 — Continuing Guidelines sent to PIs.

June 7 — Deadline for submission of new proposals.

June 10-11 — New proposals provided to subprogram coordinators.

June 11- August 18 — New proposals peer-reviewed.

August 2 — Deadline for submission of continuing proposals.

August 4 — Continuing proposals provided to appropriate subprogram coordinators.

September 13 — Peer reviews of new proposals and assessment of progress reports presented by subprogram coordinators to Sea Grant staff and Advisory Council members.

October 5-6 — Technical Review Panel meeting, including NSGO's Wisconsin program monitor, UW Sea Grant research subprogram coordinators and UW Sea Grant Advisory Council members.

October 11 — UW Sea Grant Advisory Council program review meeting.

Mid-October — Preliminary submission to NSGO – Director's Letter of Intent and list of project titles, PIs and affiliations.

Mid-October — Feedback period – Director notifies NSGO of modifications to omnibus proposal plan.

November — Acceptance letters with unofficial budgets and rejection letters sent to all PIs.

November 15 — Signed omnibus institutional proposal delivered to NSGO.

APPENDIX 12—Matrix of 2000-02 Projects and Thematic Areas

Thematic Area ☐	Lake Superior Initiative	Aquaculture for the Great Lakes Region	Chemical-Biological Interactions	Terrestrial-Aquatic Coupling	Safety at Sea	Toxics, Toxins and Pathogens	Application of Innovative Technology	Sustainable Fisheries	Special Outreach and Education
Living Resources	R/LR-77 R/LR-82 R/LR-83 R/LR-84**							R/LR-75	
Microcontaminants & Water Quality			R/MW-76			R/MW-80 R/MW-81 R/MW-82** R/MW-83**			
Policy Studies	R/PS-54							R/PS-55	
Estuarine & Coastal Processes				R/EC-6 R/EC-7					
Biotechnology			R/BT-12 R/BT-14						
Aquaculture		R/AQ-35 R/AQ-36**					R/AQ-34		
New Initiatives					R/NI-29 R/NI-30		R/NI-28		
Advisory Services		A/AS-44					A/AS-45		
Education									E/E-35
Communications									C/C-5

KEY TO MATRIX

*** = New Projects**

**** = If Sufficient Funding Becomes Available**

LIVING RESOURCES

R/LR-75 — Recruitment Mechanisms in Yellow Perch (*Perca flavescens*): Interactions among Growth, Condition and Predation (Binkowski)

R/LR-77 — Causes and Impediments of Lake Trout Recovery in Lake Superior (Hansen)

* **R/LR-82** — Dynamics of the Lake Superior Food Web (Kitchell)

* **R/LR-83** — Molecular Genetic Analysis of Lake Trout in Lake Superior and Richard's Reef, Lake Michigan (Phillips)

****R/LR-84** — Causes and Impediments of Lake Trout Recovery in Lake Superior (Hansen)

MICROCONTAMINANTS & WATER QUALITY

R/MW-76 — Impact of Contaminants on Sexual Development and Reproduction of Amphibians in Great Lakes Ecosystems (Karasov)

* **R/MW-80** — Speciation and Bioavailability of Metals in the Great Lakes Ecosystem (Armstrong)

* **R/MW-81** — Reproductive Toxicity of Methylmercury in Fish: Establishing the Relationship between Biomarkers and Reproductive Success (Sandheinrich/Rada)

** **R/MW-82** — Atmospheric Deposition of Water Soluble Compounds into Lake Michigan (Schauer)

** **R/MW-83** — Polybrominated Diphenyl Ethers: A Global Contaminant of Concern in the Great Lakes (Sonzogni) *(YR2, CAT2: if $ becomes avail.)*

POLICY STUDIES

* **R/PS-54** — Recreational Boating and Retirement on the Bayfield Peninsula of Lake Superior (Heberlein)

* **R/PS-55** — Combining Stated and Revealed Preference Data to Estimate the Economic Value of Recreational Salmon Fishing (Provencher/Bishop)

ESTUARINE & COASTAL PROCESSES

R/EC-6 — Net Heterotrophy/Autotrophy in Coastal and Offshore Lake Michigan (Cuhel/Klump/Aguilar)

* **R/EC-7** — Material Transformations through a Series of Linked Basins in a Great Lakes Land Margin Ecosystem (Klump/Waples)

BIOTECHNOLOGY

R/BT-12 — Developmental Toxicity of Dioxin in Zebrafish (Peterson/Heideman)

* **R/BT-14** — Determining the Roles of Multiple Forms of AhR and ARNT in Dioxin Toxicity in Rainbow Trout (Heideman/Peterson)

AQUACULTURE

R/AQ-34 — Use of Fish Oil for the Production of Nutraceuticals Containing Omega-3 and Conjugated Linoleic Acid Residues (Hill)

* **R/AQ-35** — Stress and Salmonid Fish: Role of Cortisol Metabolizing Enzymes (Barry/Malison)

** **R/AQ-36** — Production of Stress-Resistant, Domesticated Yellow Perch for Commercial Aquaculture (Malison)

NEW INITIATIVES

R/NI-28 — Erosion Information System in Support of Coastal Zone Management and Science (Scarpace/Vonderohe)

R/NI-29 — Prediction and Prevention of Stress Responses in Recreational Scuba Divers (Morgan)

* **R/NI-30** — Decompression Injury and Safety Recommendations in Scuba Diving (Dueland)

EDUCATION

* **E/E-35** — Recent Advances in Limnology and Oceanography Seminar (Brooks)

ADVISORY SERVICES

* **A/AS-44** – WATERS 2000: The Wisconsin Aquaculture Technology, Education and Research Service (Binkowski)

* **A/AS-45** — Applications of GIS to Coastal Zone Management: Enhancing Local Capacity (Ventura)

COMMUNICATIONS

* **C/C-5** — History beneath the Waves: Learning from Wisconsin's Shipwrecks (Gray/Karl)

NOT SHOWN (Support All Thematic Areas)

A/AS-1 — Advisory Services: Program Coordination and Field Offices — Madison Office (Miller – continuing)

C/C-1 — Communications Office and Subprogram Coordination
(Wittman – continuing)

C/C-2 — Earthwatch Public Service Radio Program (Hoops – continuing)

E/E-1 — Special Marine Education Programs (Reeb – continuing)

M/SGA-1 — Program Development (Andren – continuing)

M/SGA-2 — Program Management (Andren – continuing)

M/SGA-3 — Ship Time in Support of Sea Grant Research Projects (Andren – continuing