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Introduction

Welcome to Michigan Sea Grant! The Michigan Sea Grant College Program is a joint program of the University of Michigan and Michigan State University. Michigan Sea Grant supports research, outreach, and education to enhance the sustainable use of Great Lakes resources to benefit the economy, the environment, and quality of life.

The Michigan Setting

Sea Grant professionals collaborate with numerous partners to address some of the state's most pressing social, environmental and economic issues. Virtually surrounded by water, the State of Michigan has more than 3,000 miles of Great Lakes shoreline bordering its upper and lower peninsulas. The sheer length of coastline constitutes one of the State's greatest assets and greatest challenges. Rich in natural resources, ecological diversity and scenic beauty, the State's coastal zone is experiencing rapidly increasing population pressure. While tourism is an important industry, agriculture is also economically significant and dominates the southern portion of the state. Michigan is also known for its coastal urban centers including Detroit and Bay City, where impressive waterfront revitalization efforts are taking place.

Program Components

Within this context, Michigan Sea Grant's strategic issue areas include Sustainable Coastal Development, Aquatic Invasive Species, Anticipating Trophic Change, Coastal Wetlands and Great Lakes Education. To address these issues, the program has an annual budget of \$2.2 million (FY 03-04) from all sources including \$1.4 million in core funding, in addition to matching funds and national strategic initiatives. Michigan Sea Grant sponsors a competitive funding program open to researchers at all Michigan universities and colleges, supporting research related to its strategic issue areas. In the past few years, promising new investigators are beginning to yield important results and in many cases have fostered new partnerships and collaborations.

Michigan Sea Grant Outreach supports six extension agents strategically located in coastal communities across the state, who serve as liaisons between coastal resource users and the academic research community. In addition, communicators contribute to the Outreach program by distilling science-based information for key audiences. Michigan Sea Grant also supports formal K-16 and informal education programs. Recently, staff members have collaborated to enhance Great Lakes education with the purpose of expanding coverage and audience.

During the past five years, Michigan Sea Grant has undergone several significant staff changes that have improved overall program success. A new program director and two extension agents were hired in 2004; a new assistant director, communications director, and fiscal officer were hired in 2001; and a new webmaster/graphic designer was hired in 2000. New and veteran staff members worked together to develop a number of successful programs and products.

Organization of Briefing Book

This briefing book covers program impacts from 1999-2003 including several significant activities that occurred in early 2004. Specific actions taken since the program's last PAT are detailed on pages 1 and 2. This is followed by a comprehensive Program Overview covering performance indicators and a broad description of program components. Research, Outreach and Education impacts are presented in narrative form beginning on page 7. Projects are presented in the context of strategic plan focus areas, with the addition of several marine engineering research projects that were completed during the time period covered. Quantitative data is provided in the appendices.



Response to 1999 P.A.T.

Following is a brief overview of specific actions that have been taken in response to the recommendations of Michigan Sea Grant's program assessment in 1999. These actions are discussed in more detail throughout the briefing book. The complete text of the P.A.T. report is in Appendix I on the accompanying CD.

"Specific performance milestones in an implementation plan would provide a firmer basis for later evaluating how well the plan has been implemented... This should be made a future requirement."

- Michigan Sea Grant has developed two-year implementation plans with specific objectives and measurable actions to be achieved during the two-year period. Plans were developed for 1999-2001; 2001-2003; and 2003-2005. The 2005-2007 implementation plan for the new strategic plan is currently in development.

"We suggest that the program develop more and better partnerships with state and other agencies and leverage funds from a number of sources."

- Examples of Michigan Sea Grant's improved relationships with state agencies include collaboration with the state Office of the Great Lakes on AIS issues including AIS Awareness Week, partnering with the state Department of Environmental Quality's Environmental Science and Services Division and the Michigan Boating Industries Association on the Clean Marina Program, and working with Michigan Department of Natural Resources Fishery Division personnel in implementing the Great Lakes Fishery Leadership Institute. Other examples of partnership with state, federal and regional agencies and organizations can be found throughout the briefing book.
- Since 1999, Michigan Sea Grant has leveraged an additional \$900,000 in grants and other funds from state and federal agencies, regional organizations, private foundations and various business association partners to augment core federal and state funding. In addition, through the activities of our outreach personnel, an additional \$65,000,000 has been leveraged for our partners and stakeholders. Details on leveraged funding are available in Appendix E.

"Preproposal review should include outside advice. The right to submit a proposal, even if the preproposal gets a negative review, should be ensured."

- Pre-proposal panels since the last PAT have included state, federal and regional agency members as well as a Michigan Sea Grant extension agent. Researchers are free to submit a full proposal even if the panel does not recommend it; in 2003 one such researcher chose to submit a full proposal.

"Special effort should be made to acquaint other faculties outside the University of Michigan and Michigan State and non-marine faculties within the two universities with Sea Grant..."

- Michigan Sea Grant added the Vice President for Research from Michigan Technological University to the Policy Committee.
- Michigan Sea Grant developed a mailing list of Vice Presidents for Research and/or relevant Deans/ Department Heads at Michigan four-year universities. This group receives the biennial request for proposal notice as well as all requests for proposals from the National Sea Grant Office and is encouraged to forward it to potentially interested faculty at their respective institutions.
- Michigan Sea Grant co-sponsors a Great Lakes Day during Michigan State University's Agriculture and Natural Resources Week every year. This is an opportunity for Sea Grant to highlight the program with non-marine/ limnology faculty at Michigan State and other universities across the state.
- Michigan Sea Grant engaged faculty interested in Great Lakes issues at the University of Michigan including those from the School of Public Health, Taubman College of Architecture and Urban Planning, Ford School of Public Policy, the School of Natural Resources and Environment and the College of Literature, Science and the Arts. This effort has raised Sea Grant's profile within the University of Michigan and engaged the interest of outside faculty members in Sea Grant research opportunities.

"Further effort to work with State agencies and executive and legislative branches is encouraged."

- In addition to the partnerships with state agencies mentioned above, Michigan Sea Grant has been consulting with the state Coastal Zone Management Program and the U.S. Fish and Wildlife Service on specific management problems suited to integrated assessments.



- Michigan Sea Grant is integrating state and other agencies into the program through our requests for proposals and preproposals reviews.

- Management Team members have increased the frequency of meeting with state and federal legislators to solicit needs and update them on issues Sea Grant is addressing that will be helpful to their constituents.

“Potential funding by industrial and commercial entities should be examined as a means of leveraging the program.”

- Michigan Sea Grant has leveraged considerable industrial/commercial funding especially for the Greater Detroit American Heritage River Initiative. Please see Appendix E to review corporate sponsorship and Appendix F for a list of corporate partners.

“We recommend that Michigan Sea Grant explore locating a full-time Sea Grant Extension agent in central Detroit...”

- After the 1999 P.A.T. visit, extension agents Mark Breederland and Steve Stewart increased their programming in Detroit. Mark, in particular, through his position as chairman of the steering committee of the Greater Detroit American Heritage River Initiative demonstrated increased involvement in metropolitan Detroit issues. In early 2004, Mark moved to Traverse City, Michigan as the new northwest district agent, and the Detroit position was filled by Barry Murray.

“Michigan Sea Grant should increase the visibility of its social science work by listing these efforts as research projects, putting research objectives and core outcomes in research report form.”

- Michigan Sea Grant has made an additional effort to highlight research projects in the quarterly newsletter *upwellings*, the program annual report, one-page briefs developed for state and federal legislators, and the program Web site. This includes all relevant social science work, especially economic and policy studies.

“We recommend that Michigan Sea Grant establish an “Education” program at the equivalent level of Research, Extension and Communications...”

- The education initiatives outlined in strategic plan are now in alignment with NOAA-National Sea Grant education objectives, as well as the overarching goals of the National Sea Grant Education Network. See the Michigan Sea Grant Strategic Plan.

- In addition, Sea Grant educators have been collaborating with outreach professionals to expand the Great Lakes Education Program through a variety of educational initiatives, including:

- Applying existing experiential teaching to an adult education audience through Summer Discovery Cruises beginning in 2002. See: www.miseagrant.umich.edu/glep/index.html.
- Developing a new series of online education lessons based on existing Great Lakes Education Program curriculum, created by Sea Grant Education. This new project is funded by the Great Lakes Fishery Trust. (See page 24.)
- Funding from the Great Lakes Fishery Trust is supporting the work of a Ph.D. student in education to assist with the development of online aquatic science education content. This education specialist is focusing on enhancing and evaluating existing Great Lakes science curriculum to meet national and state education standards and benchmarks.

“We recommend that Michigan Sea Grant seek funds available from NOAA for ship operations.”

- The Great Lakes Education Program and Michigan Sea Grant researchers have received \$204,518 in ship-time support from NOAA since 2000.



Organization and Management

Leadership and Institutional Setting

Michigan Sea Grant (MSG) is a joint program of the University of Michigan (UM) and Michigan State University (MSU). Day-to-day operational decisions are made by a four-person Management Team (MT), which consists of two representatives each from the University of Michigan – Director (50%) and Assistant Director (80%) – and Michigan State University – Associate Director (20%) and Extension Program Leader (80%). MT meets monthly, among the two home institutions and with Sea Grant extension agents in their districts.

The Director is also Associate Dean for Research and Professor, School of Natural Resources and Environment (SNRE) at the University of Michigan and reports to the School's Dean. MSG-UM transferred to SNRE in 2002 from the Department of Naval Architecture and Marine Engineering, College of Engineering. This strategic move was part of the UM Office of the Vice President for Research Great Lakes Initiative to increase multidisciplinary interest in Great Lakes research, outreach and education among faculty and students.

The Associate Director is also chairperson of the Department of Fisheries and Wildlife, College of Agriculture and Natural Resources at Michigan State University and reports to the College's Dean. Michigan Sea Grant became a partnership between the two universities in 1977 to take advantage of MSU's experience in providing cooperative extension services to Michigan's communities.

Collectively, the MT provides intellectual leadership and strategic and operational direction to the program. In addition, team members have specific areas for which they are responsible. The Director provides oversight of the entire program, interacts with state and federal legislators, the UM School of Natural Resources and Environment, other UM schools and colleges, and other Michigan universities. The Associate Director works with the MSU Department of Fisheries and Wildlife and provides supervisory oversight for the MSU portion of the program. The Assistant Director provides oversight of the research and communications elements of the program, including the UM office. The Program Leader interfaces with the Michigan State University Extension Program and provides input to the Sea Grant agents' immediate supervisors, the regional extension directors. He also provides supervisory oversight of the MSU office.

In addition to management, MSG employs 17 full- and part-time staff members including eight extension agents and specialists, five communicators, a fiscal officer and administrative support staff. Communications and administrative staff are located at UM and MSU. Routine administrative activities are carried out at UM, and all grant funds are distributed, monitored and reported through the UM office. The majority of Communication activities also occur at UM, and the Communications Director is located in the UM office. MSG extension personnel are located in regional offices in six coastal communities across the state. Extension services are provided by MSU through a partnership with the university's Cooperative Extension Program. Some communication activities related to extension occur at the MSU office. The entire staff meets at least once a year, with meetings of smaller, project or issue-specific groups occurring frequently throughout the year. See Appendix A for a complete staff listing and organization chart.

Michigan Sea Grant MT receives strategic advice from a Policy Committee chaired by the Research Vice Presidents from UM and MSU and composed of senior university administrators including the Deans of MSG's administrative units; the Research Vice President from Michigan Technological University; the directors of federal, state and regional agencies and organizations; and representatives of private foundations and business. The Management Team meets with the Policy Committee at least twice yearly on a formal basis and informally with individual members of the committee throughout the year. See Appendix B for a list of policy committee members.

Project Selection

MSG operates on a two-year funding cycle during which four or five research projects are typically supported. MT determines research priorities for the coming cycle within the context of the program's strategic plan and knowledge gained through participation on regional bodies that support Great Lakes research. This collective knowledge is used to refine a Request for Pre-proposals (RFP) and it is issued in early spring to all academic institutions in the state via e-mail to research administrators, department chairs, and previously funded investigators, and through other relevant state and regional e-mail lists. The RFP is also posted on the Michigan Sea Grant Web site.

PROGRAM OVERVIEW

A local panel of state and federal agency personnel, a MSG extension agent and others familiar with state and regional Great Lakes priorities and the goals and objectives of MSG's Strategic Plan, is convened to screen the pre-proposals and recommend whether or not to invite full proposals. This screening is based on the proposals' relevance to the Strategic Plan, compliance with the RFP, and competency of the proposing team. Irrespective of the recommendation, all proposers are free to submit full proposals, which are due early in the summer.

Proposers suggest potential peer reviewers and MT identifies additional reviewers. Full proposals are mailed to peer reviewers (typically 4-6 reviewers per proposal, selected based on their relevant expertise); written reviews are due mid-summer. All peer reviewers are required to reveal potential conflicts of interest or sign a document indicating that they have none. The peer reviewers assess the proposal's rationale, scientific merit, and innovativeness, as well as the competency of the proposing team.

MT then identifies Review Panel members. The Review Panel, composed of subject matter experts not affiliated with UM, MSU or the proposing institutions, is convened in early September to discuss the proposals and peer reviews. Written peer reviews are compiled and mailed to Review Panel members with a lead reviewer assigned to each proposal. Review Panel members are also required to confirm that they have no conflict of interest. The Panel provides overall scores for each proposal, based on the same evaluation criteria used by the peer reviewers, and ranks them. MT receives this input and makes a final recommendation for funding, which is sent to the National Sea Grant Office for concurrence. Proposers are typically notified about project status in early October. See Appendix C for distribution of research among Michigan institutions.

Recruiting Talent

Michigan Sea Grant has made a special effort to reach out to new faculty members at home institutions and potential PIs across the state. Sea Grant's move to UM's School of Natural Resources and Environment helped to forge important links to additional UM faculty interested in Great Lakes research. With the financial support of the Office of the Vice President for Research (OVPR), Sea Grant launched a Great Lakes Initiative at UM in 2002 that included commissioning a series of white papers highlighting pressing Great Lakes issues, co-hosting a symposium in November 2002 and a Great Lakes Restoration workshop in September 2003 with SNRE, and providing over \$325,000 in seed funding for Great Lakes research at UM between 2002 and 2004.

At MSU, Michigan Sea Grant co-sponsors an annual Great Lakes conference highlighting a selection of current research. The conference is consistently well attended by MSU faculty, students, agency personnel and others from diverse institutions. In addition to these efforts, MSG encourages research proposals from academic institutions around the state. In the past five years, MSG has identified and funded new researchers at such institutions as Eastern Michigan University, Michigan Technological University, Kettering University and Lake Superior State. See Appendix D for a list of new principal investigators.

Integrated Program Components

Michigan Sea Grant has made significant strides in strengthening relationships with new and continuing researchers. Sea Grant extension staff regularly collaborate with researchers to apply their results to key issues faced by coastal communities around the state. One recent example is the use of marine engineering research to examine coastal conditions preceding rip currents. Sea Grant communications has also made special efforts to present funded research in a broader context via the program's Web site, newsletter and several research-focused fact sheets included on the accompanying CD. In addition to these activities, Michigan Sea Grant was instrumental in creating a joint Great Lakes Sea Grant Network-NOAA GLERL extension position filled by Rochelle Sturtevant. Sturtevant attends all MSG staff meetings and serves as a key link between Great Lakes Network Sea Grant extension agents and ongoing Great Lakes research, which she disseminates regularly to staff.

MSG has taken a number of additional steps to improve program integration among core staff members. Notably, management, extension and communications members attend all-staff meetings held at least annually to discuss priority issues and future work plans. MT has also instituted the practice of conducting meetings in agent districts to gain firsthand knowledge of important issues in those regions of the state. Recently MT implemented an all-staff reporting procedure to improve internal communication; staff members share significant monthly activities via email to keep others abreast of collaborations, newly formed partnerships, upcoming events and other key accomplishments. As a result of effective program integration, several new partnerships involving extension, communications and administration have resulted in notable impacts related to water safety and rip currents, the Michigan Clean Marina Program, Sea Grant's Great Lakes Fisheries Leadership Institute, and new educational initiatives. Highlights of these and other integrated projects appear throughout the briefing book. See Appendix E for distribution of core and matching funds among program areas, leveraged funding and national competition funding.

Connecting with Users

Engagement with Appropriate User Communities

Sea Grant staff members maintain ongoing relationships with stakeholders and frequently assist in organizing and leading conferences, workshops and informal educational events on a variety of topics. Highlights of these activities and their impacts appear in the Outreach section of the briefing book. In addition, Sea Grant management and outreach staff members serve in advisory and leadership capacities on state, regional and national organizations and initiatives. See Appendix F for a list of staff leadership positions.

This close relationship with stakeholders allows Sea Grant to identify and respond to issues of concern, often before they've become widely recognized. These emerging issues are highlighted in special sections within each outreach topic area. In many cases these activities, as illustrated by recent work to promote rip current awareness, have resulted in national collaborations and regional partnerships or led to newly funded projects.

Partnerships

Sea Grant staff members regularly collaborate with state and federal agencies, Tribal governments, citizen groups, education associations, coastal businesses and many others to leverage funding and accomplish program goals. See Appendix F for a complete list of Sea Grant partners and collaborators.

Long Range Planning

Strategic Plan Process and Quality

Michigan Sea Grant's most recent strategic planning process was comprehensive and indicative of the program's inclusiveness. Early in 2003, the MT created a strategic planning committee, comprised of two MT members, two extension agents, and two communicators representing both universities. The group used a phone survey of a focus group of key stakeholders to develop a facilitated staff retreat, the results of which were used in a series of stakeholder forums around the state. Based on input from these forums and the earlier survey and retreat, the committee prepared a draft plan for review by staff and the program's Policy Committee. After incorporating those comments, the committee circulated the plan for another internal review – to both staff and Policy Committee, and then an external review by forum attendees. The strategic planning committee considered and addressed all stakeholder comments and suggestions and presented the final copy to the Management Team for adoption.

Strategic planning forums held in 2003 were conducted in four Michigan locations including Macomb County, Lansing, Mackinaw City, and Grand Haven. With input from commercial and recreational fishing communities; K-12 educators; coastal businesses and municipalities; the port community; state, federal and tribal natural resource agencies; and public safety authorities, this strategic plan reflects the range of stakeholders with whom the program works to achieve sustainable coasts in Michigan.

Implementation Plan

To develop the program's implementation plan, Michigan Sea Grant convened an all-staff retreat in June 2004 to identify individual activities, goals and milestones related to each strategic plan topic. All staff members representing extension, communications, research, and administration contributed to the discussion and are equally invested in the final document. Special attention was given to activities that could be undertaken within the scope of the program's resources yet allow enough flexibility to respond to issues that may arise. The plan identifies short- and long-term benchmarks with consideration given to methods of evaluation to ensure ongoing success.

Producing Significant Results

Contributions to Science and Technology

Michigan Sea Grant funded a total of 43 research projects from 1999-2003. A complete list of research projects and principal investigators can be found in Appendix G. MSG-funded projects resulted in 113 publications and a U.S. patent for the Ballast Free Ship concept. See Appendix G for a complete list of published research. Additionally, principal investigators gave approximately 190 research presentations based on Sea Grant research.

Contributions to Education

Michigan Sea Grant has made significant contributions to enhancing environmental literacy and Great Lakes education through its support of student research and fellowship opportunities and targeted programs for K-12 students and teachers. Staff members have made concentrated efforts to improve curriculum development and implementation, engage traditionally underrepresented groups and explore new technologies and methods of delivering science-based content to increasingly diverse audiences.

PROGRAM OVERVIEW

Graduate and Undergraduate Education

Student education is a critical part of the Sea Grant mission. In the past five years, Michigan Sea Grant supported 84 undergraduate students and 82 graduate students who have played an integral role in Sea Grant research. Students work in many disciplines, among them fisheries biology, statistical modeling, resource economics, microbiology and decision analysis. In the period from 1999-2003, student research assistants completed 23 theses and dissertations based on their Sea Grant experiences. See Appendix H.

Fellowships

Michigan Sea Grant supported seven student fellows in the past five years including five students who earned Sea Grant Knauss Marine Policy Fellowships. Former Sea Grant Knauss Fellows are now employed in influential positions including a senior policy analyst for the Northeast-Midwest Institute (Hance), a NOAA Fisheries Policy Advisor (Lindow), an environmental legislative assistant for California Senator Barbara Boxer (Cimo), a project assistant for National Sea Grant (Agy) and majority staff for the Senate Subcommittee on Oceans, Fisheries and Coast Guard (Lynch). See Appendix H.

Sponsorship of Education Programs and Target Audiences

Michigan Sea Grant sponsors a number of award-winning educational programs geared toward K-12 students and teachers. Staff members have also recently begun to explore new partnerships and methods of content delivery that have resulted in new projects and funding. Environmental educator Anna Switzer, a University of Michigan Ph.D. student, joined the Sea Grant staff on a part-time basis in 2003 to assist in educational content development and programming.

Contributions to Outreach

Michigan Sea Grant outreach professionals include six extension agents located in coastal communities, an extension specialist at MSU, a Great Lakes Sea Grant Network agent located in Ann Arbor, and five communicators located at the UM and MSU. Outreach professionals play a critical role in providing science-based information and assistance to help Michigan constituents address economic, management and environmental challenges.

Michigan Sea Grant extension agents help connect NOAA with public agencies, natural resource managers, coastal businesses, non-government organizations and other stakeholders. Staff members form partnerships with public agencies, natural resource managers and coastal businesses; participate in state, regional and national Great Lakes initiatives; provide leadership on state,

regional and national task forces, boards, panels, and committees; conduct workshops and seminars to provide better access to Great Lakes information; and support formal and informal education programs to enhance life-long learning about the Great Lakes.

Michigan Sea Grant communications specialists support the program's research, extension, and education efforts. Communicators develop and distribute print and Web-based materials that have increased overall awareness of the program at local, regional and national levels. Staff leadership over the past five years has resulted in many programmatic accomplishments and impacts, including:

- Redesign of the program Web site, which is now relied upon by all program staff as a way to reach constituents.
- Redesign of the program newsletter, *upwellings*, distributed to more than 3,000 people quarterly.
- New publishing partnerships, including collaboration with the University of Michigan Press.
- Nationwide collaboration and distribution of materials. From 1999 to 2003, Communications distributed 105,000 publications and products.
- Media coverage of Sea Grant program activities and Great Lakes issues, including a Michigan Sea Grant article in UM's *Michigan Alumnus* magazine reaching 100,000 subscribers.

Evaluation of Programs and Products

Michigan Sea Grant employs a variety of methods to ensure that programs and products meet high quality standards. Extension staff members conduct follow-up surveys of conferences and other events coordinated on behalf of Sea Grant to evaluate effectiveness and identify future improvements. For communications products, staff members identify experts to review technical content and conduct reader surveys as appropriate. Communicators also participate in conferences and trade shows, such as the Michigan Science Teachers Association, that offer opportunities to network with Michigan educators and others who use Sea Grant products. Entering products in critique and award competitions also yields valuable product feedback.

Together, extension, communications and administration have produced 118 products and contributed to the production of an additional 50. See Appendix H for a list of outreach products followed by awards for Sea Grant products and programs.

Research

Aquatic Invasive Species

More than 160 aquatic invasive species (AIS) now inhabit the Great Lakes and some, such as zebra mussels, have caused profound ecological changes. Most AIS arrive from foreign ports, harbored in the ballast tanks of ocean-going vessels. Sea Grant research has examined ways to limit the introduction of AIS via ballast water as well as reduce the impacts of existing AIS species.

Ballast Water Treatment and Management

University of Michigan marine engineer Michael Parsons employed Computational Fluid Dynamics to demonstrate that certain areas of ballast tanks experience a low flow of new ballast water during the high-seas ballast exchange process, limiting effectiveness in flushing biological life. Results show that removal of old ballast water can be improved by key structural modifications, among them proper placement of the tank filling connections and vents. In another project led by Parsons, research results guided the system design, planning and testing of primary ballast water treatment devices designed to filter aquatic invasive species. Results were used in test installations in 2001 by the Great Lakes Ballast Technology Demonstration Project, which tested the first, large-scale water filtration system for controlling exotic species on a fully operational ship.

In a third project, Parsons developed a new ship design that would eliminate the need to transport ballast water. The ballast-free ship design concept replaces ballast tanks with a series of slow-flow ballast tubes, or trunks. When a ship carries no cargo, the structural tubes are opened to the sea, and flooding lowers the ship to its required draft. The constant flow ensures that the ballast trunks are always filled with local water. Results of the research have international implications and could lead to a new ship design that provides improved environmental protection and long-term economic savings. A U.S. patent has been granted for the Ballast-Free Ship System.

Controlling AIS from a Policy Perspective

Researchers led by natural resource economists Richard Horan and Frank Lupi of Michigan State University investigated and assessed several economic methods, or policy options, that may be used to prevent and control the introduction of aquatic invasive species. Examples of policy options include economic incentives, technology



Vessels from foreign ports are a major vector of AIS introduction into the Great Lakes.

regulations, and market-based systems. Results of a quantitative model incorporating these alternative ballast water management options demonstrate how flexible, market-based policies can significantly reduce industry-wide ballast management costs, which differ substantially across vessels. The research recommends cost-effective ways that policy makers can use economic incentives to achieve greater environmental risk reductions. The project has drawn the attention of several groups of economists and ecologists working on AIS issues, as well as policy makers at the U.S. Dept. of Agriculture, who have invited presentations by the principal investigators.

Understanding the Influence of Zebra Mussels and Toxic Cyanobacterial Blooms

Research led by Orlando Sarnelle of Michigan State University shows that lakes colonized by zebra mussels have, on average, three times higher levels of a species of blue-green algae known as *Microcystis*. Those same lakes also have about twice the level of microcystins, a toxin produced by the algae. Initially, investigators collected water samples from nearly 100 inland lakes in Michigan's Lower Peninsula, ranging from Benzie County in the northwest to Oakland County in the southeast, with established zebra mussel populations. Follow-up experiments by Sarnelle and colleagues in west Michigan's Gull Lake showed that zebra mussels are indeed the cause of the increase in toxic algae. There have been documented cases in which animals, including cattle and dogs, died after drinking water with high levels of microcystins. The toxin is also believed to be responsible for liver damage in humans.

PROGRAM ACCOMPLISHMENTS AND IMPACTS

Coastal Wetlands

Great Lakes coastal marshes are ecologically rich and productive, and provide support for various life stages of commercially and recreationally important fish species. Yet development, invasive species and undervaluation of these special habitats continue to threaten remaining Great Lakes wetlands.

Effects of Great Lakes Marsh Fragmentation on Fish Assemblages

One of the earliest and greatest impacts of shoreline development is marsh fragmentation, resulting in loss of fisheries habitat and isolation of core marsh areas. In this study, University of Michigan researchers Paul Webb and Jim Diana measured the effects of fragmentation on marsh fish communities in northern Michigan's Les Cheneaux islands. The research has contributed to an understanding of the magnitude of human impacts on coastal wetlands; this knowledge is essential for developing guidelines that minimize human impacts and guide restoration.

The research continues a program designed to help community residents monitor their own environs. It will also assist local decision-makers in progressing toward sustainable development and minimizing human impact on fish diversity and abundance. Previously, the researchers designed a fish-based monitoring program for the Nature Conservancy. The results of the current project will be integrated with earlier work and presented to community members concerned with natural resource management in Les Cheneaux. These include the Nature Conservancy, Les Cheneaux Watershed Project, and The Economic Forum Natural Resources Task Force.



Les Cheneaux, Michigan

Estimating Nonmarket Values of Coastal Wetlands

This research has strong implications for coastal wetlands protection policy in Michigan and other Great Lakes states. Using qualitative methods involving focus groups and a scientific advisory panel, a multidisciplinary team of researchers developed a survey following an experimental design (or choice experiment) mailed to a statewide

sample of 3,000 Michigan residents. Respondents evaluated ecological wetland services including biodiversity, open space, improved water quality, fish habitat, waterfowl habitat and non-game species habitat. Economic analyses will allow the researchers to identify priority wetland characteristics, estimate "willingness to pay," and provide a sense of preferred implementation methods for coastal wetland protection programs.

Sedimentation and Emergent Plant Decay

In a project led by Robert Neely of Eastern Michigan University and Robert Sinsabaugh of the University of Toledo, researchers studied the impact of sedimentation on coastal wetland processes. By monitoring experimental study units at two Lake Erie wetlands located at Winous Point in northern Ohio and Lake Erie Metropark in southeast Michigan, investigators assembled the first complete study of algal, fungal and bacterial dynamics on decomposing plant litter. The project raised many questions regarding microbial processes and the rate of decomposition in different types of coastal wetlands influenced by differing hydrological conditions. The project is part of a larger research agenda to study plant decay, microbial community dynamics, and sedimentation in wetlands. Sea Grant funding has led to additional support from the National Science Foundation to investigate the exact mechanism that affects specific types of decomposition—a project that now supports five graduate students and a cohort of undergraduate students.

Habitat Restoration During Biological Control of Purple Loosestrife

Since 1997, Sea Grant has supported biological control efforts to reduce purple loosestrife, an invasive plant that dominates many Michigan wetlands. Follow-up research led by Gregory Zimmerman of Lake Superior State University employed a combination of greenhouse studies and field observations to document changes in plant community composition. They found that biocontrol of purple loosestrife using *Galerucella* beetles, the plant's natural enemy, is effective in reducing purple loosestrife density and results in an increased abundance of native plants. Further, they showed that competition exists between purple loosestrife and cattails for nitrogen and concluded that purple loosestrife's relatively greater root:shoot ratio allows it to scavenge nitrogen more effectively. Finally, investigators found that leaf perforation caused by *Galerucella* beetles decreases loosestrife's ability to regulate water, leading to desiccation. Investigators have given research presentations to several groups in Michigan's upper peninsula, and the project has resulted in a partnership

PROGRAM ACCOMPLISHMENTS AND IMPACTS



“We now have the first clear evidence that the number of plant species increases when purple loosestrife is reduced. It’s a very slow transition from a plant community dominated by loosestrife to one that is much more diverse, with as many as 15 other plants in a given square meter.”

Doug Landis, Michigan State University

with Ducks Unlimited Canada and the Ontario Ministry of Natural Resources for biocontrol of purple loosestrife along the St. Marys River in Sault, Ontario.

A related study, supported in part by Sea Grant and led by entomologist Doug Landis of Michigan State University, also confirms that biological control using *Galerucella* beetles is an effective means of controlling purple loosestrife. The beetles have established large populations in three mid-Michigan locations and caused 100 percent defoliation of loosestrife in monitored sites. The research confirms that native plant communities re-establish after purple loosestrife density is reduced.

Fisheries Management

Fishery managers rely on accurate and timely estimates of fish populations to make sound decisions that regulate stocking and harvest allocation. Sea Grant fisheries research has developed state-of-the-art predictive models that demonstrate the response of fish populations to environmental variability and alternative management scenarios. Combined with Sea Grant research on fisheries recruitment, the models have helped explain variability in fish population demographics and the controlling factors, all of which contribute to more effective ecosystem management.

Application of Decision Analysis to Great Lakes Fishery Management

Researchers led by Michael Jones of Michigan State University employed decision analysis techniques to refine fisheries management on a regional level through better consideration of the effects of uncertainty. Researchers developed and presented decision analysis models for two case studies that addressed sea lamprey control in the St. Marys River and salmonine stocking in Lake Michigan. Results affected management decisions and strategic thinking of the participating agencies. Notably, the sea lamprey case study provided pivotal information to the Great Lakes Fishery Commission’s planning for future lamprey control on the St. Mary’s River and may influence barrier planning and stream selection. Project researchers are also working with the Lake Erie Committee on decision

analysis for walleye management and have provided advice to managers with the Ontario Ministry of Natural Resources for management issues on Lakes Huron and Ontario.

Developing and Communicating Improved Methods of Fish Stock Assessment

Michigan Sea Grant funding to Jim Bence of Michigan State University has had a positive impact on the management of lake trout and lake whitefish stocks in Great Lakes waters governed by a 2000 Consent Decree involving state, federal and tribal agencies. This area of the Great Lakes constitutes a large portion of Michigan’s waters of lakes Michigan, Huron, and Superior. Bence’s Sea Grant funded project on stock assessment methods began as he helped the participating agencies finalize stock assessment models used during the consent decree negotiations. Ideas that Bence formulated in planning his Sea Grant work were used in constructing these assessment models. Additionally, Sea Grant funding sponsored two short courses on stock assessment methods that were heavily attended by agency fishery biologists charged with ongoing stock assessments in treaty waters. Finally, Bence’s research on the performance of stock assessment methods has led to specific recommendations and modifications of these methods in treaty waters.

Managing the Lake Michigan Salmonine Fishery

These studies, led by Jim Bence of Michigan State University, formed the basis of fish community models that were used to adjust salmon and trout stocking policies in Lakes Michigan and Huron, leading to a 20 percent reduction in stocking of both species. The research has helped fisheries managers better understand the collapse of the Chinook salmon fishery in the late 1980s in relation to prey fish abundance. Changes in stocking based on the research have altered prey fish abundances and reduced the risk of a Chinook salmon die-off. Investigators contributed directly to analyses supporting stocking decisions and participated in public and agency meetings leading to these decisions, providing a critical underpinning for models used to make stocking decisions.

PROGRAM ACCOMPLISHMENTS AND IMPACTS



Sea Grant researcher David Jude was part of team of five scientists who discovered tumor-like lesions on zooplankton (copepods and water fleas), collected as part of research supported by Sea Grant and NOAA's Great Lakes Environmental Research Laboratory. This was the first time photographs had been taken of such abnormalities. After initial concern, subsequent analysis of the tumors confirmed that the lesions were herniations and not cancerous.

Recruitment Failure of Yellow Perch in Southeast Lake Michigan

Research led by University of Michigan fisheries biologist David Jude contributed to an understanding of the factors controlling yellow perch recruitment in southern Lake Michigan. The research was part of a dual project co-funded by Illinois-Indiana Sea Grant and also part of a consortium of 20 to 30 yellow perch researchers—the Yellow Perch Task Group—brought together under the auspices of the Great Lakes Fishery Commission. Work by the Yellow Perch Task Group helped expose the yellow perch recruitment problem, which subsequently led to the closing of three commercial fisheries in the 1990s and a reduction of sport fishing catch in all states. A manuscript detailing the work of the task group is currently in review by *Fisheries* magazine.



Physical and Biological Processes Influencing the Recruitment of Walleye

This research led by Dan Hayes of Michigan State University advanced the management of Lake Erie walleye, a popular sport fish that supports an estimated \$1 million recreational fishery in Michigan alone. The research identified many of the key environmental processes and conditions affecting recruitment of walleye and year-class development. This work also helped to identify critical spawning and nursery areas for Western Basin Lake Erie walleye. The research provided a scientific basis for protecting these areas, and data is being used by the Lake Erie Technical Committee and the Ohio Division of Wildlife for management purposes.

Anticipating Trophic Change

The measurement of primary production, or trophic state, continues to change as the Great Lakes respond to natural and anthropogenic factors such as polluted runoff, urbanization and climate change. Understanding the factors that control trophic change helps scientists understand the impact on the aquatic food web and influences fisheries management.

Evaluating the Trophic State of Lakes Michigan and Superior

Researchers led by Nathaniel Ostrom of Michigan State University applied a new approach for evaluating the trophic state of lakes Michigan and Superior based on the concentration and isotopic composition of oxygen. The research resulted in a detailed database of changes in the trophic state as measured by the ratio of respiration to photosynthesis and provides an important benchmark for measuring improved water quality.

With funding from the U.S. Environmental Protection Agency, Great Lakes National Program Office, the research has been extended to Lake Erie. The work is part of the Lake Erie Trophic Status project to understand the ecosystem's response to recent, dramatic changes in food web structure and composition. The combined data sets from Lake Erie, Lake Superior and Grand Traverse Bay (Lake Michigan) offer a unique perspective on the factors controlling primary production and respiration across the entire Great Lakes and for anticipating the response of the Great Lakes ecosystem to phenomena such as bioinvasions and climate change.

Ecosystem Mosaics: Modeling Pattern and Process Using Remotely Sensed Imagery

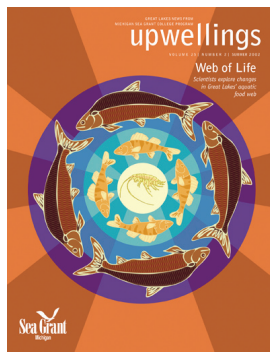
Using satellite-derived water parameters, researchers at Michigan Technological University led by Judy Wells Budd have enhanced our understanding of physical and biological processes influencing the Great Lakes. Researchers used eight years of monthly image maps showing chlorophyll and sediment variability to analyze the general annual thermal cycle of the Great Lakes. The work resulted in quantitative, basin-wide analyses of important climate parameters for each of the lakes. This is the first time these quantitative climatologies have been applied to a freshwater system.

Throughout the project, principal investigators have worked closely with scientists from NOAA-GLERL and Woods Hole Oceanographic Institute. The work has resulted in a new partnership with University of Minnesota scientists to examine the dissolved organic carbon demand of heterotrophic bacteria, which could play a significant role in climate change projections of increased surface water temperatures.

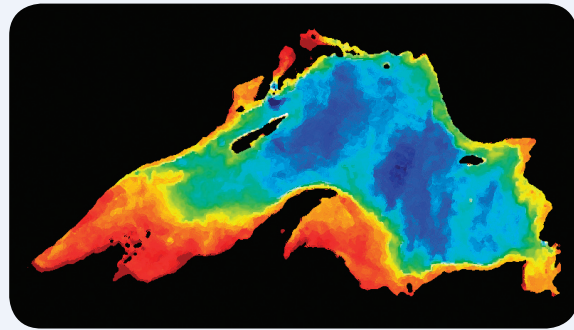
Food Web Disruption Partnership

Michigan Sea Grant was instrumental in developing a research partnership to investigate the role of four aquatic invasive species—zebra mussels, quagga mussels, spiny water flea, and fish hook flea—in food web disruption.

The Great Lakes Sea Grant Network, the Great Lakes Fishery Trust and the Great Lakes Fishery Commission formed the partnership in October 2001. The partnership enables the groups to prioritize funding, coordinate research and enhance the effectiveness of individual research projects. Michigan Sea Grant helped organize a special session at the International Association of Great Lakes Research conference in 2003.



The Summer 2002 issue of upwellings highlighted significant ecological effects of changing food web dynamics on Great Lakes fisheries, potential causes and current research.



NOAA Collaborations

Sea Grant researchers have worked extensively with the NOAA-sponsored KITES (Keweenaw Interdisciplinary Transport Experiment in Superior) project in Lake Superior and EEGLE (Episodic Events-Great Lakes Experiment) project in southern Lake Michigan.

Ostrom's Sea Grant project results have been used by the KITES team to help understand the importance of coastal currents in the transport of materials from nearshore to offshore and the impact of this transport on biogeochemical processes.

Budd's research team, integrated with both KITES and EEGLE, documented the incidence, magnitude and persistence of episodic resuspension events (sediment plumes). Model results reveal a significant impact of suspended sediment in southern Lake Michigan, indicating that plume-released nutrients play an essential role in maintaining nutrient levels in the lake.



"This [food web] partnership is a critical step in our efforts to understand how non-native species are currently disrupting food webs and what these food webs are likely to look like in the future."

Bernard Hansen, Commissioner and former Chair, Great Lakes Fishery Commission

Coastal Processes and Ecosystem Monitoring

An Environmental Monitoring System for Lake St. Clair

Elevated bacterial levels in Lake St. Clair have led to frequent closings of popular beaches in Southeast Michigan. With assistance from NOAA-GLERL, researchers led by marine engineer Guy Meadows of the University of Michigan developed a high resolution, numerical model to predict water quality conditions in Lake St. Clair and to aid local officials in predicting beach closures. Using advanced data collection and remote sensing technology, the system provided timely and accurate predictions of nearshore water quality conditions and potential threats to human health. The system was used as a management tool by local agencies, and automated buoy data was made available to the general public via Web site. The methods, approach and monitoring network used in Lake St. Clair are transferrable to other areas in the Great Lakes affected by beach closures.



Researchers deploy an automated meteorological buoy in Lake St. Clair, one of the components of an environmental monitoring network developed by UM researcher Guy Meadows.

The Relationship Between Great Lakes Water Levels, Wave Energies and Shoreline Damage

Storm damage along Great Lakes coastlines is a serious concern during periods of rising and sustained high lake levels as seen in the early 1970s and mid 1980s. Researchers led by Meadows explored the link between periods of high water in the Great Lakes and coastal storm damage. Building on earlier work, researchers assembled and analyzed data on climate, water and wave conditions, drawing upon an additional decade of data collected from the National Data Buoy Center wave measurement program. The results of this study have enhanced understanding of the processes by which lake levels and waves combine to impact our coastlines, providing management tools for coastal resource policy.

Researchers also delineated the significance of a shift in wave pattern on the impact of large harbor structures in Lake Michigan. These results have influenced federal policy. Evaluation of water level and wave set-up at two sites has shown a significant correlation to erosion events. Results have been incorporated into the U.S. Army Corps of Engineers' Lake Michigan Potential Damages Study and used by the Michigan Department of Environmental Quality Shorelands Management Division to help manage coastal resources.

Study of Grand Marais Harbor: A Natural Harbor Refuge

Researchers led by Meadows undertook a study of Grand Marais Harbor in Michigan's Upper Peninsula to gauge the extent of shoaling and erosion in the federally designated harbor of refuge that once accommodated commercial vessels. The study provided local officials and residents with estimates of the scope and extent of effort required to restore the Lake Superior harbor to a functional, stable and environmentally balanced state. Recommendations based on the research included an evaluation of the quantities of sediment to be relocated, recommended structural alterations, long-term predictions of shoreline change, impact of significant storm events on the harbor and estimated long-term maintenance costs.

Outreach

Aquatic Invasive (Nuisance) Species

Using research-based information, Michigan Sea Grant Outreach focuses on reducing the impact of aquatic invasive species through partnerships with federal and state agencies and non-government organizations. The program leads the state and the region in public awareness and education about invasive species such as zebra mussels, sea lamprey and purple loosestrife. Sea Grant outreach experts also contribute to the development of state and regional management plans, and have helped to educate many state and federal legislators about critical invasive species issues.

Controlling the spread of Aquatic Invasive Species

Aquaculture, hatchery and baitfish harvesting and transport industries have been identified as vectors for spreading aquatic invasive species. Michigan Sea Grant extension agents collaborated with colleagues at Minnesota Sea Grant to develop and lead invasive species/HACCP (Hazard Analysis and Critical Control Point) education programs across the country. As a result of Sea Grant training, more than 200 state, federal and tribal hatchery managers, private baitfish and aquaculture producers, and veterinarians from 15 states are developing invasive species/HACCP plans to use at their facilities. The U.S. Fish and Wildlife Service is now using the procedures in National Wildlife Refuges and other regional programs to minimize the spread of invasive species.

Zebra Mussel Monitoring Program

Michigan Sea Grant, in partnership with state agencies and Michigan Lake and Stream Associations, has been tracking the movement of zebra mussels in Michigan's inland waters since 1992. Cumulative data from citizen volunteers shows that zebra mussels have spread to at least 180 of Michigan's inland lakes. Sea Grant's online database of lakes monitored has been incorporated into regional and national databases. See: www.miseagrant.umich.edu/ans/lakes.html The data helps keep resource managers, policy makers and the public abreast of colonized lakes and helps increase scientists' knowledge and understanding of how and why invading organisms spread. Sea Grant news releases announcing annual monitoring results receive statewide media attention to raise awareness of aquatic invasive species and what can be done. Collaboration with *Michigan Riparian* magazine resulted in a comprehensive article in 1999 that reached 10,000 subscribers.



Getting the Word Out Locally, Regionally and Nationally

Sea Grant Communications works with partners to produce and promote educational materials to help general audiences understand the problem of aquatic invasive species (AIS). As part of Sea Grant's statewide AIS outreach effort, the communications team has worked with extension agents, state agency partners and non-profit organizations to distribute more than 35,000 publications, fact sheets, brochures and AIS identification cards, from 1999-2004.

Sea Grant communicators Joyce Daniels and Dave Brenner developed new AIS content and photos featuring 11 of the most harmful invasive species in the Great Lakes, published on the Michigan Sea Grant Web site. See: www.miseagrant.umich.edu/ans. This site was featured as a key resource by the Michigan Office of the Great Lakes in 2004 when Sea Grant communications collaborated with the Office of Great Lakes to plan and promote the state's officially designated AIS Awareness Week.

Sea Grant graphic designer Dave Brenner developed illustrations for National Sea Grant's America's Most Unwanted poster, distributed nationwide. In addition, Sea Grant communications developed a valuable digital archive of invasive species photos and graphics that have been used in hundreds of publications, presentations and displays throughout the country.

PROGRAM ACCOMPLISHMENTS AND IMPACTS

Emerging Issue: Rapid Response Plan for Hydrilla

Sea Grant is collaborating with a Michigan State University (MSU) inland lake specialist and the Michigan Office of the Great Lakes, to raise awareness of the potential for spread of invasive Hydrilla (*Hydrilla verticillata*) to Michigan waterways. The plant has clogged waterways in many southern states and has recently been identified in Pennsylvania, Massachusetts and Maine. As a result of Sea Grant collaboration, Michigan's governor-appointed Aquatic Nuisance Species Council organized a Hydrilla Task Force, which developed the state's first aquatic invasive species rapid response plan. The plan serves as a case study for the region and for the Great Lakes Panel on Aquatic Nuisance Species, in a project funded by the U.S. Environmental Protection Agency's Great Lakes National Program Office. The Great Lakes Panel is in the process of developing a model rapid response plan for use by all Great Lakes states. Michigan Sea Grant representatives on the Hydrilla Task Force have developed a volunteer Hydrilla Hunt program to enlist citizen participation in detecting this invasive plant before it gains a foothold in the state's waterways.

areas are increasingly threatened by shoreline development practices, and policies. Sea Grant outreach educates the public as well as regulatory agencies, and local decision-makers about the value and diversity of these dynamic coastal habitats.

Wetlands Education

Sea Grant extension agent Walter Hoagman produced the first comprehensive guide to Great Lakes wetlands in Fall 1998, with funds from Michigan's Coastal Zone Management Program. *Great Lakes Wetlands: A Field Guide* describes the primary characteristics of seven types of coastal wetlands and includes an illustrated guide to common wetland plants. Over the past five years, Sea Grant has distributed nearly 3,000 copies of the wetlands guide. Hoagman also collaborated to produce several educational wetlands displays at the Saginaw Bay Visitor Center in Bay City. The Center is one of the state's most important wetland education sites and is visited by more than 50,000 students annually.

Coastal Wetlands

Coastal wetlands are a vital component of a healthy Great Lakes ecosystem. They form a buffer between land and water and provide important ecological services including improved water quality, fish and wildlife habitat, and erosion control. Despite their value, these sensitive coastal

Wetlands on the Web

Drawing upon content from the wetlands field guide, Sea Grant Communications worked with Hoagman to create Web pages devoted to Great Lakes coastal wetlands. See: www.miseagrant.umich.edu/wetlands. The pages receive an average of 3,000 hits annually.

Sea Grant Communications produced an issue of upwellings in 2002 devoted to Michigan's coastal wetlands. Including a full color poster insert, the issue was distributed to 3,000 educators, natural resource managers and legislators.

PROGRAM ACCOMPLISHMENTS AND IMPACTS

Purple Loosestrife Project

Invasive plants threaten the biodiversity and function of Michigan's inland and Great Lakes coastal wetlands. In 1997, Sea Grant collaborated with MSU colleagues to create a biological control and education program to reduce density of invasive purple loosestrife. The project helped establish a network of Cooperative Biological Control Centers throughout Michigan to rear *Galerucella* beetles, the plant's natural enemy. Project participants and volunteers have released the beetles in 11 major watersheds.

Published research confirms that *Galerucella* beetles have effectively controlled loosestrife within several miles of early beetle release sites, and native wetland vegetation is beginning to re-emerge. Through annual workshops and special presentations, Sea Grant has trained dozens of naturalists, state agency personnel, more than 200 classroom teachers, and 24 volunteer leaders in biological control techniques. An estimated 4,000 students have participated in the project by releasing the beetles and conducting site monitoring.



Sea Grant has also collaborated to produce numerous outreach materials related to purple loosestrife including student and adult curriculum guides, informational brochures and a Purple Pages Web site. See: www.miseagrant.umich.edu/pp. News releases about purple loosestrife have resulted in nearly 40 newspaper and magazine articles, television broadcasts including CNN and radio interviews to raise awareness of invasive species.

Emerging Issue: Wetland Growth along Great Lakes Shorelines

Consecutive years of low water levels have allowed wetland vegetation to thrive along some Great Lakes shorelines. Desire to manage the new growth prompted many shoreline property owners in the Saginaw Bay and Grand Traverse Bay regions to clash with the state and federal regulatory agencies over maintenance of Great Lakes bottomlands. Sea Grant communications highlighted the situation in the Fall 2002 issue of *upwellings*, which helped establish contact with regulatory agencies. As a result, Sea Grant co-facilitated a multi-party Shoreline Task Force in 2003 with Michigan State University Extension. The task force developed a consensus document that identifies opportunities to allow shoreline property owners to access and enjoy their waterfront while maintaining the ecological value of the new wetland areas around the state.

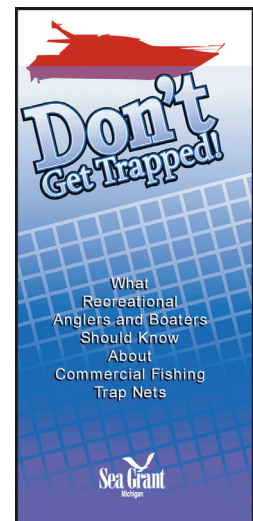
A set of recommendations was directed to pertinent regulatory agencies, including the U.S. Army Corps of Engineers and Michigan Department of Environmental Quality among others, and identifies inconsistencies in the permitting processes governing shoreline activities. In part a result of task force work, the Corps developed a regional permit, now in place for Michigan, and simplified its permitting process. More than 300 residential property owners took advantage of the new one-page permit in 2003.

Fisheries

Michigan Sea Grant provides local, regional and national leadership in fisheries outreach. Associate director William Taylor is an alternate commissioner to the Great Lakes Fishery Commission. Sea Grant Extension agent Chuck Pistis is a gubernatorially appointed advisor to the Commission. Sea Grant Extension agents are also members of the Michigan Department of Natural Resources' advisory committees on lakes Superior, Michigan, Huron and St. Clair-Erie. Sea Grant Communications has provided support for a number of fisheries workshops, events and the development of outreach products.

Treaty Fishing Consent Decree Education

A Consent Decree, adopted in 2000, allows trap nets in some new areas of the Great Lakes. To educate recreational boaters and others about how to recognize and avoid the nets, Michigan Sea Grant worked with state and tribal partners to publish the brochure *Don't Get Trapped!* and subsequently distributed more than 25,000 copies. The brochure and related Web site, *Know Your Nets*, illustrates the nets and provides instructions on ways to avoid becoming entangled. See: www.miseagrant.umich.edu/nets/index.html. Sea Grant has also played an informal mediation role. As a result of Sea Grant consultations with the Ludington Charter Boat Association, native commercial fishers from the Little River Band relocated their trap nets to less heavily fished waters further south to minimize conflict with recreational anglers.



PROGRAM ACCOMPLISHMENTS AND IMPACTS

A New Generation of Fishery Leaders: Great Lakes Fisheries Leadership Institute

Leaders of fishery organizations play an integral role in fisheries management by interacting with resource managers and serving as liaisons to citizen stakeholders. To enhance the education and leadership of this important group, Michigan Sea Grant led the Great Lakes Sea Grant Network in developing, coordinating and implementing Great Lakes Fisheries Leadership Institute in 2003. The institute was implemented in cooperation with multiple federal and state partners and funded by two grants from NOAA-National Sea Grant.

“The workshop provided an understanding of how management decisions are made and why.”

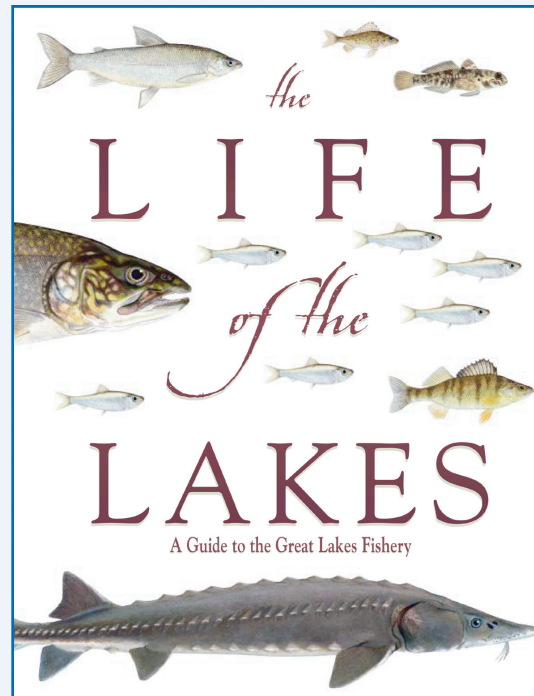
Brenda Archambo, Sturgeon for Tomorrow, Fisheries Leadership Institute participant

Michigan citizens representing more than 20 fisheries and conservation organizations participated in the institute, attending lake-focused workshops organized by Michigan, Pennsylvania and Wisconsin Sea Grant. Through classroom learning and relevant field trips, the institute presented basic fishery science and Great Lakes ecological principles, as well as fishery issues specific to lakes Huron, Michigan, Erie and Superior. A state-level meeting in Lansing provided leadership training and opportunities for working with the state legislature and with agency decision makers.

In follow-up surveys, more than 80 percent of Michigan participants rated the fisheries leadership institute as beneficial and cited the opportunity to interact with diverse stakeholders as a key component of the training. Two participants were subsequently appointed to the Michigan Department of Natural Resources Lake Huron citizens advisory group as a result of contacts made while attending the institute.

Great Lakes Fisheries Leadership Institute Curriculum

Sea Grant developed essential components of the institute curriculum, including the revised edition of the award-winning publication *The Life of the Lakes: A Guide to the Great Lakes Fishery*. Sea Grant communications worked with authors Shari Dann and Brandon Schroeder, who is now Sea Grant extension agent for Northeast Michigan, to produce the revised edition and a related ecosystem poster. The materials provided the primary introductory text for institute participants. More than 3,690 books and posters of the first and second editions have been distributed.



The Life of the Lakes Wins Publication Award

The Life of the Lakes booklet and poster employ an ecosystem approach to show how social, environmental and technological changes have influenced Great Lakes recreational and commercial fisheries over time. Special features include color photos, detailed illustrations of Great Lakes fish and a colorful ecosystem diagram. Michigan Sea Grant Communications won a publication award in 2004 for the design of The Life of the Lakes booklet from the Association for Communication Excellence in Agriculture, Natural Resources, and Life and Human Sciences.

As part of the curriculum, Sea Grant also produced reports on Michigan's charter fishing industry (see sidebar, page 17), commercial fishing industry and a guide to institutional arrangements for Great Lakes fisheries management. Michigan Sea Grant Communications developed the institute Web site and coordinated the development and distribution of the curriculum binder, CD and related materials for the Great Lakes Sea Grant Network.

PROGRAM ACCOMPLISHMENTS AND IMPACTS

CoastWatch

In collaboration with NOAA's Great Lakes Environmental Research Laboratory, Sea Grant developed the successful CoastWatch Web site, featuring up-to-date surface water temperatures, available as isothermic map images for all the Great Lakes. The lake, regional, and port image charts (updated four times daily) help recreational anglers and charter boat captains save fuel by pinpointing likely areas for fishing. Of the 222 responding captains in Sea Grant's 2002-03 charter fishing survey, 62 percent reported using the CoastWatch Web site. Nearly 808,000 Great Lakes surface water temperature images were downloaded from the Sea Grant-NOAA CoastWatch Web site during six months of the 2003 fishing season.



CoastWatch maps are an outstanding utilization of 21st century technology that significantly adds to the potential of the Great Lakes becoming the sports fishing capitol of the world. Your CoastWatch team should be proud of their accomplishments and the product they produce.

Richard Mazzarella, Lake Ontario sportfisherman

Seafood Safety Standards

The U.S. Food and Drug Administration's Hazard Analysis and Critical Control Point (HACCP) standards provide a way to monitor critical points in a process in order to minimize hazards associated with the industry. All of Michigan's commercial fishing and fish processing operations are complying with HACCP regulations as the result of training and technical assistance provided by Michigan Sea Grant extension agent Ron Kinnunen. State- and tribe-licensed fish processors in the Great Lakes region have designed and implemented HACCP plans with Sea Grant assistance. As a result of HACCP efforts, Kinnunen has worked with two Great Lakes Indian Fish and Wildlife Commission scientists on contaminant studies related to Great Lakes commercial fish. Tribal fish processors can now follow a HACCP process to ensure a finished product that will meet U.S. Food and Drug Administration guidelines for contaminants.

Aquaculture

Michigan Sea Grant extension agent Ron Kinnunen served on the board of the North Central Regional Aquaculture Center from 1999-2001. Kinnunen organized a symposium at the 2000 Midwest Fish and Wildlife Conference that facilitated discussion among 150 stakeholders about the impacts of aquaculture on the environment. He produced proceedings from the event, which was sponsored by agencies and organizations that contributed more than \$30,000.



Charter Fishing Industry Contributes to Michigan's Coastal Economy

Periodic surveys of Michigan's charter fishing industry, developed by Michigan and the Great Lakes Sea Grant Network, have helped keep decision-makers abreast of industry trends, revenue generated and the economic impact of the industry on coastal communities. The most recent report, Michigan's Great Lakes Charter Fishing Industry in 2002, is available online. See: www.miseagrant.umich.edu/fisheries

"The survey is a great asset to all charter boat captains and the ports that they work out of. The information is invaluable."

Frank English, President, Michigan Charter Boat Association

PROGRAM ACCOMPLISHMENTS AND IMPACTS

In a special project, Michigan Sea Grant participated in the Nicaragua Small Shrimp Producer Assistance Program. At the request of the U.S. Agency for International Development, NOAA enlisted Michigan Sea Grant to manage a project addressing the modernization of the Nicaraguan shrimp farming industry. Subcontractors included Florida Sea Grant and a shrimp aquaculture specialist in Michigan. The Nicaragua Small Shrimp Producer Assistance Program assisted Nicaraguan shrimp farmers in modernizing their technology to help the industry become economically viable in the wake of Hurricane Mitch.

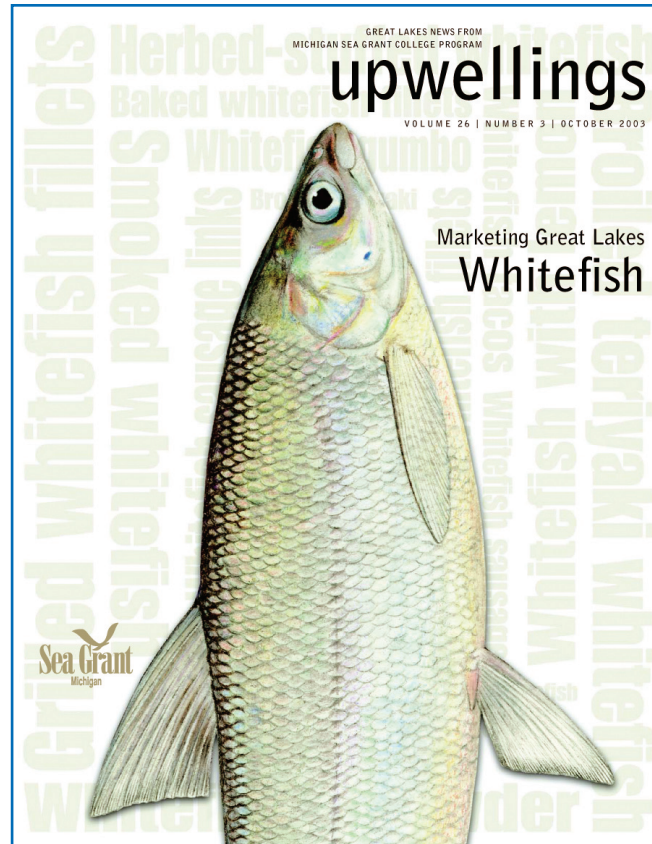
Fish Contaminants: Educating the Public

Michigan Sea Grant extension agent Ron Kinnunen is coordinating a three-year fish consumption advisory education project for Michigan's Upper Peninsula, funded by the Agency for Toxic Substances and Disease Registry through the U.S. Department of Health and Human Services.

Kinnunen has also been called upon to help assess fish contaminant data compiled by the Michigan Department of Agriculture on fish species that were called into question in regards to contaminants. The data were used in producing the Michigan sport fish consumption advisory. He also provided guidance to the Great Lakes Indian Fish and Wildlife Commission and to the Keweenaw tribal biologist about the presence of dioxin in lake whitefish, PCBs in carp and catfish, and chlordane concentrations in siscowet trout.

Fishery Seminars and Presentations

Each year, Sea Grant extension agents organize and conduct regional fisheries workshops to educate stakeholders about the latest developments in the Great Lakes fishery. Attendance at the seminars from 1999-2003 totaled more than 1,000. Through invited presentations given by experts from federal, state, and tribal agencies and universities, participants learned about such topics as the status of major fish species, commercial fishery gear avoidance, tribal fishing rights, genetics, creel census reports, habitat issues, lake trout research, Great Lakes water levels, aquatic invasive species, and cormorants.



Economic and marketing issues at the heart of Michigan's commercial fishing industry were highlighted in a 2003 issue of upwellings.

Emerging Issue: Whitefish Marketing

The profitability of Michigan's commercial fishing industry has plummeted in recent years due to multiple factors, including strong competition from Canadian producers and shrinking regional markets. Over the past three years, Sea Grant extension agents Chuck Pistis and Ron Kinnunen have worked with Michigan fish producers and state agencies to develop marketing strategies for Great Lakes lake whitefish, Michigan's biggest commercial catch.

Activities to help the industry remain viable focus on methods to broaden the sale and distribution of lake whitefish through the branding and promotion of value-added strategies. A new fisheries extension enhancement project, funded by NOAA-National Sea Grant, will allow expanded activities over the next five years.



Key business partners including DTE Energy, Stroh Companies and General Motors have been instrumental in developing and funding waterfront redevelopment projects in cooperation with the Greater Detroit AHR Initiative. See page 15 of the National Sea Grant Biennial Report: "Sea Grant Extension Helps Revitalize the Detroit Shoreline."

Sustainable Coastal Communities

More than 300 coastal communities—ranging in size from small towns to dense urban areas—thrive along Michigan’s 3,288-mile Great Lakes shoreline. Communities face an array of challenges from rapid growth and development pressure to brownfield redevelopment and economic revitalization. Sea Grant outreach collaborates with coastal communities, businesses, local citizen groups, nonprofit organizations, and state agencies to develop and fund programs that protect valuable coastal resources and stimulate economic opportunity.

Detroit River Waterfront Revitalization

For more than eight years, Sea Grant extension agent Mark Breederland has played an integral role in developing and coordinating Detroit River revitalization projects that have changed the face of Michigan’s largest urban area. Despite a legacy of industrial use, the 32-mile Detroit River is one of the most significant natural resources in Southeast Michigan. The international waterway provides drinking water to approximately five million people in the U.S. and Canada, supports a major recreational fishery and is an important migratory bird flyway. The river also serves as a vital commercial transportation route linking the upper and lower Great Lakes. Breederland chaired the steering committee of the Greater Detroit American Heritage River (AHR) Initiative from 1999-2003.

Through efforts related to the AHR initiative, more than eight miles of riverfront have been transformed from urban-industrial to mixed use development, featuring pedestrian promenades and more than 18 riverfront greenways projects. Approximately \$13 million has been leveraged for waterfront projects that led to subsequent

donations, including a \$50 million donation from the Kresge Foundation for construction and maintenance of a three-mile riverwalk. Highlights of these projects are featured on Web pages created by Sea Grant Communications and in a special issue of *upwellings* in 2001.

As part of the AHR initiative, Breederland assisted in developing a bi-national Conservation Vision for the lower Detroit River ecosystem, which led to the 2001 formation of the Detroit River International Wildlife Refuge. He and others also assisted in brownfield redevelopment planning and contaminated sediment removal from the Black Lagoon in the lower Detroit River affecting the city of Trenton.



Michigan Sea Grant is managing a project to build spawning reefs for lake sturgeon in the Detroit River to rehabilitate the state-threatened fish species. Outreach components of the project include sturgeon Web pages created by Sea Grant Communications and a display at the Belle Isle Aquarium and Dossin Great Lakes Museum featuring the history of this captivating species and the impact of habitat loss. Sea Grant communications collaborated with Detroit partners to organize and publicize a special media event in November 2003, subsequently covered in statewide daily newspapers.

PROGRAM ACCOMPLISHMENTS AND IMPACTS

Supporting Soft Engineering

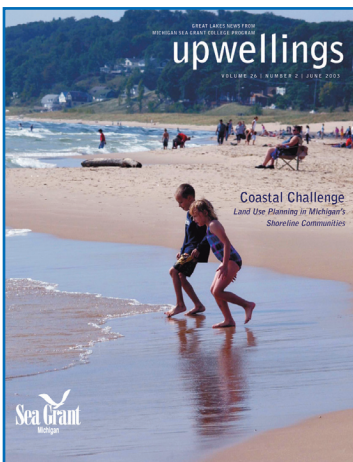
Led by Sea Grant extension agent Mark Breederland, Sea Grant developed and implemented soft engineering techniques at several demonstration sites along the Detroit River, resulting in more than 150 feet of soft-engineered shoreline. In 2001, a nationwide audience learned about soft engineering along the Detroit River in an article co-authored by Breederland in *Land and Water Magazine*. Sea Grant sponsored a soft engineering conference in 2003, attended by more than 75 engineers, landscape architects and regulatory personnel from around the state.

Coastal Planning and Zoning Study

As part of Sea Grant's coastal community development initiative, Sea Grant extension specialist Mike Klepinger surveyed more than 200 of Michigan's coastal jurisdictions and identified the status of planning and zoning at the local level. Findings were presented in a special report produced in 2003 and show that serious gaps in land use planning still occur along Michigan's shoreline. Michigan's Land Use Leadership Council consulted the report to assist in the development of more than 150 recommendations to the governor on actions to make the best use of Michigan's land resources. Michigan Sea Grant provided copies of the report to land use educators, as well as to the Michigan Society of Planning and Michigan Department of Environmental Quality's Office of Coastal Resource Management. An interview with Klepinger aired on Michigan Radio in June 2004, reaching listeners across southern and mid-Michigan.

Status of Planning and Zoning in Michigan's Great Lakes Shoreline Communities is available online.

See: www.miseagrant.org/pubs/pdf/Klep_survey.pdf



More than 3,000 readers learned about the primary impacts of unplanned growth on Michigan's shoreline resources in the June 2003 issue of *upwellings*.



In partnership with the Great Lakes Commission, Sea Grant Communications developed an illustrated poster depicting various land uses that occur in a typical Great Lakes Basin watershed. Text highlights best management practices for reducing erosion and sedimentation. Approximately 10,000 copies of the poster have been distributed by Sea Grant Communications and the Great Lakes Commission.

Planning for Water Quality – Citizen Planner Program

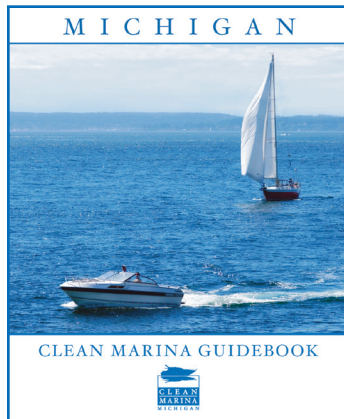
Addressing the need for coastal land use planning and education, Sea Grant extension agents taught water quality components to several hundred local officials as part of the Citizen Planner program sponsored by Michigan State University Extension. The program is a course series in land use planning directed at local officials including planning commissioners, members of zoning boards and others who guide growth and development in their communities. In follow-up evaluations, participants noted positive changes in the process for reviewing development proposals and improved communication and interaction with neighboring communities. State-wide momentum for the program has led to recommendations from the Michigan Land Use Leadership Council to expand the program.

Marinas Get Emergency Assistance

More than 700 public and private marinas are located along the Michigan shoreline, comprising an important coastal-dependent industry. In the late 1990s and early 2000s, many Michigan marinas struggled with the impact of low Great Lakes water levels, when dredging was the only means of making their facilities accessible to their customers. Sea Grant collaborated with Michigan State University researcher Ed Mahoney and the Michigan Boating Industries Association to prepare a report demonstrating that the economic loss to the boating industry was approximately \$11 million in 1999 and projected to be at least \$30 million if water levels dropped an additional six inches. As

PROGRAM ACCOMPLISHMENTS AND IMPACTS

a result of the report, the Michigan legislature passed the Emergency Recreational Boating Access Fund, providing up to \$10 million of low-interest loans to municipal marinas and an additional \$4 million to dredge state harbors. This is the first instance of a recreational industry to receive disaster funding.



A collaboration between Sea Grant Extension, Communications and the Clean Marina Program partners resulted in the development and production of a suite of clean marina outreach materials including a program logo, brochure, guidebook and Web site.

Michigan Clean Marina Program

Sea Grant entered into a unique partnership with the Michigan Boating Industries Association and the Michigan Department of Environmental Quality in 2003 to create the Michigan Clean Marina Program. The voluntary program was initiated to preserve and protect Michigan's Great Lakes and its connecting waterways by reducing marina pollution and enhancing fish and wildlife habitat in their vicinity. For participating marinas, the program offers professional benefits such as enhancing public image by promoting environmentally sound practices and saving money by adopting cost-effective best management practices. More than 30 of Michigan's marinas have already joined the Clean Marina Program. Michigan Sea Grant Communications is producing the *Clean Marina Program Guidebook* that will serve as the primary training and reference document for program participants.

Emerging Issue: Rip Currents

Rip currents can occur in the Great Lakes and have recently received heightened attention in many of Michigan's shoreline communities. In the past two years, 18 people have died along the shores of Lake Michigan, including seven deaths on July 4, 2003. These tragedies have prompted Michigan Sea Grant to strengthen existing and/or develop new partnerships with state, regional and national organizations to raise awareness of rip currents. Sea Grant staff participated in two key community groups, including the Mackinac County Water Safety Review Team since 1998; and the Great Lakes Beach and Pier Safety Task Force since 2003.

Sea Grant Communications designed new rip current brochures and beach signs for distribution in coastal areas across the nation, the Great Lakes region and in Michigan in 2004. Sea Grant extension agents have been instrumental in installing new signs and distributing thousands of new brochures. This partnership with the NOAA-National Weather Service, NOAA-National Sea Grant, and the U.S. Life Saving Association has had a positive impact on the development of consistent beach safety messages, a critical aspect of public outreach. Through these efforts, Michigan Sea Grant hopes to significantly reduce death and injury by making the public aware of steps they can take to avoid accidental death and injury due to rip currents.



RIP CURRENTS

Break the Grip of the Rip!

Rip currents are powerful currents of water moving away from shore. They can sweep even the strongest swimmer out to sea.

IF CAUGHT IN A RIP CURRENT

- ◆ Don't fight the current
- ◆ Swim out of the current, then to shore
- ◆ If you can't escape, float or tread water
- ◆ If you need help, call or wave for assistance

SAFETY

More information about rip currents can be found at the following web sites:

www.ripcurrents.noaa.gov
www.usla.org
www.miseagrant.umich.edu

- ◆ Know how to swim
- ◆ Never swim alone
- ◆ If in doubt, don't go out

Sea Grant programs across the country have helped distribute more than 100,000 new rip currents brochures in 2004, featuring the illustration of how to escape a rip current, developed by Michigan Sea Grant's Dave Brenner.

Education

Sea Grant promotes and supports widespread and varied opportunities for educators, students and citizens to acquire an understanding of aquatic science. Sea Grant promotes education that will improve aquatic and marine science literacy on the part of educators and citizens representative of all population sectors. There is tremendous potential for the expansion of Sea Grant education programs in the Great Lakes and throughout the country, according to the 2004 U.S. Oceans Commission Report: "The existing Sea Grant network could expand its roles and responsibilities, particularly in education and outreach." See: www.oceancommission.gov/documents/prelimreport/welcome.html#full

NOAA has recently increased its efforts to support education and seeks to promote careers in environmental science to ensure a diverse, more technologically skilled work force and to prepare teachers to understand and present NOAA sciences. See: www.oesd.noaa.gov/council.

Michigan Sea Grant is uniquely positioned to deliver engaging aquatic science to a variety of audiences, ranging from middle school students to life-long learners. The core of the Sea Grant education program is devoted to K-16 formal education, including a shipboard education program for 4th grade students, university fellowships, internships and research assistantships, and training for Michigan's pre-service and in-service educators. Sea Grant's educational initiatives also focus on utilizing and enhancing existing aquatic science curriculum materials and ensuring that these materials meet national and state science standards.

Local, Regional and National Leadership

Sea Grant educators provide leadership through participation in Michigan educational professional organizations (presentations, conferences, displays, distribution of curriculum materials). A Michigan Sea Grant educator is currently the regional representative for the Great Lakes Sea Grant Educators Network and participates in the National Marine Educator's Association.

Great Lakes Education Program

Through a combination of classroom education and hands-on learning, greater Detroit area students learn about the Great Lakes, as well as their own role in protecting this freshwater ecosystem through the Great Lakes Education Program (GLEP). Studies have shown that fourth grade



A fourth-grade student takes notes during a Great Lakes Education Program cruise. More than 45,000 students and adults have participated in the program.

students in Michigan generally have little understanding of the Great Lakes and local water resources. GLEP helps bridge this gap and prepare students for their roles as future decision-makers responsible for the state's natural resources. More than 45,000 students and adults in Southeast Michigan have participated in the program since 1991. GLEP received an excellent rating in the 2001 Great Lakes Fisheries Education Assessment and Summary of Needs report funded by the Great Lakes Fishery Trust. Teacher ratings of GLEP are very high, ranging from 3.92 to 4.0, with 4 being excellent.

Great Lakes Discovery Cruises

The GLEP model of experiential teaching was first applied to an adult audience with the advent of Summer Discovery Cruises in 2002. With a hiatus in 2003 due to low lake levels, Summer Discovery Cruises were again conducted in 2004 with great success. Evaluation of the 2002 Summer

PROGRAM ACCOMPLISHMENTS AND IMPACTS



Michigan Sea Grant Extension Agent Steve Stewart demonstrates water quality concepts during a Great Lakes Education Program cruise.

Discovery Cruises showed participant ratings ranging from 3.60 to 3.88 on a 4-point scale. Evaluation results from 2004 are pending. These cruises offer vessel-based education for the general public with varied themes designed to suit the interests of different groups. Cruises are conducted in collaboration with Huron-Clinton Metropolitan Park Authority staff at the Lake Erie Metropark.

Exotics Species Teacher Day Camp

Sea Grant educators collaborate with others in the region to lead the delivery of engaging research-based information locally, regionally and nationally. Examples include the Exotic Species Teacher Day Camp. Michigan teachers (109 total) have gained hands-on experience in applying exotic species concepts and increasing their knowledge of aquatic invasive animals and plants. Educators develop new multidisciplinary teaching skills to help students become environmental stewards. In turn, teachers agree to share invasive species resources and information with other teachers and outdoor educators through in-service training, demonstrations, or presentations at educational forums. The highly rated program has received awards from MSU Extension and the Great Lakes Sea Grant Network.

Life of the Lakes Museum Exhibit

As a spin-off to the production of the award-winning publication *The Life of the Lakes* (see page 16), Sea Grant Communications initiated a new partnership with the University of Michigan Museum of Natural History to develop an exhibit featuring content from *The Life of the Lakes* ecosystem poster. More than 30,000 people visited the Life of the Lakes exhibit, which was featured for six months during the Museum's focus on biodiversity. Media coverage about the exhibit included an Ann Arbor Cable Access TV interview with Sea Grant Communications Director Elizabeth LaPorte that ran for several weeks; an *Ann Arbor News* feature article; and an article in *The University of Michigan Record*.

Great Lakes and Natural Resources Camp

The Great Lakes and Natural Resources Camp for high-school students is an annual event co-sponsored by Sea Grant, 4H and Michigan State University Extension. To date, more than 900 students have participated in the camp. More than one-third of the participants rate the camp experience as very helpful in developing a career goal and personal interest in the area of natural resources ecology and management.

National Ocean Sciences Bowl

Michigan Sea Grant co-sponsors the Midwest regional competition of the NOAA National Ocean Sciences Bowl. This annual event for high school students is a highly competitive program that helps to prepare students for careers in marine and aquatic science.



Student education is a critical part of the Sea Grant mission. In the past five years, Michigan Sea Grant has supported 166 graduate and undergraduate research assistants. Former Sea Grant-funded research assistant Brandon Schroeder (right) is now a Sea Grant Extension Agent for Michigan's Northeast District.

PROGRAM ACCOMPLISHMENTS AND IMPACTS



greatlakeseducation Sea Grant

SEARCH | LINKS | CONTACT US | SITE MAP | ABOUT SEA GRANT | HOME

- K-12 Camps and Programs**
 - Great Lakes Education Program
 - Great Lakes and Natural Resources Camp
 - Purple Loosetrife Project
 - Exotic Species Day Camp (for educators)
- Great Lakes Curriculum Lessons**
 - Aquatic Food Web
 - Oxygen and Carbon Dioxide
 - Water Clarity
 - Weather and Water Temperature
- Grants and Fellowships**
 - Sea Grant Knauss Marine Policy Fellowship
 - Great Lakes Commission-Sea Grant Fellowship
 - Other Opportunities
- Educational Materials**
 - Sea Grant Bookstore
 - More Information & Links

Life of the Lakes Exhibit
This exhibit at the University of Michigan Natural History Museum explores the science of the Great Lakes, including the role of people in lake health and biodiversity.

Online Education

In response to a gap in Great Lakes ecosystem content on the Web, Michigan Sea Grant Communications developed an online pilot education series "Great Lakes Curriculum Lessons." See: www.miseagrant.umich.edu/education. Four aquatic science modules were developed using existing curriculum content. Colorful graphics are the highlight of the lessons that address the number and variety of fish and animals in the Great Lakes, dissolved oxygen, water clarity, and climate. The site has received more than 4,600 hits since December 2003.

As a result of these pilot lessons, Sea Grant Communications is managing the development of a new series of online education lessons funded by the Great Lakes Fishery Trust. Project F.L.O.W., Fisheries Learning on the Web, will use Great Lakes ecosystem curriculum content from the Great Lakes Education Program as the basis for the lessons in 2004-2005. Funding from the Great Lakes Fishery Trust is supporting the work of a Ph.D. student in education to assist with this project to ensure that lessons meet educational standards and benchmarks.

Educational Resources and Materials

Sea Grant educators, communicators and extension staff work collaboratively to distribute aquatic science materials to Michigan educators. Through annual participation in the Michigan Science Teacher Association conference and direct mail distribution, Sea Grant has been successful in providing teachers with aquatic science content for many Michigan classrooms.

- More than 105,000 publications focusing on aquatic science have been distributed since 1999. See Appendix H for a complete list of publications and products distributed.



Collaboration between Michigan Sea Grant and the University of Southern California Sea Grant allowed two Michigan students to participate in a summer science program for young women held on Catalina Island in 2003. The field-oriented program challenges young women to explore ecological and biological principles through an interactive approach to learning. Mary Sims of Big Rapids (above) was one of the participating students.

- Publication discounts are offered to Michigan educators for classroom publications, including posters, booklets, ID Guides, CD, and other publications.
- Many invasive species materials are distributed for little or no cost.
- Free lessons and aquatic science information are available online.
- Sea Grant's quarterly publication, *upwellings*, is mailed and electronically distributed to more than 3,000 educators and is also available online. *Upwellings* is one of only a few publications reporting on Great Lakes science and education.

"I received my latest issue of upwellings ... and was very impressed by the information it provided. As an elementary teacher, I felt it offered higher level reading opportunities combined with environmental issues important to people of any age."

Beth Brooks, Cook Elementary, Grand Blanc Community Schools



Appendices



APPENDIX A

Michigan Sea Grant College Program Staff Full-Time Equivalent Allocations

Administration - UM	Percentage of Support			Total FTE	Percentage of Contribution to MSG
	Federal	State	Other		
Donald Scavia		100%		1	50%
Jennifer Read	40%	23%	37%	1	80%
Elyse Larsen	50%	50%		1	100%
Debra Bogi	50%	50%		1	100%
Administration - MSU					
William Taylor		100%		1	20%
Julie Traver		75%		.75	40%
Communications - UM					
Elizabeth LaPorte	50%	50%		1	100%
Joyce Daniels	38%	38%		.75	100%
David Brenner	100%			1	100%
Minuet Henderson*	38%	38%		.75	100%
Anuja Mudali	75%			.75	100%
Communications - MSU					
Carol Swinehart	100%			1	100%
Patricia Stewart*	50%	50%		1	50%
Extension - MSU					
John Schwartz		80%	20%	1	80%
Ronald Kinnunen	100%			1	100%
Brandon Schroeder		100%		1	100%
Mark Breederland	100%			1	100%
Steve Stewart	50%	50%		1	100%
Chuck Pistis	60%	40%		1	60%
Mike Klepinger	100%			1	100%
Rochelle Sturtevant	75%	25%		1	100%
Pamela Bailey		50%		.50	100%
Sonia O'Connor	50%			.50	100%

*No longer with the program as of 2004

Michigan Sea Grant College Program Policy Committee

Dr. Jeffrey Armstrong, Dean
College of Agriculture & Natural Resources
Michigan State University

Dr. Margaret Bethel, Director
Michigan State University Extension
Michigan State University

Dr. Michael Bernitsas
College of Engineering
University of Michigan

Dr. Rosina Bierbaum, Dean
School of Natural Resources & Environment
University of Michigan

Dr. Stephen Brandt, Director
NOAA Great Lakes Environmental Research Lab

Dr. Ken DeBeausseart, Director
Office of the Great Lakes
Michigan Dept. of Environmental Quality

Dr. Leon Carl, Director
USGS Great Lakes Science Center

Dr. Michael Donahue, President/CEO
Great Lakes Commission

Mr. Carlos Fetterolf, Jr.
National Review Panel (past member)

Dr. Chris Goddard, Executive Secretary
Great Lakes Fisheries Commission

Ian Gray, Vice President
Research & Graduate Education
Michigan State University

Dr. Gail Imig, Program Director
Food Science & Rural Development
W.K. Kellogg Foundation

Dr. George Leroi, Dean
College of Natural Science
Michigan State University

Dr. Jennifer Read, Assistant Director
Michigan Sea Grant
University of Michigan

Dr. David D. Reed
Vice President for Research
Michigan Technological University

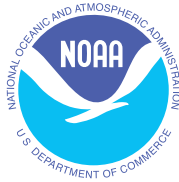
Dr. Donald Scavia, Director
Michigan Sea Grant
School of Natural Resources & Environment
University of Michigan

Dr. John Schwartz, Extension Program Leader
Michigan Sea Grant
Dept. of Fisheries and Wildlife
Michigan State University

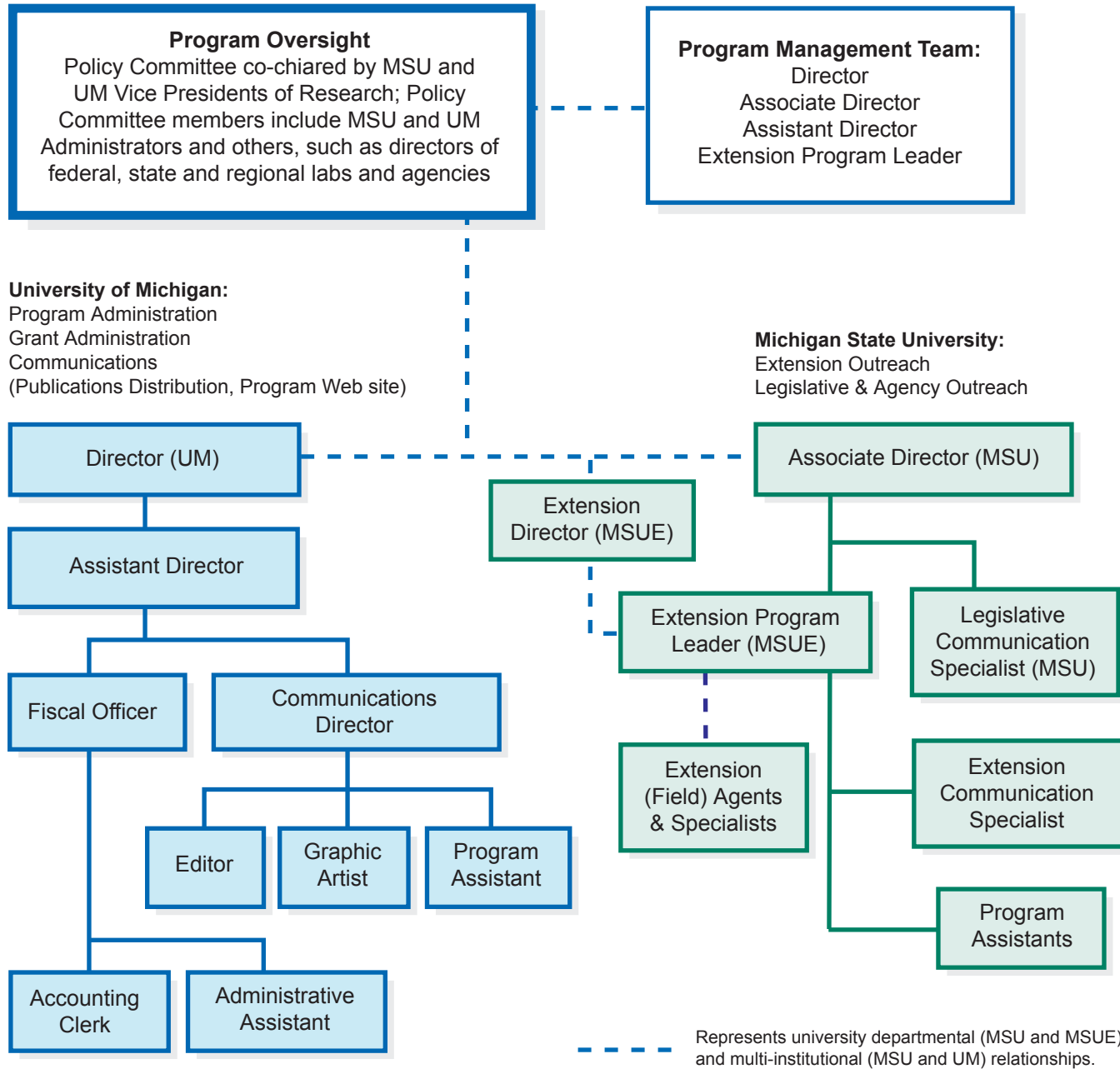
Dr. William Taylor, Associate Director
Michigan Sea Grant
Dept. of Fisheries and Wildlife
Michigan State University

Dr. Fawwaz Ulaby
Vice President for Research
University of Michigan

APPENDIX B



Program Organization and Structure Michigan Sea Grant College Program



Project Selection – Core Funds

Years	1999	2000	2001	2002	2003	Total
Pre-Proposals	29	15	24	*	20	88
Full Proposals Submitted	14	12	14		11	51
Full Proposals Funded	4	3	7		5	19
Institutions (PreProposals)	9	8	9		8	**17
Institutions (Full Prop. Submitted)	5	6	7		5	**12
Institutions (Full Prop. Funded)	3	2	5		3	**8

* Second year of 2-year funding cycle.

**Total number of different institutions

Recruiting Talent

Years	1999	2000	2001	2002	2003	Total
New Projects	11	12	9	8	11	51
Continuing Projects	5	7	4	7	1	24
New PIs	1	1	2	1	3	8
Success of Home Institution	64%	42%	33%	50%	36%	*45%
New Institutions	1	1	1	0	1	4
Success In National Competitions	38%	8%	46%	22%	46%	*33%
Regional & Multi-Program Projects	1	0	0	0	4	5

*Average

APPENDIX E

Distribution of Core Federal and Matching Funds Among Program Areas

Year	Sea Grant	Match	Research	Extension	Education	Comm.	Prog. Dev.	Admin.
Year 1 (97-98)	1,002,136	694,334	529,543	564,688	68,747	251,811	100,000	271,681
Year 2 (98-99)	1,113,159	757,475	608,630	607,903	61,640	256,388	60,955	252,530
Year 3 (99-00)	1,221,557	697,473	622,871	596,893	63,612	241,654	116,715	235,153
Year 4 (00-01)	1,240,437	698,087	652,464	635,629	65,203	243,530	82,100	259,598
Year 5 (01-02)	1,501,025	846,717	654,586	953,489*	107,355	278,984	80,617	290,711
Year 6 (02-03)	1,359,125	831,409	662,644	781,417*	110,518	287,082	69,161	279,713
Year 7 (03-04)	1,409,720	756,233	420,797	850,146*	114,532	368,428	52,641	359,409
Year 8 (04-05)	1,414,170	740,645	409,203	875,400*	116,322	375,394	18,805	357,454
Totals	10,261,329	6,022,373	4,560,738	5,847,564	707,930	2,303,271	580,994	2,306,249

*The Extension budget, 2001-02 through 2004-05, includes resources for the Great Lakes Sea Grant Network — GLERL extension agent shared among eight regional programs.

National Competition Funding - NSI Awards and Fellowships

Year	(97-98)	(98-99)	(99-00)	(00-01)	(01-02)	(02-03)	(03-04)	(04-05)	Totals
Aquatic Nuisance Species	405,852	409,920	391,618	410,494	-	347,121	700,958	433,199	3,099,162
Biotechnology	-	-	-	-	-	-	685,931	202,854	888,785
Fisheries Extension Enhancement	-	-	-	-	-	-	125,230	166,130	291,360
Ballast Water	-	-	108,294	-	-	125,839	409,711	-	643,844
Knauss Fellows	36,000	36,000	-	76,000	38,000	76,000	-	-	262,000
*Coastal Management Fellows	32,000	32,000	-	-	Fellow	Fellow	-	-	64,000
*Great Lakes Commission - Sea Grant Fellows	-	-	-	-	-	-	Fellow	Fellow	-
Totals	473,852	477,920	499,912	486,494	38,000	548,960	1,921,830	802,183	5,249,151

*MSG placed candidates in these fellowships, but the funds did not flow through the program. As of 1998, NOAA Coastal Services Center coordinated the funding of Coastal Management Fellowship.

Leveraged Funding from Partners and Additional Program Funding

Source of Funds	1999	2000	2001	2002	2003
Chippewa-Ottawa Resource Authority					5,000
Clinton River Cruise Company				17,000	
Colina Foundation			1,200		
Detroit Edison Foundation	67,975				
Downriver Career Technical Consortium	14,000	15,000	15,600	12,000	
Great Lakes Commission					4,992
Great Lakes Fishery Trust*				110,000	
Great Lakes Protection Fund*					45,000
Illinois/Indiana Sea Grant		232			400
International Joint Commission		69			
Lake Michigan Federation		13			
Ludington Area Charterboat Association				200	
Michigan Boating Industries Association				700	
Michigan Charter Boat Association				750	
Michigan Coastal Management Program*				309,292	
Michigan Department of Agriculture	140,000				
Michigan Department of Community Health				3,000	
Michigan Department of Environmental Quality		7,050			
Michigan Department of Natural Resources		65,000			
Michigan Geographic Alliance		1,290			
Michigan Office of the Great Lakes		16,500			
Michigan Salmon & Steelhead Fishermen's Association				1,450	
Michigan State University (MSU) Extension				21,700	1,560
MSU Extension - Great Lakes Area of Expertise				2,500	
MSU Extension Program Development		500			
Michigan State University Wayne County				30,000	
Minnesota Sea Grant		147			315
National Ocean Sciences Bowl	500				
National Oceanic & Atmospheric Administration*					22,000
New York Sea Grant		275			156
Ohio Sea Grant		43			78
Pennsylvania Sea Grant		198			216
United Parcel Service Foundation				34,800	
University Southern California Sea Grant					3,000
Wayne County				1,000	1,000
Wisconsin Sea Grant		1,023			1,320
Total	222,475	107,340	16,800	544,392	85,037

*Additional program funding from grants, contracts and development activities.

APPENDIX E

Leveraged and Additional funding for External Projects Facilitated by MSG Staff Members

Source of Funds	1999	2000	2001	2002	2003
Agency for Toxic Substances & Disease Registry*					150,000
Aqua Springs Fish Farm		200			
Central Lake Superior Watershed Partnership		1,000			
DaimlerChrysler				5,000	
Detroit Free Press				1,000	
DTE Energy				5,000	
Ford Motor Company				5,000	
General Motors				5,000	
Great Lakes Commission		14,437		16,666	
Great Lakes Fishery Commission		1,000			
Kresge Foundation*				50,000,000	
Marquette County Historical Museum		1,000			
Michigan Coastal Management Program			40,000	60,000	250,000
Michigan Department of Environmental Quality*		3,000	50,000		
Michigan Legislature*		14,000,000			
Michigan State University Extension				1,550	1,900
Minnesota Sea Grant		1,000			
Moosewood Nature Center		1,000			
National Oceanic Atmospheric Administration*		3,000			
National Park Service - Urban Park & Rec. Resource*			490,000		
National Steel-Great Lakes Operations				2,500	
North Central Regional Aquaculture Center	9,500	5,000	6,000		1,000
Ohio Sea Grant		1,000			
Praxair				1,000	
UAW/GM Center for Human Resources				2,500	
US Army Corps of Engineers*	10,000				
US Fish & Wildlife Service*		20,000			
Total	19,500	14,051,637	586,000	50,105,216	402,900

*Additional program funding from grants, contracts and development activities.

Leadership by Staff

Person	Organization	Position	Dates
Breederland, Mark	Greater Detroit American Heritage River Initiative	Chair – steering committee	1998-2003
	Detroit Greenways Partnership	Facilitator	1996-97
	Lake St. Clair Conference	Member – steering committee	1999
	Lake St. Clair Management Plan	Member – steering committee	
	St. Clair Shores Waterfront Advisory Committee	Member	1996-2003
	Brownfield/Greenfield Policy Roundtable	Member – steering committee	2002-03
	Belle Isle Cleanup Day	Member – planning committee	2001
	Community Foundation of SE Michigan– Greenways Initiative Forum	Member – steering committee	1999-2001
	Brenner, Dave	Agricultural Communicators in Education	Member
Great Lakes Sea Grant Network		Regional Webmaster	1997-
Sea Grant Web Specialists Network		Chair	2003-
Sea Grant Network Media Committee		Member	2000-
Hoagman, Walter	Heat Energy Action Team	Chair	1999-2001
Kinnunen, Ron	North Central Regional Aquaculture Center		
	Board of Directors	Member	1999-2000
	Extension Technical Committee	Chair	
	Strategic Planning Team	Member	1999
	National Risk Management Feasibility Program for Aquaculture (USDA)		
	Trout Advisory Committee	Member	
	Sea Grant Aquaculture Theme Team	Member	
	Michigan Department of Natural Resources		
	Lake Superior Fish Advisory Committee	Member	
Fisheries Management Plan – Isle Royale	Member – ANS Resource Person	2002-	
Klepinger, Mike	Michigan Alliance for Environmental & Outdoor Education	President	1999-2002
	City of Mason Planning Commission	Member	1997
	Great Lakes Aquatic Nuisance Species (ANS) Panel	Alternate	1997
	Research committee member		2000-03
	I&E committee		1997
	Michigan ANS Management Plan	Co-writer	1996
	Michigan ANS Management Plan Update	Policy committee member	2002
	Michigan ANS Hydrilla Task Force	I&E, Policy committee member	2004-
	Great Lakes Sea Grant Network		
Sustainable Coasts Committee	Chair	1996-	
Sea Grant Coastal Communities and Economies Theme	Team Member	2003-	
LaPorte, Elizabeth	Association for Communication Excellence in Agriculture (ACE)	Member	2004-
	Sea Grant Communications Growth Committee	Member	2003
	Great Lakes Sea Grant Network	Communications Chair	2003-
	Great Lakes Information Network	Board Member	2003-

APPENDIX F

Person	Organization	Position	Dates
McKinney, John	Grand Traverse Bay Watershed Initiative	Chair – Board of Directors	1999 -2001
	Rotary Charities	Vice-Chairperson – Board of Trustees	
	MSU Extension Tourism Area of Expertise Team	Member	1999-2003
	National Association of County Agricultural Agents	Chair – Aquaculture Committee	1999-2003
Pistis, Chuck	Great Lakes Fishery Commission	Advisor	1999
	Michigan Department of Natural Resources		
	Lake Michigan Task Force	Member	1999
	Lake Erie Task Force	Member	1999
	National Association of County Agricultural Agents	Vice-Chair	2002
Read, Jennifer	Michigan Great Lakes Protection Fund Board	Member	2002-
	International Association for Great Lakes Research	Member	2001-
	Great Lakes Futures Roundtable	Member	2003-2004
	Sea Grant Association	Alternate	2001-
Scavia, Don	ESTUARIES, Estuarine Research Federation	Associate Editor	1998
	Frontiers in Ecology and Environment, Ecological Society	Associate Editor	2002
	Professor, SNRE	Associate Dean	2004
	Sea Grant Association	Member	2004
	National Marine Fisheries Service, Pacific Regional Administrator selection panel	Member	2003
	National Marine Fisheries Service, Pacific Science Center Director selection panel	Member	2003
	President’s Early Career Award in Science and Engineering selection panel	Member	2003
	NOAA Office of Satellite Data, Processing, and Distribution program review panel	Member	2003
	National Weather Service Chief Hydrologist selection panel	Member	2002
	Gulf of Mexico Hypoxia Assessment Team, CENR	Chair	2000-2001
	Coastal Research and Monitoring Team, Clean Water Action Plan	Co-Chair	2000
	USGCRP Coastal Assessment Team	Co-Chair	2000
	Subcommittee on Ecological Systems, CENR	Co-Chair	1997-2001
	Assembly of Sea Grant Program Leaders	Chair	1999
Schwartz, John	Michigan Department of Natural Resources State Park Stewardship Strategic Planning Comm.	Member	2001-02
	Great Lakes Aquatic Nuisance Species Panel	Member	
Stewart, Steve	Lake St. Clair Management Plan	Steering Committee	2001
	Macomb County Marina Advisory Committee	Member	2001
	Lake St. Clair Advisory Committee	Member	2001
	National Sea Grant Educators Group	Secretary	2003

Person	Organization	Position	Dates
Stewart, Patricia	Association for Women in Communications	Member	2004
	Public Relations Society of America Michigan Chapter		
	League of Women Voters		
	International Association of Business Communicators	Member	
	American Association of University Women	Member	
Swinehart, Carol	Michigan Outdoor Writers Association		
	Board of Directors	Member	2002
	MSU President's Advisory Committee on Disability Issues	Member	2001-04
		Chair	2003-04
	MSU Extension Director's Committee on Persons of Difference	Member	2002-04
	Epsilon Sigma Phi		
	Alpha Psi Chapter	Member	
	Michigan AIS Hydrilla Task Force	Member	2004
	Michigan Extension Specialists Association	Member	
	American Water Works Assn. Research Foundation	Member	1997-2003
	Public Council on Drinking Water Research		
Taylor, William	Great Lakes Fishery Commission	Member	2003
	Sport Fishing and Boating Partnership Council	Chair	2003
	Michigan's Aquatic Nuisance Species Coordinating Council	Member	2003
	Michigan Economic and Environmental Roundtable Advisory Board	Member	1999-
	Recreational Boating and Fishing Foundation Evaluation Committee	Chair	1999-
	Great Lakes Fishery Trust Science Advisory Team	Member	1996-
	North-Central Regional Aquaculture Center Board of Directors	Chair	1995-
	Michigan State University		
	Dept. of Fisheries and Wildlife	Professor	1989-
	College of Agriculture and Natural Resources	Acting Dean	1999-2000
	Canadian Studies Centre	Professor	1989-
	Ecology and Evolutionary Biology Program	Professor	1989-
	Michigan Department of Natural Resources Fisheries Division	Associate Fishery Biologist	1986-
	Technical Advisory Committee for Fish	Member	1981-
	American Fisheries Society Past President's Advisory Council	Member	1998-
	Trout Unlimited Au Sable River Property	Board of Directors	1983-
State of Michigan Environment Review Panel	Member	1999-2000	
International Joint Commission Science Advisory Board	Member	1998-2001	

APPENDIX F

Collaborations And Partnerships

INTERNATIONAL

Sea Grant collaborated with environmental and natural resources agencies in the following countries:

Canada
Honduras
Nicaragua

BI-NATIONAL

Detroit International Wildlife Refuge
Great Lakes Commission
Great Lakes Information Network
Great Lakes Observing System
Great Lakes Panel on Aquatic Nuisance Species
International Joint Commission

FEDERAL

Executive

Council on Environmental Quality
U.S. Aid

U.S. Department of Agriculture

Joint Subcommittee on Effluents (w/USEPA)
Natural Resource Conservation Service
Niles Laboratory
North Central Regional Aquaculture Center
U.S. Forest Service

U.S. Department of Commerce

National Oceanic and Atmospheric Administration
Office of Oceanic and Atmospheric Research
National Weather Service
National Ocean Service, National Marine Sanctuaries

U.S. Department of Defense

U.S. Army Corps of Engineers
Detroit District

U.S. Environmental Protection Agency

Development, Community and Environment Division
Joint Subcommittee on Effluents (w/USDA)
Large Lakes Laboratory, Grosse Ile
Office of Policy, Economics and Innovation

U.S. Department of Health & Human Services

Centers for Disease Control
Agency for Toxic Substances and Disease Registry

U.S. Department of the Interior

Bureau of Land Management
National Park Service
Isle Royale National Park
Pictured Rocks National Lakeshore
Sleeping Bear Dunes National Lakeshore

Urban Park and Recreation Recovery
U.S. Fish & Wildlife Service
U.S. Geological Survey

Transportation

U.S. Coast Guard

TRIBAL AUTHORITIES

Bay Mills Tribe
Burt Lake Band of Indians
Chippewa Ottawa Resources Authority
Clearwater Fish Cooperative
Grand Traverse Band of Ottawa & Chippewa Indians
Great Lakes Indian Fish & Wildlife Commission
Hannahville Indian Community
Keweenaw Bay Indian Community
Little River Band of Ottawa Indians
Native American Community Services-Grand Rapids

Natural Resources Council

Red Cliff Band of Lake Superior Chippewa Indians
Sault Tribe of Chippewa Indians
St. Croix Chippewa Indians

STATE

Michigan Office of the Attorney General

Michigan Department of Natural Resources Fisheries

Institute for Fisheries Research
Non-game Wildlife
Parks
Bay City State Recreation Area
Tawas State Park

Michigan Department of Environmental Quality

Director's Office
Coastal Management Program
Geological and Land Management Division
Office of the Great Lakes

Michigan Department of Agriculture

Aquaculture Program
Select Michigan Program

State of Michigan Interagency/Intergovernmental

Central Lake Superior Watershed Partnership
Chippewa/East Mackinac Conservation District
Detroit/Wayne County Port Authority
Downriver Community Conference
Huron-Clinton Metroparks Authority
Metro Beach Metropark
Lake Erie Metropark

Detroit River Remedial Action Plan
 Northeast Michigan Council of Governments
 Ottawa Conservation District
 Pollution Prevention & Technical Assistance
 Southeast Michigan Council of Governments
 Timberland RC & Development Council
 Tri-County Regional Planning Commission

COUNTIES

Huron
 Macomb
 Sanilac
 Schoolcraft
 St. Clair
 Wayne
 Resource Conservation and Development
 Councils (4)

TOWNSHIPS

Arcadia (Manistee County)
 Brownstown (Wayne County)
 Kincheloe (Chippewa County)
 Lake (Clare County)
 Portage (Kalamazoo County)
 Robinson (Ottawa County)

CITIES

Detroit
 Belle Isle Aquarium
 Belle Isle Zoo
 Belle Isle Nature Zoo
 Detroit 300 Celebration
 Dossin Great Lakes Museum
 East Grand Rapids
 Escanaba
 Grand Haven
 Grand Marais
 Huron Beach
 Manistee
 Mackinac Island
 Marquette
 Port Austin
 St. Clair Shores
 Taylor
 Trenton
 West Bloomfield
 Wyandotte

EDUCATION

Schools, School Districts

Allegan	Lincoln Park
Allen Park	Livonia
Anchor Bay	Monroe
Beaver Island Lighthouse School	Munising
Buckley School	River Rouge
Centerline	Romeo
Chippewa Hills High School	Roseville
Chippewa Valley	Royal Oak
Clintondale	Sankore Marine Immersion Academy
Dakota	Saugatuck
Dearborn	Sault Ste. Marie
Dearborn Heights	South Lake
Delta County	Southfield
Delta-Schoolcraft Intermediate	Southgate
Detroit	St. Clair
East China	St. Clement
Ecorse	St. Joan of Arc
Flat Rock	St. Mary's Elementary School
Gibraltar	Taylor
Grosse Ile	Trenton
Gwinn	Trinity
Holland	Utica
Huron	Van Dyke
Iron County	Warren Woods
L'Anse Creuse	Woodhaven
Lakeshore	Wayne-Westland
Lakeview	Wyandotte
Lapeer	

Colleges

Macomb Community College
 Northwest Michigan College, Water Studies Institute

Universities

Au Sable Institute of Environmental Studies
 Grand Valley State University
 Great Lakes Institute for Environmental Research,
 University of Windsor
 Illinois State University
 Iowa State University
 Lake Superior State University
 Michigan State University
 Agricultural Economics
 Center for Great Lakes Culture
 Community, Agriculture, Recreation and Resource Studies
 Fisheries & Wildlife
 Food Science & Human Nutrition
 Knight Center for Environmental Journalism
 National Food Safety & Toxicology Center
 Office of Vice President for Research
 Planning and Zoning Center
 Provost's Office

APPENDIX F

Michigan State University Extension Program
Land Use Area of Expertise
Food Safety Area of Expertise
Victor Institute
Michigan Natural Features Inventory
Michigan State University County Extension Offices:
Alcona, Alger, Allegan, Alpena Bay, Cheboygan,
Chippewa, Emmett, Iron, Lake, Macomb, Mackinac,
Manistee, Marquette, Mason, Mecosta, Menominee,
Monroe, Newaygo, Ottawa, St. Clair, Wayne, Wexford
Michigan Technological University
Mississippi State University
North Carolina State University
North Dakota State University
Northern Michigan University
Ohio State University
Purdue University
University of Detroit-Mercy
University of Idaho
University of Michigan
College and Architecture and Urban Planning
College of Engineering
Atmospheric Oceanic and Space Sciences
Naval Architecture and Marine Engineering
Ford School of Public Policy
Museum of Natural History
Office of Vice President for Research
School of Natural Resources and Environment
University of Michigan Press
University of Minnesota
University of Missouri
University of Wisconsin

Educational Organizations

Bay Pines Youth Detention Facility
Bay Sail
Downriver Career Technical Consortium
Envirothon
Environmental Education Consortium
Fox Island Education Association
Great Lakes Schoolship Consortium
Inland Seas Education Association
Metropolitan Detroit Science Teachers Association
Michigan Alliance of Environmental & Outdoor Education
Michigan Biology Teachers Association
Michigan Council of Teachers of Mathematics
Michigan Science Teachers Association
National Marine Educators Association
North American Association for Environmental Education
National Association of Interpretation
Pipe Island Project Enterprise

BUSINESSES

American Electric Power
Aquaculture Bioengineering Corporation
Baker Fishery, Inc.

BASF
Basic Marine
Bayport Fish Company
Bay Metro Water
Bell's Fisheries
Big Bay de Noc Fishery
Big Stone Bay Fish Company
Butzel-Long
Cabela's
Daimler-Chrysler
DTE Energy
Escanaba Electric Plant
Ford Motor Company
Frazier Fisheries
Gauthier-Spaulling Fisheries
General Motors
Jensen Fishery
King's Fisheries
King and MacGregor
Lake Superior Fisheries
Mackinac Fish Company
Matson Fisheries
Mead Paper Company
Michigan Economic Development Corporation
Minnesota Aquafarms
National Steel
Newago Fisheries
Northern Initiatives
Parish Fisheries
Perch Research International
Peterson Fishery
RETAP Agriculture Engineering
Ruleau Brothers, Inc.
Seafood Systems
Shore Bank Bidco
Stroh Companies
Thill's Fish House
Tiki Fisheries
U.P. Water Works Institute
UPS Foundation
VanLandschoot Fisheries
Walter Fisheries
Wilcox Fisheries
Wisconsin Electric Power Company

INDUSTRY/TRADE ASSOCIATIONS

Bait Association of Ontario
International Ship Masters' Association
Lake Carriers Association
Marina Operators Association of America
Marine Environmental Education Fund
Marine Retailers Association of America
Michigan Aquaculture Association
Michigan Bait Dealers Association
Michigan Boating Industries Association
Michigan Charter Boat Association

Michigan Farm Bureau, Ottawa County
 Michigan Fish Producers Association
 Michigan Harbor Masters
 Mount Clemens Businesswomen's Association
 National Marine Manufacturers Association
 Ohio Aquaculture Association
 States Organization for Boating Access
 Traverse Area Assoc Realtors
 Upper Great Lakes Captains Association
 U.S. Great Lakes Shipping Association
 Western Basin Lake Erie Charter Boat Association
 Wisconsin Aquaculture Association

NON-PROFITS

Alger Underwater Preserve Committee
 Arbutus Lake Association
 American Water Works Association
 Bay Sail
 Blue Water Task Force
 Community Foundation of Southeast Michigan
 Council of Michigan Foundations
 Crystal Lake Association
 DeGraff Nature Center
 Detroit Historical Museum
 E.L. Johnson Nature Center
 Farmland Alliance
 Friends of the Rouge
 Friends of the Detroit River
 Friends of Belle Isle
 Iosco Audubon Society
 Isle Royale Institute
 Jesse Besser Museum
 Garden Clubs of America
 Grand Traverse Area Sport Fishing Association
 Great Lakes Children's Museum
 Great Lakes Shipwreck Historical Society
 Great Lakes Sportfishing Council
 Holland Fish & Game Club
 Keweenaw Sportsmen Club
 Lake Michigan Property Owners Association
 Lake Superior Center
 League of Women Voters
 Mackinac County Water Safety Review Team
 Mackinac County Sheriffs Department and EMT unit
 Manistee Community Foundation
 Metropolitan Affairs Coalition
 Michigan Chapter of Rails-to-Trails Conservancy
 Michigan Dune Alliance
 Michigan Farm Bureau
 Michigan Lake and Stream Associations
 Michigan Maritime Museum
 Michigan Outdoor Writers Association
 Michigan Steelhead and Salmon Fishermen's Association
 Michigan Underwater Preserve Council
 Marquette Underwater Preserve Committee

Michigan United Conservation Clubs
 Marquette County Historical Society Museum
 Muskegon Conservation Club
 PAR Group
 Partnership for Saginaw Bay
 Ravenna Sportsmans' Club
 Rotary: Grand Haven, Spring Lake, St. Joseph, Traverse City
 Sawyer Lake Association
 Schooner Dennis Sullivan
 Shakey Lakes Association
 Society of Environmental Journalists
 Society of Science Writers
 South Shore Fishing Association
 Stony Lake Property Owners Association
 The Watershed Center
 The Nature Conservancy – Great Lakes
 Three Lakes Association
 Thunder Bay Island Preservation Society
 Tip of the Mitt Watershed Council
 West Michigan Environmental Action Council
 Wetlands Foundation of West Michigan

SEA GRANT PROGRAMS

Florida Sea Grant
 Illinois-Indiana Sea Grant
 Maryland Sea Grant
 Minnesota Sea Grant
 New York Sea Grant
 North Carolina Sea Grant
 Ohio Sea Grant
 Oregon Sea Grant
 Pennsylvania Sea Grant
 Puerto Rico Sea Grant
 Texas Sea Grant
 University of Southern California Sea Grant
 Wisconsin Sea Grant

States and Regions

Sea Grant extension staff collaborated with the U.S. Fish and Wildlife Service and natural resource agencies in the following states and regions:

California
 Idaho
 Iowa
 Mississippi River Region
 Mountain-Prairie Region
 Nevada
 Oregon
 Pacific Region
 Southwest Region
 Utah
 Washington
 Wisconsin
 Wyoming

Research Projects and Principal Investigators 1999-2003

KEY

EMU = Eastern Michigan University
GLC = Great Lakes Commission
LSSU = Lake Superior State University
MSU = Michigan State University
NEMW = Northeast Midwest Institute
UM = University of Michigan
UT = University of Toledo
WMU = Western Michigan University

1999

R/GLF-46, Bence/Hayes, MSU (continuing)

Understanding and Managing for Variation in the Lake Michigan Salmonine Fishery

R/GLF-47, Hayes/Jones, MSU (continuing)

Physical and Biological Processes Influencing Recruitment of Walleye

***R/NIS-1, Hoehn/Lupi, MSU**

The Potential Economic Damage of Ruffe in the Great Lakes

R/GLF-49, Jones/Bence, Peterman, MSU, Simon Fraser University

Application of Decision Analysis to Great Lakes Fishery Management

R/GLF-45, Jude, UM (continuing)

Recruitment Failure of Yellow Perch in SE Lake Michigan: Evaluation of the Starvation and Predation Hypotheses

***R/NIS-2, Jude, UM**

Invasion Susceptibility and Ecosystems Fragmentation of Great Lakes Coastal Rivers and Lakes by the Newly Introduced Round and Tubenose Goby

R/GLF-48, Lupi/Hoehn, Rutherford/Moore, MSU, UM

Ecological and Economic Consequences of Hydropower-Related Watershed Restoration on Salmonid Productivity in Great Lakes Tributaries

R/T-38, Meadows, UM (continuing)

The Relationship Between Great Lakes Water Levels, Wave Energies and Shoreline Damage

R/GM-1, Meadows, UM

Proposed Study of Grand Marais Harbor: A Natural Harbor of Refuge at Grand Marais, Michigan

R/ES-17, Nriagu, UM

Bioregulation of Trace Metals in the Great Lakes

R/T-39, Vlahopoulos, UM

Modeling of Noise from the Propulsion System of a Fishing Boat/Ship and Development of Noise Reduction Techniques

2000

R/GLF-50, Bence, MSU

Developing and Communicating Improved Methods of Fish Stock Assessment

R/T-40, Bernitsas, UM

Reduction of Slow Large Amplitude Motions of Towed/Moored/Anchored Systems

R/ES-18, Ostrom/Ostrom, MSU

Evaluation of the Trophic State of Lakes Michigan and Superior

***R/NIS-6, Parsons, UM**

Ballast Water Treatment and Management: Critical Fluid Systems Design Issues Associated with Automatic Ballast Water Filtration

***R/NIS-3, Perakis, Donahue, UM, GLC**

Economic Impact of Measures to Limit Introduction of Non-Indigenous Species on St. Lawrence Seaway Shipping

***R/NIS-4, Sarnelle, MSU**

Understanding the Influence of Zebra Mussels on Toxic Cyanobacterial Blooms

***R/NIS-5, Zimmerman, Landis, LSSU, MSU**

Habitat Restoration During Biocontrol of Purple Loosestrife

2001

M/PD-1, Coon, MSU

Effects of Habitat Characteristics on the Distribution, Growth, and Survival of Juvenile Fish in the Great Lakes Wetlands

M/PD-2, Faisal, MSU

Prevalence of Mycobacterium spp. in Michigan Great Lakes Fish and Water

R/EP-9, Horan/Lupi, MSU

The Economics of Policy Options for Controlling the Introduction and Spread of ANS in the Great Lakes

R/CW-16, Kaplowitz/Lupi/Hoehn, MSU

Estimating Nonmarket Values for Great Lakes Coastal Wetlands

*ANS or NSI funding



Round Goby

R/EM-7, Meadows, UM

An Environmental Monitoring Network for Lake St. Clair

R/CW-15, Neely, Sinsabaugh, EMU, UT

Sedimentation and Emergent Plant Decay in Coastal Wetlands

M/PD-6, Sutton, Purdue

Overwinter Mortality of age-0 Lake Herring in Relation to body Size, Physiological Condition, and Water Temperature

R/ER-18, Wells-Budd/Kerfoot/Green, Chen, MTU, Univ of Georgia

Ecosystems Mosaics: Modeling Pattern and Process Using Remote Sensed Imagery

R/GLF-51, Webb/Diana, UM

Effects of Great Lakes Marsh Fragmentation of Fish Assemblages

***R/NIS-7, Jude, UM**

Impact, Barriers, and Control of Round and Tubenose Gobies in the Great Lakes

***R/NIS-8, Parsons, UM**

Ballast Water Treatment and Management: A Paradigm Shift in Ballasting: The Possibility of a Ballast-Free Ship

2003

R/ME-3, Adlerstein/Rutherford, UM

Impact on Exotic Species and Nutrient Decline on Fish Community Structure and Food Web Linkages in Saginaw Bay, Lake Huron

R/EP-10, Cangelosi, NEMW

Great Lakes Restoration Plan

***R/NIS-12, Donahue, GLC**

A Collaborative Approach to Advance Implementation of State Management Plans for Prevention and Control of ANS in the Great Lakes Region

***R/NIS-13, Faisal, MSU**

Identification of Diseases and Host Defense Mechanisms in the Zebra Mussel (*Dreissena polymorpha*)

R/ZM-10, Faisal/Coussens, MSU

Identification of Adhesion Molecules in the Zebra Mussel (*Dreissena polymorpha*)

***R/NIS-11, Faisal, MSU**

The Use of Cdna Microarrays to Identify Genes Involved in the Immunotoxicity of Benz(a)pyrene in the Rainbow Trout

R/ME-4, Jude, UM

The Impact of the Diporeia Decline on the Competitive Interactions and Distributions of Slimy and Deepwater Sculpins in Lake Michigan

R/ES-20, Lewis, Kettering University

An Evaluation of Seasonal and Temporal Variability in Potential trace Metal Remobilization in Coastal Wetlands Sediments Using Voltametric Microelectrode Technology and Solid Phase Extraction Techniques

M/PD-11, Mingus/Nanzer, WMU

Great Lakes Stewardship and Ownership

***R/NIS-10, Nwogu, UM**

Ship Induced Wave Effects in Rivers and Estuaries

***R/NIS-9, Parsons, UM**

Computational Fluid Dynamics Study of Ballast Exchange Effectiveness and Improved Ballast Tank Designs

M/PD-10, Rose, MSU

Water Quality and Public Health Risks in the Great Lakes

M/PD-16, Sarnelle, MSU

Complex Interactions Between Zebra Mussels and Phytoplankton: Variation in Grazing Effects Across the Trophic Gradient

R/FP-2, Scribner, MSU

Spatial Genetic Structuring of Forage Fish in the Upper Great Lakes

*ANS or NSI funding

Journal Articles, Book Chapters, Proceedings

Aquatic Nuisance Species Research

- Carman, S.M., Janssen, J., Jude, D.J., and Berg, M.B. 2003. Diet and feeding behavior of round gobies in a zebra mussel-free river, the Flint River, Michigan. *Canadian Journal of Fisheries and Aquatic Science* (in preparation).
- Carman, S. 2002. A diet study of the round goby in the Flint River, Michigan. MS thesis. Loyola University, Chicago, Ill. 54 pp.
- Charlebois, P., L. Corkum, D. Jude, and C. Knight. 2001. The round goby (*Neogobius melanostomus*) invasion: current research and future needs. *Journal of Great Lakes Research* 27:263-266.
- Charlebois, P. 2002. *PCBs in Gobies*, edited by Berg, M., Jude, D.J., and Janssen, J. Brochure. Environmental Protection Agency.
- Clapp, D., P. Schneeberger, D. Jude, G. Madison, and C. Pistis. 2001. Monitoring round goby (*Neogobius melanostomus*) population expansion in eastern and northern Lake Michigan. *Journal of Great Lakes Research* 27:335-341.
- French, J.R. III and D. Jude. 2001. Diets and diet overlap of nonindigenous gobies and small benthic native fishes co-inhabiting the St. Clair River, Michigan. *Journal of Great Lakes Research*. 27:300-311.
- Hanari, N., K. Kannan, Y. Horii, S. Taniyasu N. Yamashita, D. Jude and M. Berg. 2004. Polychlorinated naphthalenes and polychlorinated biphenyls in benthic organisms of a Great Lakes food chain. *Arch. Envir. Contam. Tox.* 47:84-93. Environmental Protection Agency.
- Horan, R.D., C. Perrings, F. Lupi, and E. Bulte. 2002. Biological pollution prevention strategies under ignorance: The case of invasive species. *American Journal of Agricultural Economics* 84:1303-1310.
- Horan, R.D., and F. Lupi. 2002. Tradable risk permits to prevent future introductions of alien invasive species into the Great Lakes. *Ecological Economics*.
- Horan, R.D., and F. Lupi. 2003b. Economic incentives for controlling trade-related biological invasions in the Great Lakes. *Agricultural and Resource Economics Review* (in review).
- Janssen, J. and D. J. Jude. 2001. Recruitment failure of mottled sculpin *Cottus bairdi* in southern Lake Michigan induced by the newly introduced round goby *Neogobius melanostomus*. *Journal of Great Lakes Research* 27:319-328.
- Jude, D. J. and S. Hensler. 2001. First records of a fish species, the ghost shiner *Notropis buchanani*, in Michigan. *Michigan Academician* 33:253-260.
- Jude, D. J. 2001. Round and tubenose gobies: 10 years with the latest Great Lakes phantom menace. *Dreissena: The Digest of the National Aquatic Nuisance Species Clearinghouse* 11(4): 1-14.
- Jude, D. J. and J. Leach. "Fish management in the Great Lakes" (revised), Chapter 23, pp. 623-664 in *Fisheries Management in North America*, edited by C. Kohler and W. Hubert. American Fisheries Society, Bethesda, Maryland. 1999.
- Jude, D.J., Janssen, J., and Stoermer, E. "Lake Michigan's non-indigenous species: Marination and homogenization" in *The Lake Michigan Ecosystem*, edited by M. Munawar (submitted).
- Jude, D. "The impact of round (*Neogobius Melanostomus*) and tubenose (*Proterorhinus Marmoratus*) gobies on Great Lakes native species" in workshop proceedings, Borok, Russia.
- Jude, D. J., J. Janssen, and E. Stoermer. "The uncoupling of trophic food webs by invasive species in Lake Michigan" in *The State of Lake Michigan*, edited by M. Munawar and T. Edsall. Ecovision World Monograph Series, S. P. B. Academic Publishing, The Netherlands (in press).
- Jude, D. J., D. Albert, D. Uzarski, and J. Brazner. "Lake Michigan's coastal wetlands: distribution, biological components with emphasis on fish, and threats" in *The State of Lake Michigan*, edited by M. Munawar and T. Edsall. Ecovision World Monograph Series, S. P. B. Academic Publishing, The Netherlands (in press).

- Lupi, F., and R.D. Horan. 2003. "Tradable risk permits and incentives to prevent invasive species introductions in the Great Lakes" in *Economics of Detection and Control of Invasive Species*. Workshop proceedings. North Dakota State University, Center for Agricultural Policy and Trade Studies, Fargo, ND (in press).
- Madenjian, C., G. Fahnenstiel, T. Johengen, T. Nalepa, H. Vanderploeg, G. Fleischer, P. Schneeberger, D. Benjamin, E. Smith, J. Bence, E. Rutherford, D. Lavis, D. Robertson, D. Jude, and M. Ebner. 2002. Dynamics of the Lake Michigan food web, 1970-2000. *Canadian Journal of Fisheries and Aquatic Science* 59:736-753.
- Perakis, A.N. and Zhiyong Yang. 2002. An evaluation of the economic impact of proposed non-indigenous species control measures for the St. Lawrence Seaway using multi-attribute decision theory. *European Journal of Operation Research* (submitted).
- Raikow, D. F., A. E. Wilson, O. Sarnelle and S. K. Hamilton. 2004. Exotic zebra mussels promote dominance of the noxious cyanobacterium *Microcystis aeruginosa* in low nutrient lakes. *Limnology and Oceanography* 49:482-487.
- Sarnelle, O., Wilson, A.E., Hamilton, S.K., Knoll, L.B., and Raikow D.E. Complex interactions between exotic zebra mussels and the noxious phytoplankter, *Microcystis aeruginosa*. *Limnology and Oceanography* (submitted).
- Savino, J., D. Jude, and M. Kostich. 2001. Use of electrical barriers to deter movement of round goby. *American Fisheries Society Symposium* 26:171-182.
- Vanderploeg, H. A., T. F. Nalepa, D. J. Jude, Edward L. Mills, Kristen T. Holeck, James R. Liebig, Igor A. Grigorovich, and Henn Ojaveer. 2002. Dispersal and emerging ecological impacts of Ponto-Caspian species in the Laurentian Great Lakes. *Canadian Journal of Fisheries and Aquatic Science* 59:1209-1228.
- Wilson, A. E. and O. Sarnelle. 2002. Relationship between zebra mussel biomass and total phosphorus in European and North American lakes. *Archiv für Hydrobiologie* 153:339-351.
- Adams, J.V., Bergstedt, R.A., Christie, G.C., Cuddy, D.W., Fodale, M.F., Heinrich, J.W., Jones, M.L., McDonald, R.B., Mullett, K.M., and Young, R.J. 2003. Assessing assessment: can the expected effects of the St. Marys River sea lamprey control strategy be detected? *Journal of Great Lakes Research* 29 (Supplement 1): 717-727.
- Benajmin, D.M. and Bence, J.R. Spatial and temporal changes in the Lake Michigan Chinook salmon fishery, 1985-1996. Michigan Department of Natural Resources, Fisheries Division, *Fisheries Research Report* (in press).
- Benajmin, D.M. and Bence, J.R. Statistical catch-at-age assessment of Chinook salmon in Lake Michigan, 1985-1996. Michigan Department of Natural Resources, Fisheries Division, *Fisheries Research Report* (in press).
- Bence, J.R., and Smith, K.D. "An Overview of Recreational Fisheries of the Great Lakes," in *Great Lakes Fisheries Policy and Management: A Binational Perspective*, edited by W.W. Taylor and P. Ferri. Michigan State University Press. 1999, pp. 259-306.
- Ebener, M.P., J.R. Bence, K. Newman and P. Schneeberger. *An overview of the application of statistical catch-at-age models to assess lake whitefish stocks in the 1836 treaty-ceded waters of the upper Great Lakes*. Great Lakes Fishery Commission Tech. Rep. 66 (in press).
- Faisal, M., Elsayed, E.E., Fitzgerald, S. Identification of a novel *Mycobacterium* sp. pathogenic to largemouth bass (*Micropterus salmoides*). *Journal of Emerging Diseases* (in preparation).
- Haeseker, S.L., Jones, M.L., and Bence, J.R. 2003. Estimating uncertainty in the stock-recruit relationship for St. Marys River sea lamprey. *Journal of Great Lakes Research* 29 (Supplement 1): 728-741.
- Hayes, D.B., B. Thompson, J. Bence and T. Kwak. "Biomass, Density and Yield Estimators," in *Analysis and Interpretation of Freshwater Fisheries Data*, edited by Michael Brown and Christopher Guy. American Fisheries Society Special Publication (submitted).
- Hayes, D. B. "Issues Affecting Fish Habitat in the Great Lakes Basin," in *Great Lakes Fisheries Policy and Management: A Binational Perspective*, edited by W.W. Taylor and P. Ferri. Michigan State University Press. 1999, pp. 209-238.

APPENDIX G

- Jones, M.L. and S.L. Haeseker. 2001. Application of decision analysis to Great Lakes sea lamprey management. Completion report to Great Lakes Fishery Commission. 26 pp.
- Jones, M.L. 2001. "Managing Salmonine Stocking Programs in the Great Lakes: Balancing Ecological Risks and Social Preferences," in *Taking Stock of Our Future. Great Lakes United Conference Proceedings*, edited by J. Nalbome and E.L. Michael. Dec 5, 1999. Buffalo, NY, pp. 79-101
- Krause, A.E., Hayes, D.B., Bence, J.R., Madenjian, C.P. and Stedman, R.M. Temporal and spatial patterns in age abundance of bloater and alewife in Lake Michigan: a model-based approach incorporating correlated errors. *Transactions of the American Fisheries Society* (in review).
- Krause, A.E., Hayes, D.B., Bence, J.R., Madenjian, C.P., and Stedman, R.M. 2002. Measurement variability in nine Lake Michigan fish species. *Journal of Great Lakes Research* 28: 44-51.
- Madenjian, C.P., Fahnenstiel, G L., Johengen, T.H., Nalepa, T.F., Vanderploeg, H.A., Fleischer, G.W., Schneeberger, P.J., Benjamin, D.M., Smith, E.B., Bence, J.R., Rutherford, E.S., Lavis, D.S., Robertson, D.M., Jude, D.J., and Ebener, M.P. 2002. Dynamics of the Lake Michigan food web, 1970-2000. *Canadian Journal of Fisheries and Aquatic Science* 59:736-753.
- Omair, M. Vanderploeg, H., Jude, D.J., and Fahnenstiel, G. 1999. First observations of tumor-like abnormalities (exophytic lesions) on Great Lakes Zooplankton. *Canadian Journal of Fisheries and Aquatic Science* 56:1711-1715.
- Omair, M., Naylor, B., Jude, D., Quddus, J., Beals, T., and Vanderploeg, H. 1999. A morphologic analysis of exophytic lesions of zooplankton. *Invertebrate Pathology* 77(2): 108-113.
- Pangle, K.L., Sutton, T.M., and Brown, P.B. 2003. Evaluation of practical and natural diets for juvenile lake herring. *North American Journal of Aquaculture* 65:91-98.
- Pangle, K.L., Sutton, T.M., Kinnunen, R.E., and Hoff, M.H. Overwinter survival of age-0 lake herring in relation to body size, physiological condition, energy stores, and food ration. *Transactions of the American Fisheries Society* (in review).
- Pangle, K.L., and Sutton, T.M. Temporal changes in the relationship between body condition and proximate composition of juvenile lake herring. *Journal of Fish Biology* (in preparation).
- Pangle, K.L., Sutton, T.M., Kinnunen, R.E., and Hoff, M.H. Effects of body size, physiological condition, and lipid content on the thermal tolerance of lake herring. *Journal of Great Lakes Research* (in preparation).
- Radomski, P., T.J. Quinn II, and J.R. Bence. Comparison of virtual population analysis and statistical kill-at-age analysis for a recreational kill-dominated fishery. *Canadian Journal of Fisheries and Aquatic Science* (in revision).
- Roseman, E. F., Taylor, W.W., Hayes, D.B., Haas, R.C., Davies, D.H., and Mackie, S.D. Physical processes influencing early life stages of walleye in western Lake Erie, in *Proceedings of 1998 Wakefield Symposium*, Anchorage AK (submitted).
- Roseman, E. F., W. W. Taylor, D. B. Hayes, J. Fofrich, Sr., and R. L. Knight. 2002. Evidence of walleye spawning in Maumee Bay, Lake Erie. *Ohio Journal of Science* 102:51-55.
- Roseman, E.F., W.W. Taylor, D.B. Hayes, R.L. Knight, and R.C. Haas. 2001. Removal of walleye eggs from reefs in western Lake Erie by a catastrophic storm. *Transactions of the American Fisheries Society* 130:341-346.
- Roseman, E.F., W.W. Taylor, D.B. Hayes, R.C. Haas, D.H. Davies, and S.D. Mackey. 1999. "Influence of Physical Processes on the Early Life History Stages of Walleye (*Stizostedion vitreum*) in Western Lake Erie," in *Ecosystem Approaches for Fisheries Management*. University of Alaska Sea Grant, AK-SG-99-01, Fairbanks, pp. 43-54.
- Roseman, E.F., W.W. Taylor, D.B. Hayes, R.L. Knight, and R.C. Haas. 1999. The demise and rehabilitation of walleye in Lake Erie, in *Sustainable Lake Management: Proceedings of the Eighth International Conference on the Conservation and Management of Lakes*, Volume 2: S15B-11.
- Roseman, E. F., W. W. Taylor, D. B. Hayes, R. C. Haas, R. L. Knight, and K. O. Paxton. 1996. Walleye egg deposition and survival on reefs in western Lake Erie (USA). *Annales Zoologici Fennici* 33:341-351

- Stewart-Oaten, A. and Bence, J.R. 2001. Temporal and spatial variation in environmental assessment. *Ecological Monographs* 71:305-339
- Szalai, E., Fleischer, G. and Bence, J.R. Modeling time-varying growth using a generalized von Bertalanffy model with application to bloater (*Coregonus hoyi*) growth dynamics in Lake Michigan. *Canadian Journal of Fisheries and Aquatic Science* (in review).
- Taylor, W.W., D.B. Hayes, C.P. Ferreri, K.D. Lynch, K.R. Newman, and E.F. Roseman. 2002. "Integrating Landscape Ecology into Fisheries Management: A Rationale and Practical Considerations," in *Integrating Landscape Ecology into Natural Resource Management*, edited by J. Liu and W. W. Taylor. Cambridge University Press, Cambridge, England. pp. 366-389.
- Ward, C., Eshenroder, R.L., and Bence, J.R. 2000. Relative abundance of lake trout and burbot in the main basin of Lake Michigan in the early 1930s. *Transactions of the American Fishery Society* 129: 282-295.
- ### Marine Engineering Research
- Borlase, G.A., N. Vlahopoulos. An energy finite element optimization process for reducing high frequency vibration in large scale structures. *Journal of Finite Element Analysis and Design*, Vol. 36, 2000, pp. 51-67.
- El-Asmer, W. and O. Nwogu. 2004. Finite volume solution of the Boussinesq equations on an unstructured grid. *Journal of Computational Physics* (in preparation).
- Jiang, C., Troesch, A.W., and Shaw, S.S. Global stability analysis for a time-varying dynamic system under random excitation. Theme Issue on Nonlinear Dynamics of Ships, *Philosophical Transactions of the Royal Society*, London. June 15, 2000
- Kent, C. P. and Parsons, M. G. Computational fluid dynamics study of the effectiveness of flow-through ballast exchange. *Transactions of the Society of Naval Architects and Marine Engineers*, Vol. 112, 2004 (accepted for publication).
- Kim, B.K. and M. M. Bernitsas. 2001. Nonlinear dynamics and stability of spread mooring with riser. *Applied Ocean Research*, Vol. 23. No. 2, pp. 111-123.
- Kotinis, M., Parsons, M.G., Lamb, T. and Sirviente, A., Development and investigation of the ballast-free ship concept. *Transactions of the Society of Naval Architects and Marine Engineers*, Vol. 112, 2004 (accepted for publication).
- Matsuura, J. P. J., M. M. Bernitsas, L. O. Garza-Rios, and K. Nishimoto. 2002. Sensitivity and robustness of hydrodynamic mooring models. *Journal of Offshore Mechanics and Arctic Engineering*, ASME Transactions, Vol. 124, pp. 179-189.
- Nwogu, O. and T. Gourlay 2004. Turbulent bores generated by high-speed vessels in shallow confined channels. *Journal of Fluid Mechanics* (in preparation).
- Nwogu, O. and G. Meadows 2004. Sediment suspension by deep-draft vessels in confined waterways. *ASCE Journal of Hydraulic Engineering* (in preparation).
- Nwogu, O. 2004. On waves generated by high-speed vessels in shallow water. *Journal of Ship Research* (in preparation).
- Obar, M., Lee, Y.-W. and Troesch, A.W. An experimental investigation into the effects initial conditions and water on deck have on a three degree of freedom capsize model, in *Proceedings, 5th International Workshop on the Stability and Operational Safety of Ships*, University of Trieste, ITALY, September, 2001.
- Parsons, Michael G. 2002. Systems considerations in the design of the primary treatment for ballast systems. *Marine Technology*. (February.)
- Simos, D. N., G. P. Pesce, M. M. Bernitsas and S. B. Cohen. 2002. Hydrodynamic model induced differences in SPM post-pitchfork bifurcation paths. *Journal of Offshore Mechanics and Arctic Engineering*, ASME Transactions, Vol. 124, pp. 174-178.
- ### Coastal Wetlands Research
- Ammonette, R. et al. Diversity, redundancy, and efficiency in the microbial decomposition of *Typha* litter. *Freshwater Biology* (in preparation).
- Dempsey, D., and M.D. Kaplowitz. 2002. The persistence of local wetland ordinances in Michigan. *Michigan Environmental Law Review*. 19:18-23 (January).
- Hoehn, J.P., F. Lupi, and M.D. Kaplowitz. 2003. Untying a Lancastrian bundle: ecosystem valuation for wetland mitigation." *Journal of Environmental Management*. 68(3):263-272.
- Kaplowitz, M.D. and S.G. Witter. 2002. Identifying water security issues at the local level. *Water International*. 27(3):387-394 (September).

- Kaplowitz, M.D., F. Lupi, and J.P. Hoehn. 2004. "Multiple- Methods for Developing and Evaluating a Stated Choice Survey to Value Wetlands," in *Methods for Testing and Evaluating Survey Questionnaire*, edited by S. Pressor, J. M. Rothgeb, M.P. Couper, J.T. Lessler, E. Martin, J. Martin, and E. Singer. Hoboken, NJ: John Wiley and Sons, pp. 503-524.
- Kaplowitz, M.D. and J. Kerr. 2003. Michigan residents' perceptions of wetlands and mitigation. *Wetlands*. 23(2): 267-277.
- Landis, D.A., Sebolt, D., Haas, M. and M. Klepinger. 2003. Establishment and impact of *Galerucella californiensis* L. (Coleoptera: Chrysomelidae) on *Lythrum salicaria* L. and associated plant communities in Michigan. *Biological Control* 28:78-91.
- Lupi, F., M.D. Kaplowitz, and J.P. Hoehn. 2002. The economic equivalency of drained and restored wetlands in Michigan, *American Journal of Agricultural Economics*. 84(5) December: 1355-1361.

Natural Resource Economics

- Jones, Carol A., and Frank Lupi. Winter. 1999. The effect of modeling substitute activities on recreational benefit estimates. *Marine Resource Economics*, 14(4).
- Lupi, Frank., A tale of tails: the role of choice occasions in repeated-logit demand models, *Journal of Agricultural and Resource Economics* (in review).
- Lupi, Frank, and Peter M. Feather. 1998. Using partial site aggregation to reduce bias in random utility travel cost models. *Water Resources Research*, 34(12):3595-3603.
- Moore, M.R., E.B. Maclin, and D.W. Kershner. 2001. Testing theories of agency behavior: evidence from hydropower relicensing decisions of the Federal Energy Regulatory Commission. *Land Economics*, Vol. 77, No. 3, pp. 423-442.
- Moore, Michael R., Elizabeth B. Maclin, and David Kershner. Testing theories of agency behavior: evidence from hydropower project relicensing decisions of the Federal Energy Regulatory Commission. *Journal of Environmental Economics and Management* (in review).

Trophic Change Research

- Bogdan, J.J., J.W. Budd, and K.C. Hornbuckle. 2002. The effect of a large resuspension event in southern Lake Michigan on the short-term cycling of organic contaminants. *Journal of Great Lakes Research* 28 (3): 338-351.
- Budd, J.W., W.C. Kerfoot, A.N. Pilant, L.M. Jipping. 1999. The Keweenaw current and ice rafting: use of satellite imagery to investigate copper-rich particle dispersal. *Journal of Great Lakes Research*, 25(3): 642-662.
- Budd, J.W., A.M. Beeton, D.A. Culver, W.C. Kerfoot, and R.P. Stumpf. 2001. Satellite observations of *Microcystis* blooms in western Lake Erie, *Verh. Internat. Verein. Limnol.* 27:3787-3793.
- Budd, J.W., T.D. Drummer, G.L. Fahnenstiel, T. Nalepa. 2001. Remote sensing of biotic effects: Zebra mussels (*Dreissena polymorpha*) influence on water clarity in Saginaw Bay, *Limnol. Ocean.* 46(2): 213-223.
- Budd, J.W. and D.S. Warrington. Temporal-spatial evolution of a productive southern shore corridor in the Keweenaw region of Lake Superior, *Journal of Great Lakes Research* (in final review).
- Chen, C., Ralph, S.A. Green, J.W. Budd and F.Y. Zhang. 2001. Prognostic modeling studies of the Keweenaw current in L. Superior. part I: formation and evolution. *J. Phys. Ocean.* 31: 379-395.
- Chen, C., L. Wang, Ji. R, D. J. Schwab, D. Beletsky, J. W. Budd, G. L. Fahnenstiel, B. Eadies and H. Vanderploeg. 2004. Impacts of suspended sediment on the ecosystem in Lake Michigan: a comparison between the 1998 and 1999 plume events. *Journal of Geophysical Research*, Vol. 109, No. C10.
- Chen, C., R. Ji., D. J. Schwab, D. Beletsky, G. L. Fahnenstiel, T. H. Johengen, H. Vanderploeg, M. Jiang, B. Eadie, M. Bundy, W. Gardner, J. Cotner, P. J. Lavrentyev. 2002. A model study of the coupled biological and physical dynamics in Lake Michigan. *Ecological Modelling*, 152: 150-168.
- Churchill, J.H., E.A. Ralph, A.M. Cates, J.W. Budd, N.R. Urban. 2003. Observations of a negatively buoyant river plume in a large lake. *Limnol. Ocean.* 48 (2): 884-894

- Diehl, S.F., J.W. Budd, D. Ullman, J-F Cayula. 2002. Geographic window sizes applied to remote sensing sea surface temperature front detection. *J. Atmos. Ocean. Tech.* 19: 1105- 1113.
- Ji, R., C. Chen, J.W. Budd, D.J. Schwab, D. Beletsky, G.L. Fahnenstiel, T.H. Johengen, H. Vanderploeg, B.J. Eadie, M. Bundy. 2002. Influence of suspended sediments on the ecosystem in Lake Michigan: A 3-D coupled bio-physical modeling experiment. *Ecol. Model* (in final review).
- Li, Hanyi, J.W. Budd, S.A. Green. Evaluation and Regional Optimization of Satellite-based Chlorophyll-a Algorithms for Lake Superior,. *Journal of Great Lakes Research* (in final review).
- McGervey E., P.H. Ostrom, N.E. Ostrom, J. Jeremaison and J.E. Baker. 1999. Seasonal variation in the biogeochemical cycling of seston in Grand Traverse Bay, Lake Michigan. *Organic Geochemistry.* 30: 1543-1557.
- Ostrom N.E., A. Macrellis and P.H. Ostrom. The response of nutrient cycling in Grand Traverse Bay to climate change. Grand Traverse Bay Watershed Initiative *State of the Bay Report, 2000.*
- Roberts B.J., T.G. Owens, N.E. Ostrom, and R. W. Howarth. Ecosystem respiration rates are not constant over diel cycles: direct quantification using dissolved oxygen concentration and isotopic composition in experimental ponds. *Limnology and Oceanography* (in review).
- Russ M.E., N.E. Ostrom, H. Gandhi, P.H. Ostrom and N.R. Urban. 2004. Temporal and spatial variations in R: P ratios in Lake Superior, an oligotrophic freshwater environment. *Journal of Geophysical Research – Oceans.* Vol. 109, No. C10.
- Uehara T. and N.E. Ostrom. Seiches in Grand Traverse Bay. Grand Traverse Bay Watershed Initiative *State of the Bay Report, 2000.*
- Zhu, J., C. Chen, E. Ralph, S.A. Green, J.W. Budd, F.Y. Zhang. 2001. Prognostic modeling studies of the Keweenaw Current in L. Superior. Part II: simulation, *J. Phys. Ocean.* 31: 396- 410.

Coastal Processes and Environmental Monitoring

- Meadows, G. July 2001. *An Environmental Monitoring Network for Lake St. Clair*, Progress Report, Ocean Engineering Laboratory Report.
- Meadows, G. Aug. 2000. *Blossom Heath Harbor, USCG Station St. Clair Shores Harbor Entrance Study.* Ocean Engineering Laboratory Report No. OEL-0003.

University of Michigan Great Lakes Symposium: Our Challenging Future

www.miseagrant.umich.edu/symposium/papers.html, series of White Papers, PDF documents, published online by Michigan Sea Grant, 2002.

- Aquatic Nuisance Species*, Jude.
- Diversion and Consumptive Uses*, Wright.
- Great Lakes Community Health*, Nriagu.
- Great Lakes Fisheries*, Clark.
- Great Lakes Sediment*, Adriaens.
- Great Lakes Sustainable Development*, Norton, Gerber.
- Great Lakes Ecological History*, Smith, O'Shea.
- Impacts of Climate Change*, Meyers.
- Nonpoint Source Contaminants*, Samson, Gladwin.
- Nutrient Loading and its Relevance to the Great Lakes Basin*, Allan.

U.S. Patent

- Parsons, Michael G. 2004. Ballast Free Ship System. U.S. Patent #6694908. U.S. Patent and Trademark Office, Washington, DC

APPENDIX H

Students Supported: Graduate, Undergraduate and Fellows

Year	(99-00)	(00-01)	(01-02)	(02-03)	(03-04)	Totals
Undergraduate	3	11	30	16	24	84
Graduate	11	11	28	17	15	82
Knauss Fellows	-	2	1	2	-	5
Coastal Management Fellows	-	-	1	-	-	1
Great Lakes Commission & Sea Grant Fellows	-	-	-	-	1	1
Totals	14	24	60	35	40	173

Michigan Sea Grant Fellows 1999 – 2003

Knauss Fellowships

2000, Allen Hance, (UM), U.S. Rep. Ron Kind (D-WI)

2000, Emily Lindow, (UM), Senate Commerce Committee, Subcommittee on Oceans and Fisheries - Republican side

2001, Laura Cimo, (UM), Upper Mississippi River Congressional Task Force

2002, Megan Agy, (UM), U.S. Rep. Frank Pallone, Jr. (D-NJ)

2002, Kristine Lynch, (MSU), Senate Subcommittee on Oceans, Atmosphere, and Fisheries, Minority

NOAA Coastal Management Fellowship Program

2002, Ruby Papp, (UM), San Francisco Bay Conservation and Development Commission

Great Lakes Commission-Sea Grant Fellowship

2003, Jon Dettling, (UM)

Dissertations and Theses

- Amonette, Rachael. 2002. Diversity, redundancy, and efficiency in the microbial decomposition of *Typha* litter. M.S. thesis. University of Toledo.
- Field, A.L. 2004. Seasonal variation in ratios of community respiration to gross photosynthesis determined by stable isotopes and concentrations of dissolved oxygen in Grand Traverse Bay, Lake Michigan. M.S. thesis, Michigan State University, 43 pp.
- Godby, Neil. 2000. Growth, diet and prey availability for juvenile steelhead in the Muskegon River and Bigelow Creek, Michigan. M.S. thesis. University of Michigan.
- Haeseker, S.L. 2001. Incorporating uncertainty into St. Marys River sea lamprey management through decision analysis. Ph.D. dissertation. Michigan State University. 121 pp.
- Haibo, Wan. 2003. Time-space variability of diatoms in southern Lake Michigan based on geographic information systems analysis. M.S. thesis. Michigan Technological University.
- Holland, Stephen. 1999. Set-up costs and capacity constraints in the theory of natural resource extraction. Ph.D. dissertation. University of Michigan.
- Horne, Bradley. 2002. Simulating effects of hydro-dam alteration on thermal regime and wild steelhead recruitment in the Manistee River. Ph.D. dissertation. University of Michigan.
- Jacobus, Jennifer. Expected Fall 2004. Habitat fragmentation in aquatic ecosystems: A study of boundaries, area, dispersal and behavior of fishes in coastal marshes. Ph.D. dissertation. University of Michigan.
- Jones, Tracy. Expected Fall 2004. Distributions of *Orconectes virilis* and *O. rusticus*, an invasive species, among the bays of Les Cheneaux in northern Lake Huron. M.S. thesis. University of Michigan.
- Kotchen, Matthew. 2003. Green markets and conservation behavior: theoretical and empirical essays on private provision of environmental public goods. Ph.D. dissertation. University of Michigan.
- Li, Hanyi. Ph.D. 2004. Satellite-based seasonal and interannual primary productivity estimates in the Great Lakes. Michigan Technological University.
- Matsuura, J.P. 2003. Station Keeping of Ships Based on Nonlinear Slow Motion Dynamics. Ph.D. dissertation. University of Michigan.
- Osterberg, David. J. 2003. Spatial distribution of zooplankton in Lake Superior's Keweenaw current, M.S. thesis. Michigan Technological University.
- Ray, Lisa Jane. May 2004. Forage fish distributions among the bays of Les Cheneaux in northern Lake Huron. Undergraduate honors thesis. University of Michigan.
- Roberts, B.J. 2004. Assessing diel respiration in pelagic ecosystems using oxygen stable isotopes: when do the highest rates occur and who is respiring under different light and nutrient regimes? Ph.D. dissertation, Cornell University, 228 pp.
- Russ, M.E. 2003. The ratio of respiration to photosynthesis in Lake Superior and the North Pacific Ocean: evidence from stable isotopes of O₂. Ph.D. dissertation, Michigan State University, 103 pp.
- Smith, Justin. 2004. Response of epiphytic algae on *typha latifolia* detritus to experimental sediment manipulation in L. Erie wetlands. M.S. thesis. Eastern Michigan University.
- Su, Rong. 2004. Microbial dynamics associated with decomposing *Typha latifolia* litter in two Lake Erie coastal wetlands: Effects of sedimentation and hydrology. M.S. thesis. Eastern Michigan University.
- Swank, David. 2004. Life history variation in Great Lakes steelhead. Ph.D. dissertation. University of Michigan.
- Szalai, S.B. 2003. Uncertainty in the population dynamics of alewife (*Alosa pseudoharengus*) and bloater (*Coregonus hoyi*) and its effects on salmonine stocking strategies in Lake Michigan. Ph.D. dissertation. Michigan State University. 198 pp.
- Warolin, Benjamin E. 2003. The economics of aquatic nuisance species prevention in the Great Lakes. Plan B Paper. Michigan State University.
- Wilberg, Michael. Expected. An evaluation of statistical catch-age methods. Ph.D. dissertation. Michigan State University.
- Zhang, Weiguo. 2003. Energy finite element method for vibration analysis of stiffened plates under fluid loading. Ph.D. dissertation. University of Michigan.

Staff and Product Awards 1999-2004

1999

APEX Award of Excellence, Communications Concepts, Inc., for *Discovering Great Lakes Dunes*, Carol Swinehart, communications specialist

Bronze Award, Agricultural Communicators in Education (ACE), for *Discovering Great Lakes Dunes*, Carol Swinehart, communications specialist

Educational Project Award, Board of Certified Entomologists of Mid America, for Purple Loosestrife Project, Mike Klepinger, extension specialist

Employee Development System Individual Award, Michigan State University Extension, for Detroit River American Heritage River Initiative, Mark Breederland, extension agent

Outstanding Educational Program Award, American Distance Education Consortium, for Exotic Species Teacher Day Camp, Steve Stewart and Mike Klepinger, Michigan coordinators

Regional Distinguished Team Award, National Extension Association, North Central Region, Epsilon Sigma Phi, for Coastwatch Web site

Site of the Month (May 1999), Great Lakes Information Network, for Michigan Sea Grant Web site, Devra Polack, Web specialist

2000

Award of Excellence, Sea Grant Advisory Services Association, for HACCP program, Ron Kinnunen, extension agent

APEX Award of Excellence, Communications Concepts Inc., for *upwellings*, Joyce Daniels, editor

APEX Grand Award, Communications Concepts Inc., for Michigan Sea Grant Web site, Devra Polack, Web specialist

Award for Outstanding Program, Great Lakes Sea Grant Network Program Leaders, for Detroit River American Heritage River Initiative, Mark Breederland, extension agent

Award for Outstanding Program, Great Lakes Sea Grant Network Program Leaders, for Exotic Species Teacher Day Camp, Mike Klepinger, Steve Stewart and the Great Lakes Sea Grant Network

2000 Clean Waters Award, Michigan Outdoor Writers Association, for Grand Traverse Bay Watershed Initiative, John McKinney, extension agent

Distinguished Academic Staff Award, Michigan State University: Ron Kinnunen, extension agent

Employee Development System Team Award, Michigan State University Extension, for Exotic Species Teacher Day Camp, Steve Stewart and Mike Klepinger, coordinators

Employee Development System Team Award, Michigan State University Extension, for Grand Traverse Botanical Gardens, John McKinney

Gold Award, Agricultural Communicators in Education (ACE), for *upwellings* Online, Devra Polack, Web specialist and Joyce Daniels, editor

National Team Award, USDA Forest Service, for Mackinac County Water Safety Review Team, Ron Kinnunen, extension agent

2001

APEX Award of Excellence, Communications Concepts, Inc., for *Great Lakes Facts* brochures, Carol Swinehart, communications specialist

Award of Distinction, Grand Traverse Regional Community Foundation, for *Outdoors with your Nature Passport* CD-Rom, John McKinney, extension agent

Award for Outstanding Program, Great Lakes Sea Grant Network Program Leaders, for HACCP, Ron Kinnunen, extension agent

Diversity Award, Michigan State University Extension, for work with Tribal Fisheries, Ron Kinnunen, extension agent

Employee Development System Individual Award, Michigan State University Extension, for Aquaculture Development, Ron Kinnunen, extension agent

Employee Development System Award, Michigan State University Extension, for Great Lakes Education Program (Wayne County), Steve Stewart, extension agent

Gold Award, Agricultural Communicators in Education (ACE), for Alaska Sea Grant Salmon Migration game, graphic design and illustration, Dave Brenner

John A. Hannah Award for Outstanding Program, Michigan State University Extension, for HACCP, Ron Kinnunen, extension agent

2002

APEX Award of Excellence, Communications Concepts, Inc., for conference program materials, Dave Brenner, designer

APEX Award of Excellence, Communications Concepts, Inc., for feature writing, Joyce Daniels, editor

Award for Innovative Programming (rip currents), Michigan Department of Community Health, for Mackinac County Water Safety Review Team, Ron Kinnunen, extension agent

Distinguished Academic Staff Award, Michigan State University: Chuck Pistis, extension agent

James Hall Award, Michigan Outdoor Writers Association, for *Great Lakes Facts* press kit, Carol Swinehart, communications specialist

Site of the Month (January 2003), Great Lakes Information Network for Michigan Sea Grant Web site, Dave Brenner, Web specialist, Elizabeth LaPorte, communications manager

Special Recognition, Greater Detroit American Heritage River Initiative: Mark Breederland, extension agent

2003

Award for Outstanding Program, Great Lakes Sea Grant Network Program Leaders, for ANS HACCP, Ron Kinnunen and Mike Klepinger, coordinators

Award for Superior Program, Great Lakes Sea Grant Network Program Leaders: Reaching Anglers through Television Programming, Mike Klepinger

Blue Ribbon Award, Sea Grant Week 2003, for Michigan Sea Grant Web site, Dave Brenner, Web specialist, Elizabeth LaPorte, communications director, Joyce Daniels, editor

Blue Ribbon Award, Sea Grant Week 2003, for upwellings, Dave Brenner, designer, Joyce Daniels, editor, Elizabeth LaPorte, communications director

2004

Bronze Award, Association for Communication Excellence in Agriculture, Natural Resources and Life and Human Sciences (ACE), for *The Life of the Lakes: A Guide to the Great Lakes Fishery*, Shari Dann, Brandon Schroeder, authors. Dave Brenner, Joyce Daniels, Elizabeth LaPorte, Carol Swinehart

Bronze Award, Association for Communication Excellence in Agriculture, Natural Resources and Life and Human Sciences (ACE), for *upwellings*, Dave Brenner, designer, Joyce Daniels, editor, Elizabeth LaPorte, communications director

Honorable Mention — Exemplary Team, University of Michigan Dept. of Human Resources, for Michigan Sea Grant Communications: Dave Brenner, Joyce Daniels, Elizabeth LaPorte, Anuja Mudali

Outreach Publications and Products

Michigan Sea Grant staff members produced 118 products and contributed content, editorial review or graphics to an additional 50 products produced by partner organizations, denoted with an asterisk (*).

Books and Booklets

Biological Control of Purple Loosestrife, educator series:

Cooperator's Handbook, Cooperator Essentials, Rearing & Releasing Natural Enemies, Secondary School Activities, Upper Elementary: Teacher's Guide, and Upper Elementary: Student Workbook. Mike Klepinger, Michigan State University Extension, 2001.

Coastal Plants Identification Guide, University of Michigan Press, Ellen Elliott Weatherbee; Elizabeth LaPorte and David Brenner, consultants and contributing photographers (in press).

A Conservation Vision for the Lower Detroit River Ecosystem, Metropolitan Affairs Coalition, Mark Breederland. 2002.*

Discover Our Wild Side: Southeast Michigan, Rich in Water, Wildlife, Heritage and Recreation, Greater Detroit American Heritage River Initiative and the Metropolitan Affairs Coalition, Mark Breederland, 2002.*

Integrated Pest Management for Nuisance Exotics in Michigan Inland Lakes, Michigan State University Extension, Mike Klepinger, 2000.

The Life of the Lakes: A Guide to Great Lakes Fishery, Shari Dann and Brandon Schroeder; edited, designed and produced by David Brenner, Joyce Daniels, Elizabeth LaPorte and Carol Swinehart, Michigan Sea Grant, 2003.

Marine and Aquatic Science Literacy: Educating the 21st Century Workforce, NOAA-National Sea Grant, 2004.*

Reconnecting to the Detroit River, Mark Breederland. Metropolitan Affairs Coalition, 2002.*

Reporting on Risk, Katz, Kamrin and Walter, Michigan Sea Grant, National Sea Grant and The Foundation for American Communications, 1999.

Rivers Uniting Communities, Greater Detroit American Heritage River Initiative, 2002.*

State of the Strait: Status and Trends of the Detroit River Ecosystem Conference, Proceedings, Jennifer Read, John Hartig, University of Windsor, 2001.*

Brochures

Break the Break of the Rip. NOAA-National Weather Service, Elizabeth LaPorte, David Brenner, editing and design. 2004.

Don't Get Trapped. Chuck Pistis, Ron Kinnunen, Dave Brenner, 2002.

Clean Marina Michigan. Elizabeth LaPorte, Joyce Daniels, Dave Brenner, Michigan Sea Grant, Michigan Dept. of Environmental Quality and the Michigan Boating Industries Association, 2003.

Great Lakes Facts: Lake Huron, Lake Erie, Lake Michigan, Lake Ontario, Lake Superior, Great Lakes Basin. Brochure and map series. Carol Swinehart, editor. Michigan Sea Grant. 2000.

Guide for Safe Diving from Recreational and Charter Vessels, U.S. Coast Guard, Michigan Underwater Preserves Council, Ron Kinnunen, 2000.

Michigan Sea Grant Educational Resources. Publications flier. Michigan Sea Grant Communications. 2001.

Protect Our Waters. Michigan Sea Grant and Wisconsin Sea Grant, 2004.

ID Cards

Eurasian Watermilfoil, Minnesota Sea Grant and the Great Lakes Sea Grant Network, 2003.*

European Frogbit, Minnesota Sea Grant and the Great Lakes Sea Grant Network, 2003.*

Hydrilla Hunt, Mike Klepinger, Carol Swinehart, Michigan State University Extension, and Michigan Sea Grant, 2004.

Purple Loosestrife, Michigan Sea Grant and the Great Lakes Sea Grant Network, 2003.

Ruffe, Minnesota Sea Grant and the Great Lakes Sea Grant Network, 2002.*

Round Goby, Minnesota Sea Grant and the Great Lakes Sea Grant Network, 2002.*

Rusty Crayfish, Minnesota Sea Grant and the Great Lakes Sea Grant Network, 2003.*

Spiny & Fishhook Waterflea, Minnesota Sea Grant and the Great Lakes Sea Grant Network, 2003.*

Zebra Mussel, Wisconsin Sea Grant and the Great Lakes Sea Grant Network, 1999.*

Guidebooks and Manuals

Aquatic Nuisance Species - HACCP Manual. Edited by G. Gunderson, Minnesota Sea Grant and Ron Kinnunen, Michigan Sea Grant. 2001.

Clean Marina Program Guidebook, Michigan Sea Grant, Michigan Department of Environmental Quality, Michigan Boating Industries Association (in press 2004).

Great Lakes Fishery Leadership Institute - Curriculum Guide. Elizabeth LaPorte, Dave Brenner and Rochelle Sturtevant, Michigan Sea Grant and the Great Lakes Sea Grant Network, 2003.

Newsletters

Commercial Fishing Newslite, Ronald Kinnunen, editor. Michigan Sea Grant Extension www.miseagrant.umich.edu/pubs/cfn 1999-2001.

Upwellings, Joyce Daniels, editor. Michigan Sea Grant Communications, 1999-present.

Lake Monitoring Programs, 1999.

Tuning in to Low Power Radio, 1999.

Improving Grand Marais Harbor, 1999.

River Revival, 1999.

Dive into History, 2000.

Soft Engineering, 2000.

European Frogbit, 2000.

Michigan Sea Grant: Then and Now, 2000.

Michigan's Urban Coastline, 2001.

New Fisheries Agreement, 2001.

Safety on the Lakes, 2001.

Discovering the Great Lakes, 2002.

Treasures of the Great Lakes, 2002.

Web of Life, 2002.

Marketing Great Lakes Whitefish, 2003.

Coastal Challenge, 2003.

Rip Currents: Be Aware, Swim With Care, 2004.

Posters and Other Products

America's Most Unwanted Aquatic Nuisance Species. Poster. David Brenner, illustration and design. NOAA-National Sea Grant, 2001.

Aquatic Invasive Species Week. Poster. Michigan Dept. of Environmental Quality, Office of the Great Lakes, Elizabeth LaPorte, Michigan Sea Grant, 2004.

Best Management Practices, Joint Sea Grant Program Management. Poster. Elizabeth LaPorte, David Brenner, Michigan Sea Grant, NOAA-National Sea Grant Week, 2002.

Break the Break of the Rip. Beach Signs. NOAA-National Weather Service, David Brenner, 2004.

Education postcard, David Brenner, Joyce Daniels, Michigan Sea Grant, 2004.

Grand Haven postcard, David Brenner, Joyce Daniels, Michigan Sea Grant, 2004.

Great Lakes Wetlands. Poster. Walter Hoagman, David Brenner, Elizabeth LaPorte, Joyce Daniels Michigan Sea Grant, 2002.

Life of the Lakes Ecosystem. Poster. David Brenner, Elizabeth LaPorte, Joyce Daniels, Carol Swinehart, Michigan Sea Grant, 2002.

Stop Aquatic Hitchhikers! Sticker. Great Lakes Sea Grant Network and the U.S. Fish and Wildlife Service, 2003.

Where Land Meets Water. Poster. Jennifer Read, Elizabeth LaPorte, Dave Brenner, Gary Overmeier, Michigan Sea Grant and the Great Lakes Commission, 2003.

E.S.C.A.P.E. Educator's Compendium, Illinois-Indiana Sea Grant and the Great Lakes Sea Grant Network, 2003.*

Life of the Lakes postcard, David Brenner, Joyce Daniels, Michigan Sea Grant, 2004.

Sand Dunes postcard, David Brenner, Joyce Daniels, Michigan Sea Grant, 2004.

Aquatic Invasive Species bookmark, Joyce Daniels, Elizabeth LaPorte, Dave Brenner, Michigan Sea Grant, 2004.

Technical Reports

American Heritage River Progress Report, Greater Detroit American Heritage River, 2002.*

Aquatic Nuisance Species Found at Isle Royale, Ron Kinnunen, Michigan Sea Grant, 2003.

Building the Riverfront Greenway: The State of Greenway Investments Along the Detroit River, Metropolitan Affairs Coalition, 2001.*

CoastWatch Updates to Computer-automated Translation of Satellite Data, Carol Swinehart, Elizabeth LaPorte and David Brenner, Michigan Sea Grant and Michigan State University Extension, 2004.

Environmental Strategies for Aquaculture, North Central Regional Aquaculture Center, Ron Kinnunen, 2001.

APPENDIX H

Great Lakes Commercial Fisheries, Great Lakes Fisheries Leadership Institute, Ron Kinnunen, 2003.

Great Lakes Fishery Agencies, Great Lakes Fisheries Leadership Institute, Carol Swinehart, Michigan Sea Grant, 2003.

Hurricane Mitch, Nicaragua Aquaculture Project Report, edited by Joyce Daniels and Elizabeth LaPorte. Florida Sea Grant and Michigan Sea Grant, 2001.

Improving Salmonid Aquaculture in the North Central Region, North Central Regional Aquaculture Center, Ron Kinnunen, 2000.

Institutional Arrangements for Great Lakes Fisheries Management, Great Lakes Fisheries Leadership Institute, Jennifer Read, Michigan Sea Grant, 2003.

Marketing of Hybrid Walleye and Sunfish, Ron Kinnunen, Michigan Sea Grant, 2000.

Michigan Charterboat Industry Study, Chuck Pistis, Michigan Sea Grant, 2002.

Michigan's Great Lakes Charter Fishing Industry, Great Lakes Fisheries Leadership Institute, Chuck Pistis, Michigan Sea Grant, 2003.

Recent Greenway Developments Along the Detroit River Corridor, Mark Brederland, Michigan Sea Grant, Metropolitan Affairs Coalition, 2001.*

Safe Harvest and Disposal of Aquatic Weeds to Prevent the Spread of Zebra Mussels, Eurasian Watermilfoil and other Exotic Species, Mike Klepinger, Michigan Sea Grant, 2000.

Status of Planning and Zoning in Michigan's Great Lakes Shoreline Communities, Mike Klepinger, edited by Joyce Daniels, Michigan Sea Grant, 2003.

Sea Grant Program Reports and Materials

Media Guidelines Policy Report, Elizabeth LaPorte, Michigan Sea Grant, 2003.

Michigan Sea Grant Annual Report. Michigan Sea Grant Communications. 1999. 2000. 2001. 2002 (*upwellings*) 2003 (*upwellings*).

Michigan Sea Grant Biennial Report, Michigan Sea Grant, 1999.

Michigan Sea Grant Education Fact Sheet, David Brenner, Joyce Daniels. 2004.

Michigan Sea Grant Outreach Fact Sheet, David Brenner, Joyce Daniels. 2004.

Michigan Sea Grant Research Fact Sheet, David Brenner, Joyce Daniels. 2004.

Michigan Sea Grant Strategic Plan 2000-2005.

National Sea Grant Biennial Report, David Brenner (graphic design and photography), NOAA-National Sea Grant, 2004.

National Sea Grant Strategic Plan, David Brenner (graphic design and photography), NOAA-National Sea Grant, 2004.

Omnibus Proposal FY 2001-2003 and FY 2003-2005. Michigan Sea Grant.

Outreach Growth Report, Outreach Growth committee/Elizabeth LaPorte (contributor), National Sea Grant, 2002.*

People and Projects, Michigan Sea Grant Communications. 1999. 2000. 2001.

Program Brochure, Michigan Sea Grant Communications. 1999. 2002.

Program Evaluation Report 1988-1999, Michigan Sea Grant, 1999.

Program Fact Sheet, Communications Team, Michigan Sea Grant, 2002.

Electronic Documents

Web sites

Upwellings Online, David Brenner, Joyce Daniels, Michigan Sea Grant, www.miseagrant.umich.edu/pubs/up, 1999-2004.

Purple Pages, Purple Loosetrife Project, Mike Klepinger, Carol Swinehart, Dave Brenner, www.miseagrant.umich.edu/pp, 2000.

Great Lakes Education Program, Steve Stewart, Joyce Daniels and Dave Brenner, www.miseagrant.umich.edu/glep, 2001.

CoastWatch - Near Real-time Great Lakes Surface Temperature Imagery, Chuck Pistis, John Schwartz, Carol Swinehart, Jim Fenner, David Brenner, Michigan Sea Grant, Michigan State University (MSU) Center for Remote Sensing and MSU Extension, www.coastwatch.msu.edu, 2001.

- Know Your Nets!* Chuck Pistis, Ron Kinnunen, Joyce Daniels and David Brenner, www.miseagrant.umich.edu/wetlands/index.html, 2002.
- Great Lakes Coastal Wetlands*, Walter Hoagman, David Brenner, Elizabeth LaPorte, and Joyce Daniels, www.miseagrant.umich.edu/wetlands, 2002.
- Clean Marina Program*, Chuck Pistis, Joyce Daniels, Elizabeth LaPorte, and David Brenner, www.miseagrant.umich.edu/boating/cleanmarina.html, 2003.
- Frequently Asked Questions About ...*
- Aquatic Invasive Fishes*
www.miseagrant.umich.edu/ans/fish.html
- Aquatic Invasive Plants*
www.miseagrant.umich.edu/ans/plants/html
- Aquatic Invasive zebra mussels and quagga mussels*
www.miseagrant.umich.edu/ans/mussels.html
- Aquatic Invasive Zooplankton*
www.miseagrant.umich.edu/ans/zoo.html
- Dave Brenner and Joyce Daniels. Michigan Sea Grant. 2003.
- Beach Safety Outreach Campaign* – Elizabeth LaPorte, David Brenner and Joyce Daniels, Michigan Sea Grant, www.miseagrant.umich.edu/beach/index.html, 2004.
- Belle Isle/Detroit River Sturgeon Spawning Habitat Project*, David Brenner, Jennifer Read, Michigan Sea Grant, www.miseagrant.umich.edu/sturgeon, 2004.
- Current Research Projects*, Joyce Daniels, Jennifer Read, Michigan Sea Grant, www.miseagrant.umich.edu/research/2004/current04.html, 2004.
- Online Fact Sheets (PDF)**
- Zebra Mussels in the Great Lakes*, www.miseagrant.umich.edu/pubs/on/msg-92-700.html, 2001.
- Zebra Mussels May Clog Irrigation Systems*, www.miseagrant.umich.edu/pubs/on/msg-93-701.html, 2001.
- Safe Use of Zebra Mussels in Classrooms and Laboratories*, www.miseagrant.umich.edu/pubs/on/msg-93-703.html, 2001.
- Slow the Spread of Zebra Mussels and Protect Your Boat Too*, www.miseagrant.umich.edu/pubs/on/msg-94-713.html, 2001.
- Round Gobies Invade North America*, www.miseagrant.umich.edu/pubs/on/msg-95-500.html, 2001.
- Ruffe: A New Threat to Fisheries*, www.miseagrant.umich.edu/pubs/on/msg-96-501.html, 2001.
- Gobies: Cyberfish of the '90s*, www.miseagrant.umich.edu/pubs/on/msg-96-702.html, 1996.
- The Spiny Water Flea Bythotrephes Cederstroemi: Another Unwelcome Newcomer to the Great Lakes*, www.miseagrant.umich.edu/pubs/on/msg-97-504.html, 2001.
- Zebra Mussel in North America: The Invasion and Its Implications*, www.miseagrant.umich.edu/pubs/on/msg-97-503.html, 2001.
- Five Lampreys of Michigan*, www.miseagrant.umich.edu/pubs/on/msg-97-500.html, 2001.
- Field Guide to Aquatic Exotic Plants and Animals*, www.seagrant.umn.edu/exotics/fieldguide.html, Minnesota Sea Grant, 2002.
- Great Lakes Restoration Fact Sheet*, Joyce Daniels, Jennifer Read and David Brenner, www.miseagrant.umich.edu/restore.html, 2003.
- Ballast Water Fact Sheet*, Joyce Daniels, Elizabeth LaPorte, David Brenner, Michigan Sea Grant, www.miseagrant.umich.edu/ans, 2004.
- Lake St. Clair Fact Sheet*, Joyce Daniels, Elizabeth LaPorte, David Brenner, Michigan Sea Grant, 2004.
- Lake Michigan Fisheries Fact Sheet*, Joyce Daniels, Elizabeth LaPorte, David Brenner, Michigan Sea Grant, 2004.
- Integrated Assessments Fact Sheet*, Donald Scavia, David Brenner, Michigan Sea Grant, 2004.

APPENDIX H

Video, CD and Multi-media

From Net to Sale: Controlling Aquatic Nuisance Species with the HACCP Approach for Baitfish and Aquaculture Industries. Video. Minnesota Sea Grant and the Great Lakes Sea Grant Network, Mike Klepinger, 2002.

Great Lakes Education Program, Steve Stewart, Michigan State University Extension, 1999.

Great Lakes Fishery Leadership Institute. Curriculum CD. Elizabeth LaPorte, Dave Brenner and Rochelle Sturtevant, Michigan Sea Grant and the Great Lakes Sea Grant Network, 2003.

Outdoors with your Nature Passport. CD. John McKinney. Grand Traverse Regional Community Foundation. 2000.*

The Purple Loosestrife Project: Partnerships in Michigan Communities, Mike Klepinger, Michigan State University Extension, 2001.

Photographs, Illustrations and Graphics

Michigan Sea Grant Communications contributed photos, illustrations and graphics to the following publications and organizations.

ABCs of PCBs. 2002. Illinois/Indiana Sea Grant.

Advisor newsletter. 2001. Great Lakes Commission.

Cetacean Bycatch Resource Center. 2003.

Delaware Sea Grant

Detroit Newspapers in Education, 2001.

Detroit Water and Sewerage Newsletter. 2001.

Farmington School District. 2002.

Fisheries newsletter, Minnesota Department of Natural Resources, 2003.

FLW Outdoors Magazine. 2003. Benton, Kentucky.

Great Lakes Commission 2002-2003 Annual Report. Great Lakes Commission.

Heart Lake Press, Outdoor Media, 2003.

Illinois Natural History Survey, 2002.

Indiana Dept. of Natural Resources Fishing Guide, 2003.

Introduction to Marine Bioinvasion. 2001. Pearson Education.

Lake Champlain Sea Grant

Marine and Aquatic Science Literacy, NOAA-National Sea Grant, 2004.

Michigan Dept. of Environmental Quality. 2004. Environmental education unit.

Michigan Fishing Guide, 2002-2004. Michigan Dept. of Natural Resources.

Midland Soil Conservation District. 2003.

Mississippi Sea Grant

Mobile Aquatic Nuisance Species display. 2001. U.S. Fish and Wildlife Service.

Nab the Aquatic Invader. 2004. SGNIS Web site.

National Wetlands Newsletter. 2003. Tip of the Mitt Watershed Council.

New Hampshire Sea Grant

NOAA National Weather Service. 2004. Training module, North Carolina Sea Grant

Oakland Lakefront Magazine, 2003.

Ocean Treasures, Alaska Sea Grant, 2004.

Oregon State University - Hatfield Marine Science Center. 2004.

Ohio State University Natural Resources. Web site. 2003.

100th Anniversary Newsletter, University of Michigan School of Natural Resources and Environment, 2003.

Pennsylvania Sea Grant. 2004. Aquatic invasive species poster.

Restoring and Conserving America's Coastal Ecosystems and Habitats. 2003. NOAA-National Sea Grant. Produced by Rhode Island Sea Grant.

Southeast Michigan Recreation and Development Council. 2003. Web site.

Wild Times. 2004. Wyoming Game and Fish Dept.

Wisconsin Natural Resources. 2004. Wisconsin Dept. of Natural Resources.

Michigan Sea Grant News Releases

Michigan Sea Grant issued 53 news releases from January 1999-May 2004, resulting in significant media coverage of Sea Grant news and activities in statewide newspapers, regional and national magazines, and on radio and television. Please see Michigan Sea Grant's media clippings folder for selected articles.

1999

Jan: New reader helps students explore field of science writing
 Feb: At least 100 Michigan lakes now infested with zebra mussels
 Feb: Slides, illustrations of exotic species available from Michigan Sea Grant
 Feb: Great Lakes, great challenges to be presented at MSU conference*
 May: NOAA and University of Michigan scientists discover tumors in freshwater zooplankton*
 Aug: Michigan Sea Grant summer publications

2000

Feb: Nineteen more Michigan lakes reported infested with zebra mussels in '99
 Feb: Changes and challenges focus Great Lakes conference at MSU*
 June: Sea Grant online publication receives award
 July: Are zebra mussels in your lake? Drop a brick and find out
 July: Seeing purple? Is it loosestrife? New card helps identify the nuisance
 Oct: Interim director named for Michigan Sea Grant
 Oct: Web specialist brings artistic flair to Michigan Sea Grant

2001

Feb: Zebra Mussels found in 30 more Michigan inland lakes
 Feb: Great Lakes Facts publications provide interesting, important information
 Mar: Michigan Sea Grant awards \$766,032 for Great Lakes research
 July: ANS-free bait?*

July: New communications officer at Michigan Sea Grant
 Aug: Beetles appear to be winning the war against purple loosestrife in Michigan
 Oct: Partnership will measure effects of aquatic nuisance species on Great Lakes food web, fisheries
 Oct: Jennifer Read named assistant director, Michigan Sea Grant
 Oct: Threats to Great Lakes: New report [invasive species]

2002

Jan: Michigan Sea Grant Knauss Fellows to help shape Great Lakes and marine policy
 Feb: Zebra mussels muscle into more Michigan inland lakes
 Feb: Great Lakes conference at MSU presents issues and challenges*
 Mar: Sea Grant Extension Agent/Ottawa County Extension Director receives MSU's highest award
 April: UM-MSU partnership marks 25 years of cooperation and service to state
 May: UM SNRE student receives NOAA Coastal Management Fellowship

May: More than half of Michigan's counties have lakes with zebra mussels: Wash and watch to slow the spread
 June: Boaters: Don't get trapped!
 June: Michigan Sea Grant provides water safety information
 Oct: Youthful expressions about aquatic invasions*
 Nov: University of Michigan re-invigorates Great Lakes research and initiates Michigan Sea Grant director search
 Nov: New Great Lakes research, outreach and education partnership forms
 Nov: Great Lakes gift packages
 Dec: Four appointed to aquatic nuisance species coordinating council
 Dec: Michigan Sea Grant recommends new Great Lakes research projects

2003

Feb: Mussels on the move in Michigan invade 11 more lakes
 Feb: Great Lakes conference focuses on understanding and managing the changing system*
 April: Great Lakes emergent wetlands: Agencies, environmental groups release consensus document
 May: Beetles take a bite out of purple loosestrife: Dramatic impacts now evident in some Michigan wetlands
 Aug: Michigan Sea Grant study shows serious coastal growth pressure and planning gaps
 Sept: Michigan Clean Marina Program begins
 Sept: Big Rapids teen participates in California's summer science program for high school women
 Oct: *New Life of the Lakes* booklet takes unique approach to Great Lakes fisheries
 Oct: Fisheries leaders wanted: Public involvement critical to fisheries management process
 Nov: Michigan's charter fishing industry bounces back: Greater revenues, larger boats but fewer captains
 Nov: Belle Isle projects funded*

2004

Jan: Donald Scavia to head Michigan Sea Grant College Program
 Jan: Michigan Sea Grant Extension Agents appointed for northern Michigan
 Jan: Life of Lakes exhibit and lecture launch museum theme semester on biodiversity
 Feb: Seven more zebra mussel-infested lakes confirmed in 2003
 Mar: Regional conference to focus on deadly Great Lakes rip currents
 May: Great Lakes swimmers: Beware of potentially deadly rip currents

*Joint news release referencing Michigan Sea Grant