

MICHU-Q-99-002



**EVALUATION REPORT
1988 - 1999**

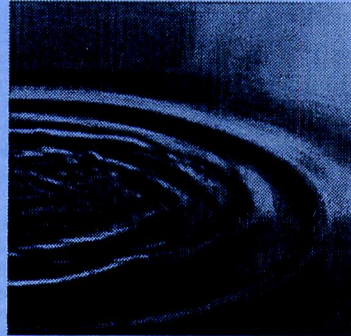


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EXECUTIVE SUMMARY

INTRODUCTION AND METHODOLOGY

The Michigan Sea Grant College Program conducted an evaluation of its administration, research, education and outreach through Extension and Communications for the period 1988-1998.

Several assessment techniques were used, including facilitated discussion (administration), reviewing reports (research, education and outreach) and conducting surveys (Extension and Communications).

RESULTS AND DISCUSSION

Administration - Through facilitated discussions, members of Michigan Sea Grant's Management Team conducted a critical review of their effectiveness as a team and the overall administrative structure of the program. That review indicated that Michigan Sea Grant's partnership arrangement has been proven very worthwhile, provides great intrinsic value to the program, and should be the mode of operation for the foreseeable future. The review also revealed that the Management Team would benefit from more effective internal communication and a clearer understanding of some of the issues they address.

Research - After reviewing project reports submitted by principal investigators, the director and associate director concluded that Michigan Sea Grant research has proven very successful in those areas where it has carefully invested its funds. Several projects have achieved noteworthy results and made significant contributions in their disciplines. The review also showed that the most productive investment of research funds tends to be in single-investigator or two-investigator projects versus larger team studies. Overall, the level of productivity, as measured by publication in peer-reviewed outlets, presentations at national meetings and students supported, has been excellent. However, self-reporting by investigators, which is the primary means of ascertaining research productivity and the social and economic benefits of the research, suffers from a lack of compliance. The Management Team will make renewed efforts to improve self-reporting by investigators.

Education - The ability to track the results of Sea Grant's support of students is related to principal investigators' compliance with reporting requirements. Based on the available reports, it appears that the program's support has helped at least 50 students earn advanced degrees in the past decade. Michigan Sea Grant has also succeeded in nominating 18 Marine Policy Fellows who have had productive experiences working with the U.S. Congress and federal agencies such as the U.S. Environmental Protection Agency and NOAA.

Outreach-Extension - Sea Grant Extension's (SGE) assessment involved conducting a survey of clientele and partners and reviewing the achievement of its stated objectives for the past decade. The combination of findings from these two efforts indicates that SGE is a mature, productive and beneficial outreach program, whose audiences appreciate its work. Sustaining such performance is the challenge for SGE's future.

Outreach-Communications - Communications' evaluation involved conducting a survey of subscribers to the program's newsletter and reviewing the achievement of its stated objectives for the past decade. The newsletter survey indicated that no major changes were necessary to satisfy

the current readership, yielded overwhelmingly positive comments and produced some suggestions about making it even more useful such as featuring more material about Michigan Sea Grant projects. The review of Communications objectives and accomplishments showed that this outreach component of the program has achieved some notable successes and is making progress toward timely productivity.

CONCLUSIONS AND RECOMMENDATIONS

Michigan Sea Grant has conducted a critical review of its performance during the past decade and learned some important lessons. The primary lessons are:

- It is important to evaluate the program periodically to assess its strengths and weaknesses and to plan for improvements.
- It can be difficult to assess one's own performance objectively, but worth the exercise if one is honest and committed to improving in the future.

The major recommendations that logically follow from this review are:

- Continue to identify high priority issues and support research and outreach projects that address those issues.
- Monitor and review research projects more regularly to achieve better reporting from principal investigators and to share the findings from their work with appropriate audiences.
- Continue to recruit well-qualified nominees for the Marine Policy Fellowships.
- Sustain high quality outreach through Extension and Communications and continually scan for emerging issues and unmet needs.
- Continue to work on effective communication and collaboration among staff members and researchers.

INTRODUCTION

Michigan Sea Grant has recently evaluated itself in order to gain insights about its strengths and weaknesses from its history and to develop plans to be more successful in the future. This self-evaluation was an honest attempt to be objective and fair to the program as a whole, relishing notable accomplishments and benefits appropriately while seeking to improve the program's methods and productivity. What follows is a brief discussion of the methods used to conduct the self-evaluation and participate constructively in the PAT review process; sections on the evaluation of the various program components; and conclusions and recommendations for future improvements.

METHODS AND EMPHASES

During 1996-99, staff members conducted assessments of each component of the program-- administration, research, education and outreach for the period 1988-1998. Benchmarks and criteria that the Program Assessment Team is asked to use in evaluating the program from its perspective were also used for the self-assessment so that the results can be compared. The methods used in the assessment of each component were as follows:

Administration - At the outset of Michigan Sea Grant's strategic planning process in 1998, the Management Team engaged in a self-assessment led by a professional facilitator. In mid-1999, the director reviewed the team's progress toward becoming a more optimally functioning program leadership group. The Management Team also reflected on the structure of the program, the partnership agreement between the two lead institutions and relationships with other universities, agencies and organizations.

Research - In evaluating research, the director and associate director reviewed completion reports for all the projects from this period to assess their impact and benefits. Input from principal investigators was sought to provide as current information as possible about subsequently published peer-reviewed articles and papers, presentations, contributions to science and engineering and economic and social benefits.

Education - Staff members compiled a list of all known Michigan Sea Grant supported students and the degrees they received. This information is in a separate report. Brief biographical sketches of selected students and their professional accomplishments were written. A list was also compiled of all Marine Policy Fellows from Michigan and their fellowship appointments.

Outreach - Extension - The performance of Michigan Sea Grant Extension (SGE) was evaluated in two ways. First, a survey was conducted contacting approximately 370 clientele and partners who have had experience with Extension's outreach during the past 20 years. Second, the programming objectives stated in SGE proposals from 1988-1998 were reviewed to ascertain whether the objectives had been achieved through activities and

accomplishments and with what economic and social benefits. Also included was information from previous evaluations of some individual projects and programming areas.

Outreach - Communications - The performance of Michigan Sea Grant Communications was also assessed in two ways. First, in late 1997 Communications conducted a reader survey of subscribers to the program's quarterly newsletter *upwellings*, which has historically been the largest investment of human and financial resources in the communications budget. Second, objectives, accomplishments and benefits for the 1988-1998 period were also reviewed and assessed by a senior staff member.

Finally, the management team reviewed the assessments of the major components of the program to develop a clearer understanding of strengths and weaknesses and to develop recommendations for improving the program in the future, especially in the sphere of more fully integrating research, education and outreach.

The results of the separate assessments are presented the following sections of this report.

ADMINISTRATION

INTRODUCTION AND METHODOLOGY

One of the underlying criteria for good Sea Grant programs is an administrative structure and function that lends itself to managing for success. Michigan Sea Grant has periodically reviewed this critical component of its program to ascertain whether the existing structure is the best one to fulfill its purpose.

The most recent such review commenced in 1996, when the present (then newly appointed) director reviewed the history of the program's administration, and the Management Team proposed changes that they thought would strengthen the administrative structure and function. The second step was to consult with the program's Policy Committee in late 1996 and, with their approval, to implement the changes. Third, early in 1998 a professional facilitator conducted a retreat with the Management Team to assess its characteristics and performance and ascertain its members' perspectives on the program. Fourth, the entire Michigan Sea Grant staff met in retreat with the same facilitator in the spring of 1998 to assess the program's strengths and weaknesses and begin the needs assessment phase of strategic planning. What follows is a summary of those four steps and the outcomes of the process.

A HISTORICAL PERSPECTIVE ON A UNIQUE STRUCTURE

Each Sea Grant program has developed a unique administrative structure, presumably designed with the intent to best meet the needs of its local constituency. As a Sea Grant program gains experience and maturity, its administrative structure may well change to better serve its stakeholders. Michigan Sea Grant has certainly followed that path to its current structure.

Michigan Sea Grant began thirty years ago under the exclusive direction of the University of Michigan, which tried to develop a coherent program that embraced all the elements of the then newly defined Sea Grant concept. While the University of Michigan had extensive expertise in Great Lakes and marine research and education, it had little outreach experience. Unfortunately, it was not successful in conducting the outreach required to serve the Great Lakes State's far-flung and very diverse stakeholders. The program's failure in this critical area threatened the integrity of the whole program. This setback prompted the administration of the University of Michigan (UofM) to rethink its approach, and, happily, the concept of joint management with Michigan State University (MSU) emerged in 1972. MSU is the state's land grant institution and has a reputation for outstanding Extension work.

Combining the considerable strengths of these two institutions made Michigan Sea Grant a more fully functional program. It was the first such formal partnership between the state's two major publicly supported universities and it has been sufficiently successful to serve as a model for others that have been established since.

Although the University of Michigan (UofM) has the ultimate administrative authority for Michigan Sea Grant, most administrative functions are shared equally between the two partners. The Management Team is comprised of a Director (UofM), Associate Director (MSU), Assistant Director/Communications Manager (UofM), and Extension Program Leader (MSU). The Vice Presidents for Research at the UofM and MSU jointly chair the Policy Committee, the principal advisory body for Michigan Sea Grant with an equal number of deans/senior administrators from each university. The Management Team tends to meet ten times a year and the Policy Committee semiannually.

Under this structure, all field agents and one communications staff member are employed by MSU Extension, while all the other communications staff members are employed at UofM.

Such a partnership presents several challenges:

- to maintain a spirit of unity in the face of normal pressures to promote one's own institution, (occasionally at the expense of another);
- to seek the best talent for the problem or issue at hand regardless of institutional affiliation and refrain from making decisions on a purely "political" basis;
- to recognize and promote the achievements of all program participants regardless of institutional affiliation and refrain from the temptation to minimize others' accomplishments;
- to remain open-minded and flexible when it comes to creating new, necessary permutations of the partnership to achieve greater effectiveness.

The partnership approach also carries with it many "transaction costs." Probably the most significant among them is the additional time it may take to make decisions collegially, maintaining the excellent communication necessary to sustain cohesiveness among staff members, and grappling with more than one institution's procedural and other requirements. Among the financial costs are travel, lodging, communication and dual accounting.

While a substantial amount of effort is necessary to make collaboration succeed, its benefits far outweigh the extra investment of energy. Among them are:

- tapping the complementary wealth of knowledge and experience available at both institutions;
- developing synergistic partnerships to address Great Lakes issues;
- increasing dissemination of the program's information through the constituencies and stakeholders of both institutions;
- greater benefits to stakeholders through the program's outreach programming.

This general architecture of joint operation has carried Michigan Sea Grant very well for the past twenty-five years. However, this is not a static configuration and it has been continually adjusted to meet the changing demands on the program and the competing demands on its senior administrators.

RESTRUCTURING TO MANAGE FOR SUCCESS

With the appointment of each new Sea Grant Director, some adjustments have typically been made in the administrative structure. When the current director of Michigan Sea Grant assumed his position in July 1996, the program took several steps that, in some respects, initiated its self-evaluation.

For many years, Michigan Sea Grant had a part time director appointed to serve the program on a .25--.33 FTE basis. As of 1996, the program's assistant director was serving in two capacities -- 75 percent of his time as assistant director and 25 percent as a field agent working from an off campus location. The net result was that, on many occasions, no Michigan Sea Grant administrators were in the UofM office. This resulted in missed opportunities, delayed responses to inquiries, less than adequate supervision of communications team (which reported to the assistant director) and a sense that no one at UofM was dedicated primarily to leading and administering the program.

In an effort to provide more substantial leadership to the program, improve the function of its administrative structure and strengthen the universities' partnership, Michigan Sea Grant made some changes between 1996 and early 1998. The new director sought a major change in commitment to Michigan Sea Grant--making the director's position a .75 FTE appointment. This meant that the program's primary administrator would have a much greater sense of obligation to Sea Grant. Because of the director's background in research and grant making, he would provide leadership in that area. In addition, because the new director had served as full time assistant director of Michigan Sea Grant for eight years, he recognized the value of that position in the day-to-day operation of the program. He also saw a need to strengthen the communications program and requested an in-depth analysis of its structure and function and staff recommendations for its future.

As a result, Management Team proposed to the policy committee that the communications coordinators function be combined with the assistant director position and become a full member of Management Team. This arrangement also provided a more parallel and balanced structure for Management Team with the director and associate director from UofM and MSU respectively leading research and the assistant director/communications coordinator and Extension program leader, also from the UofM and MSU respectively, leading outreach.

With the approval and support of the policy committee, Management Team began to implement these changes, concluding the assistant director/agent arrangement (the former assistant director became a full-time Sea Grant Extension agent again) and, in early 1997, launching a search for an assistant director/communications manager. In late May 1997 the position was filled, bringing Michigan Sea Grant to its current administrative structure.

FORGING A STRONGER MICHIGAN SEA GRANT ADMINISTRATION

With the new structure and all the management team members in place, Michigan Sea Grant began developing a new long-range plan, with the assistance of a skilled,

experienced facilitator. To lay an adequate foundation for strategic planning, he conducted a two-day retreat with Management Team in January 1998. In retrospect, the retreat was primarily an administrative self-evaluation process. The facilitator began with overview statements about Michigan Sea Grant and Management Team members' perceptions about the program's level of effectiveness. Management Team members began to acknowledge their current individual weaknesses and the shortcomings of the team. The retreat then moved to identifying points of agreement among Management Team members and points of disagreement about the manner in which Michigan Sea Grant was administered. Finally, issues that have been consistent problems, yet have been rarely if ever approached directly (in strategic planning, these are called "unmentionables"), were attacked head-on as a way of improving the ability of Management Team to function.

Some of the principal overview findings from the January 1998 retreat were:

- Management Team members were skeptical of the value of strategic plans.
- Michigan Sea Grant has been successful, despite many changes in administrative personnel.
- Outreach consistently delivers good results for Michigan Sea Grant.
- Research is less predictable but has also produced huge successes.
- Some research has been unsuccessful, but this has been difficult to predict a priori.
- Michigan Sea Grant is very successful in educating the public.

The views of the program's administrative functionality differed widely among the four Management Team members, such that consensus was not easily reached. Some of the issues about which views among the four members of the Management Team differed substantially were:

- Management Team has effective internal communication.
- Management Team engages in logical problem solving.
- Management Team can engage in effective self-evaluation and make adjustments.
- Management Team functions well as a group.
- Management Team members strike the correct balance in making decisions.
- Management Team can readily adapt to changing situations.

The facilitator gleaned this information using a system that allowed each Management Team member to express his/her opinion anonymously. The electronic system, called "Option Finder," makes it possible to express one's views candidly, and led all Management Team members to clearly understand that changes would be essential in order to improve its function. However, when compared with Management Team members' agreement on the more overarching suite of questions above, it was clear that Michigan Sea Grant has achieved a great deal of success despite some functional problems within its principal administrative unit.

The bottom line was that Michigan Sea Grant is managing to achieve success, but it can probably achieve even more by resolving some of these administrative issues. This very

important finding led to the final set of exercises at the Management Team retreat-- tackling those hitherto unmentionable issues that had always been avoided. Some of these issues include:

- Management Team members do not devote sufficient time to Michigan Sea Grant.
- Management Team members need to take more care in understanding each other's different views.
- Management Team needs to devote more time to securing additional program resources.
- Management Team needs to better prioritize Michigan Sea Grant's research emphases.
- Management Team needs to discuss allocation of program resources more thoroughly.
- Management Team needs to help improve the coordination between extension and communications.
- Management Team members should adopt a more holistic view of the program.

Through this retreat, the Management Team, individually and collectively, developed a clearer understanding of the issues it needs to address in order to function optimally on behalf of the program. A sixteen-page summary of this workshop is available.

Since January 1998, the Management Team has, with varying degrees of success, addressed many of these issues. As a self-evaluation exercise, the retreat was a tremendous success in that many barriers between Management Team members have since fallen and previously unmentionable topics can now be discussed openly. The outcome has been a more effective management approach that focuses more of the team's energies on honest, open problem-solving and features less stress on unexpressed underlying concerns.

PLANNING STRATEGICALLY FOR THE FUTURE

Having set the stage for strategic planning by clarifying Management Team and administrative issues, the program conducted another retreat in April 1998. The same facilitator gathered the entire staff of Michigan Sea Grant and began the issues identification stage of the strategic planning process in earnest. The focus was to develop Michigan Sea Grant's direction for the next five years, and it largely succeeded in that context, providing the backbone for the plan that continued to emerge over the next several months. In addition, some points on interaction among program components, such as internal communications, understanding of one another's roles in the program, the intrinsic merit of each part of Michigan Sea Grant, and openness to new ideas were broached, and the Management Team members who attended took note of them. However, because one team member could not attend the all staff retreat, the administrative self-evaluation aspect of that event was somewhat constrained. More than fifty pages of notes from the April 1998 retreat are also available upon request.

CONCLUSIONS AND RECOMMENDATIONS

The self-evaluation process of Michigan Sea Grant Administration discussed above was very effective, but somewhat wrenching. Managing for success dictates that the Management Team set the template for working together with clarity of purpose. Hidden agendas, poor communication, any degree of distrust and similar issues are certain to undermine effective program wide management. Identifying these issues and coming to grips with them has been a difficult undertaking, and the process is still ongoing. However, the self-evaluation process begun in early 1998 has been highly effective in resolving many problem areas. The outcome is a more successful Michigan Sea Grant College Program.

RESEARCH

INTRODUCTION AND METHODOLOGY

Over the past decade, Michigan Sea Grant has supported a wide variety of research that includes both applied studies and more basic investigations. Similar to most other Sea Grant programs, the preponderance of research supported by Michigan Sea Grant has been applied to specific questions raised about the aquatic environment. Because Michigan is a Great Lakes state, Michigan Sea Grant research has been predominantly but not exclusively Great Lakes-oriented.

Research is a fundamental component of Michigan Sea Grant as it provides, among many other things, much of the knowledge base that serves to answer many of the questions arising from external stakeholders. In a perfect Sea Grant world, research supported by each program would be in direct response to question(s) raised by its external stakeholders. As the research draws to a close, answers could be provided to the questions raised by the stakeholders, and the cycle would continue with yet more questions. However, in this less than perfect Sea Grant world, many questions are asked that cannot be easily or quickly answered by research. Likewise, some research does not have an immediate application to questions raised, but rather provides a broadening of the knowledge base that ultimately will answer questions of importance. Despite these modest limitations, Michigan Sea Grant research remains a central component of the program and a vital and essential activity.

Research represents a major activity of Michigan Sea Grant and, similar to most other programs, comprises about 40-50% of the federal support provided to the program. Over the past decade, Michigan Sea Grant has supported approximately 75 research projects.

The rationale for a self-evaluation of Michigan Sea Grant research is to understand the principal products of the investment in research, the advances in science and engineering that have come from the principal findings, whether a project's social and economic benefits are readily observed at this point, and what can be done better in the future. An additional yet equally important aspect of a self-evaluation is determining whether the current approach to monitoring Michigan Sea Grant research is sufficient to track the progress and outcome of the funds invested or if a modification in the approach is needed.

The method used for this self-evaluation was an after-the-fact review of research findings during the past ten years. Seeking additional information from past studies at this time has proven a challenge because former investigators have moved to new positions, adopted new research interests, accepted administrative positions or retired. Because the 75 projects represent approximately 100 investigators, keeping track of this group has proven difficult. These issues have served to make the methodology for the self-evaluation of Michigan Sea Grant research relatively straightforward.

As of June 1999, progress and completion reports for thirty-six projects completed during the decade were on file in the Michigan Sea Grant office at the University of Michigan.

Approximately fifteen of the seventy-five projects are still in progress and have no final reports. Finally, 21 investigators had not filed any reports on their prior research. The director contacted them, and 11 responded with updated information. This provided summary information for slightly more than 60 percent of the 75 projects. Efforts continue to obtain information on the approximately 13 projects for which no reports have yet been filed. By late October 1999, it is anticipated that reporting information for all but five or six projects will be received.

The progress and completion reports provide good information on the findings and products of the research. The report format and information requested by Michigan Sea Grant has not changed greatly over the past decade. However, program administrators have sought to streamline the reporting effort as much as possible in order to improve response to the requests for reports. This has included asking for updates each year that a project is active, relying increasingly on electronic report filing and asking the investigators to remain in touch with Michigan Sea Grant as research products such as publications emerge after the project end date.

The basic information about each project contained in the report forms is the following:

- a recap of project objectives, methods and approach (derived from the original proposal summary form),
- a narrative section on the principal findings of the project (that varies in length from a few paragraphs to a dozen pages),
- lists of publications, presentations, students supported, degrees conferred and courses taught with partial or complete support from Sea Grant research,
- and a brief narrative on principal outreach accomplishments.

A carefully crafted report usually covers this ground in three to four pages.

The primary method of self-evaluation was for the Director and Associate Director to read the project reports, determine a sense of productivity of the research and make corresponding tabulations of the information. In addition, other Michigan Sea Grant staff prepared two to four page portfolios (included elsewhere in the PAT materials) that in some cases include research projects and provide a perspective on research findings.

AREAS OF MICHIGAN SEA GRANT RESEARCH EMPHASIS

In the past decade, Michigan Sea Grant has supported research in the following five main areas:

- Great Lakes fishes,
- naval architecture and marine engineering,
- environmental studies,
- non-indigenous species,
- miscellaneous other topics.

The distribution of projects among these topics has not been even. Of the 75 projects supported, 20 (27 percent) were in Great Lakes fishes. These included projects in fish recruitment, fisheries economics, fish contaminant, fish consumption advisories, fish spawning, and spawning habitat. Twenty (27 percent) were in naval architecture and marine engineering. These projects ranged from general studies of offshore engineering, design of high-speed planing craft, analysis of fishing vessel capsizing, studies of ballast exchange on the high seas and improved vessel navigation systems. Five projects (six percent) were in the area of environmental studies, which included the cycling of toxic substances and impacts of new predators into the Great Lakes food web. Fifteen projects (20 percent) were focused on the newly arrived zebra mussel (nonindigenous species) and included studies on impacts of zebra mussels on plankton, methods to disrupt zebra mussel spawning, effect of zebra mussels on the underwater reef environment, and the impacts of other invaders on the Great Lakes food web. The remaining 15 projects covered mostly small program development studies, initiation of a Saginaw Bay subprogram, and evaluation of a youth education program conducted by Michigan Sea Grant.

In the mid 1990s, the National Sea Grant office began a national competition for nonindigenous species research and outreach funds. Since then, Michigan Sea Grant has shifted and broadened the nonindigenous species research it supports, and most of the newer projects that are still underway involve investigation of nonindigenous species other than the zebra mussel, for example the two species of gobies and the ruffe. Lately the emphasis has shifted more toward intervention to prevent the introduction of new species rather than the study of recent arrivals.

An additional shift in the area of emphasis of Michigan Sea Grant research will soon occur as a result of the newly completed Strategic Plan.

PROJECTS OF IMPORTANCE

Ten years or less after the completion of a research project, it can be difficult to evaluate the full impact of a study or suite of studies. Readily observed products such as the number of students supported/graduated, the number of publications or the number of presentations are easily gleaned from the project reports. Often more difficult to ascertain are the net societal benefits of a research project. Nonetheless, as part of the review of the reports, several projects stood out as being clearly productive. Nine of these are presented below with a brief description of their principal findings.

Fisheries - *Physical and biological processes influencing recruitment of rainbow trout.* The principal thesis of this study is that a unique combination of physical and biological processes is required to support successful recruitment of rainbow trout in the Great Lakes. The timing of the onset of spring warming and the thermal regime in the lakes during the preceding winter are the major determinants of success in the year class. *Principal Investigator* - Dr. William Taylor, Michigan State University. Initiated in 1993, supported two students and has resulted in two publications, and six presentations.

Fisheries - *Ecological and economic impacts of watershed restoration on salmonid productivity in Lake Michigan tributaries.* The principal thesis is that small hydroelectric dams on Michigan streams and rivers have a substantial impact on the natural reproduction of stream spawning fish. Preliminary findings suggest that loss in the area of sport fishing and fish recruitment might be significant in comparison to the power generated by small dams. *Principal Investigator* - Dr. Michael Moore, University of Michigan. Initiated in 1997 and still in progress, to date this project has supported seven students at the University of Michigan and Michigan State University and has resulted in two publications and eight presentations.

Fisheries/economics - *Economic value of contaminant advisories to individual Great Lakes sports anglers.* The primary concept is that the negative publicity from fish consumption advisories has the potential to have an economic impact on sport fishing in the Great Lakes region. Surveys of anglers showed only a modest economic impact, but that a substantial amount of confusion arises in the sport fishing community due to unclear fish consumption advisories. *Principal Investigator* - Dr. Jeffery Hanson, Michigan State University. Initiated in 1990, supported three students, and resulted in three publications and two presentations.

Naval architecture - *Predicting complicated dynamics leading to vessel capsizing.* The capsizing of small vessels, particularly fishing vessels, continues to plague the boating industry. Lives are lost when these small boats capsize, and this risk is especially present when the vessels are greatly heeled over during the hauling of commercial fishnets. Models have been developed to provide some measure of analysis of small boat stability where capsizing conditions are prevalent. *Principal Investigator* - Dr. Armin Troesch, University of Michigan. Initiated in 1989, it supported one student and resulted in four publications and one presentation.

Naval architecture - *A nonlinear probabilistic approach to fishing vessel capsizing.* The two investigators extended the research to cover more conditions, especially water on the deck of the vessel, where capsizing is likely to occur. *Principal Investigator* - Dr. Steven Shaw, Michigan State University. Initiated in 1991 as a continuation of the project listed above, it has supported two students, resulted in five publications and three presentations.

Marine engineering - *The relationship between Great Lakes water levels, wave energies and shoreline damage.* The dramatic rise and fall of Great Lakes water levels, often reaching a meter difference in a few years, presents a unique challenge to building structures in the near shore or water/land interface environment. Prediction of the extremes of wave energies would greatly aid in making these structures durable. A statistical relationship between water levels (usually driven by short-term climate patterns) and wave energies has emerged to help make those predictions, and the project is attempting to better understand that relationship. *Principal Investigator* - Dr. Guy Meadows, University of Michigan. Initiated in 1998, this project is still in progress, is currently supporting several students and has already resulted in one publication and two presentations.

Environmental - *Interaction between juvenile fish and the Cladoceran Bythotrephes cederstroemi and the behavioral aspects of predation.* In the late 1980s, *Bythotrephes cederstroemi* invaded the Great Lakes from the Baltic region of Eastern Europe and became very well established as a component of the summer and fall food web. This organism possesses a long caudal spine that comprises 9/10 of its body length. This causes problems for young fish less than two inches long that try to swallow the sharp, stiff spine. The research findings show how the small fish fixate on the zooplankton, yet cannot feed on the well-defended animal. *Principal Investigator* - Dr. Charles Kerfoot, Michigan Technological University. Initiated in 1991, supported one student and has resulted in three publications and four presentations.

Naval architecture/zebra mussel - *Ship operation and safety aspects of ballast water exchange at sea.* In response to the continuing invasion of the Great Lakes by nuisance aquatic species and in particular the arrival of the zebra mussel, a program of voluntary exchange of ballast water on the high seas was implemented. However, it was uncertain if ships are at risk with such operations. The research revealed that, for two typical classes of ships traveling across the North Atlantic and into the St. Lawrence Seaway, ballast exchange is always safe during seas of less than ten feet, is usually safe in ten to 20 foot seas and unsafe in seas greater than 20 feet. *Principal Investigator* - Dr. John Woodward, University of Michigan. Initiated in 1991 (program development funds only), this project has supported one student and resulted in one publication and one presentation.

Zebra mussel - *Impact of Dreissena polymorpha on the planktonic diatoms in Western Lake Erie and lower Saginaw Bay, Lake Huron.* The zebra mussel as a filter-feeding organism has had a major impact on the amount of algae suspended in the water column, particularly in Lake Erie. While ample anecdotal evidence of the impact of zebra mussel filter feeding exists, very few rigorous before and after comparisons have been done. Dr. Beeton was able to carefully analyze planktonic diatom samples from the same location in Lake Erie near Bass Island and lower Saginaw Bay before and after the zebra mussel infestation. Her comparison shows dramatic differences between the two plankton communities. *Principal Investigator* - Dr. Ruth Beeton, University of Michigan. This project was initiated in 1994 and has resulted in two publications and two presentations.

RESEARCH OUTCOMES AND IMPACTS

Three types of products result from the research activities supported by Michigan Sea Grant. These are papers published, professional presentations made and students supported. In addition are the social and economic benefits of the research, but these are more difficult to quantify and often take a long time to realize. For the most part, Michigan Sea Grant administration has depended on self-reporting by the investigators to document the publications, presentations and students supported.

The thirty-six projects for which reports are on file yielded 110 publications, the vast majority of which were in peer reviewed journals. This is an average of 3.1 publications per project. That average includes a half dozen or so program development research projects, for which publications are uncommon. Hence the overall publication productivity

of the regular research projects approaches 3.5 papers per project. Viewed in context of major categories of projects, the self-evaluation discovered the following:

- The eleven fisheries research projects yielded 24 publications or an average of 2.2 publications per project.
- The eleven naval architecture and marine engineering projects yielded 62 publications or an average 5.6 publications per project.
- The three environmental studies projects produced four publications for an average 1.3 publications per project.
- The 11 other research studies generated 20 publications for an average 3.1 per project.

A similar analysis was made for presentations based on Michigan Sea Grant funded research. That analysis showed an overall total of 114 presentations from the thirty-six projects, or an average 3.2 presentations per project. Again, this included a half dozen or so programs development projects that usually are too brief in duration to expect presentations at scientific meetings. Taking those projects into account, the average number of presentations becomes 3.8 per project. Considering the number of presentations by major research topic category, the following was reported:

- The 11 fisheries research projects resulted in 51 presentations or 4.6 per project.
- The 11 naval architecture and marine engineering projects produced 21 presentations for 1.9 per project.
- Thirteen presentations were listed for the four environmental studies projects for 4.3 per project.
- The other 11 research projects yielded 29 presentations for 2.6 per project.

The final tabulation was for students supported by the research projects. A total of 87 students received some measure of support from the 36 projects or an average of 2.4 students supported per project. The number of students supported varied very little among the project categories, with an average 2.5, 3.0, 2.3 and 1.8 students supported by the fisheries, naval architecture and marine engineering, environmental studies and other categories respectively. Richer detail on some of the students supported by Michigan Sea Grant can be found in the education section of this self-evaluation report.

Beyond the simple categorization of publications, presentations and students supported, self-evaluation of Michigan Sea Grant research is a difficult task. Where has a project or small suite of projects made a substantial impact or when will they make an impact? Except in very rare instances, the full magnitude of the findings is not usually fully appreciated just a half-dozen or so years after a project is completed. A case in point is the cold-water near drowning research supported by Michigan Sea Grant in the 1960s and 1970s. Two decades later we know that the efforts to understand the mammalian diving reflex have made an incalculable difference in the way that first responders treat people submerged in cold water for long periods of time. Now dozens of lives are saved each year, whereas before these people would have been left for dead. In a corresponding sense, what will be the impact of Michigan Sea Grant research conducted in the 1990s? While it is

possible to have a sense of the importance of outcomes, it is unreasonable to assume that the full degree of impact is known less than ten years after the research has drawn to a close.

That said, the following are a few of the Michigan Sea Grant-supported research projects from this period that have already demonstrated social and economic benefits.

SOCIAL AND ECONOMIC BENEFITS

Fisheries models - Computer-based statistical models developed through Michigan Sea Grant research provide fisheries managers with information necessary to predict the response of fish populations to environmental fluctuations and harvest. This information allows fisheries managers to understand historic trends in fish populations, forecast fish population year-class strength, and to implement management strategies that respond to changes in fish populations. More specifically, fisheries models have assisted with the following:

- Simulation modeling predictions are used to formulate salmonid stocking strategies for Great Lakes waters of Lakes Michigan, Superior, and Huron.
- Harvest restrictions for Great Lakes fishers are formulated based on model predictions.
- Models have identified gaps in existing data and information indicating the direction for future research and modeling efforts.

Naval architecture and marine engineering - Perhaps more than any other research area, the economic and social benefits of the engineering studies are self-evident. One obvious social benefit is the protection of life for fishermen and recreational boaters. Safer, more stable watercraft will inevitably save lives. With commercial fishing one of the most risk prone occupations in the U.S., any marginal increase in safety of watercraft will pay substantial dividends in terms of lives saved. From an economic perspective, computer models can simulate different hull designs without the expense of trial and error construction.

- The noise abatement study has clear social benefits in terms of the health of both fishermen and recreational boaters. Anyone who has spent much time around small boats can vouch for the noisy conditions associated with them. Addressing the problem in a sophisticated manner will provide a tremendous social benefit.
- The cost of protecting the shoreline and its manmade structures is enormous. In many instances, more money has been spent on protecting the shoreline than the value of the property saved. Any manner in which shoreline property damage can be predicted will have huge economic consequences. The Great Lakes, with highly variable water depths, is particularly prone to extensive shoreline damage.

Sport fishery - Michigan Sea Grant supported ground breaking research on the economic impact of the sport and charter fishery in the early 1980s that established the significance of this activity to coastal communities. In reports on these studies, local officials have found the evidence they've needed to make investments in infrastructure and enhancements to waterfront facilities, which have made the sport fishery, especially charter fishing businesses, more viable.

Commercial fishery - Michigan Sea Grant research on whitefish population dynamics has provided the commercial fishing industry with information essential to understanding its target species. Sea Grant Extension also helped the Keweenaw Bay Tribe obtain a \$60,000 grant to conduct applied research on marketing lake herring.

Fisheries management - Research supported by Michigan Sea Grant has contributed to the understanding of fish population dynamics, life history, recruitment, natural reproduction of introduced salmonids, dietary requirements of particular species, and the effects of climate and other abiotic forces on the fishery. This research has provided crucial knowledge to Great Lakes fisheries managers.

Research facilitated by Michigan Sea Grant on contaminants in the early 1990s showed a definite correlation between the length and weight of chinook salmon and the concentration of PCBs, thus providing a reasonable rationale for consuming younger, smaller fish (up to approximately 18 pounds). Based on these and other findings, Michigan state health officials have included these factors in their risk protocol for issuing fish consumption advisories.

Research Integration with Outreach

In the introduction to this section, the integration of research and outreach in a perfect Sea Grant world is presented. "Research supported by each Sea Grant program would be in direct response to question(s) raised by external stakeholders. As the research draws to a close, answers could be provided to the questions raised by the stakeholders and the cycle would continue with yet more questions." Michigan Sea Grant's world is not perfect, but the integration of its research and outreach components has occurred in some creative and productive ways.

Sea Grant Extension has participated quite actively in developing strategic research emphases twice in the past decade. In the mid 1990s, Extension staff members solicited input from clientele about research needs and helped craft a plan to address some of the priority needs. Furthermore, each research project included a specific outreach component designed in collaboration with the principal investigators. Of the three such projects initially funded by the program, one was a highly collaborative effort that resulted in ground breaking findings about experiential environmental education, as well as the production of a new curriculum for Michigan Sea Grant's major youth education program. The other has led to a research project that engages stakeholders in the development of fisheries management models.

Outreach staff members' expertise and insights provided the platform for crafting the program's most recent strategic plan with substantial input from clientele. Outreach staff always have the opportunity to encourage prospective principal investigators to submit proposals and the opportunity to review and comment on proposals that are submitted. Extension agents often include Sea Grant principal investigators and their students in programs for clientele and have, on occasion, become actively involved in the research itself. Extension also taps the expertise of Sea Grant researchers in providing technical assistance to its clientele.

The communications staff looks for opportunities to publicize research projects and results that are of wide public interest and importance in the program's quarterly newsletter *upwellings* and on its web site, as well as through the print and broadcast media. Principal investigators also turn to communications for assistance in developing publications and other outreach products, as well as support for page charges and reprints of articles published in peer-reviewed professional journals.

FINDINGS

The primary criterion used for selecting high quality research in the U.S. has been the peer review system. Despite the numerous drawbacks of this system of identifying the best proposals, the results of publications, presentations and students supported suggest that Michigan Sea Grant has been successful in supporting good, sound and productive science and engineering studies. Further, the self-evaluation showed that single investigator or co-investigator projects matched to a budget of appropriate scale are the most productive.

In 1994 and 1995, Michigan Sea Grant substantially shifted the emphasis of its research program to support a much smaller number of larger team-oriented projects involving upwards of ten senior investigators. While team research has much positive merit, the outcome for Michigan Sea Grant was not favorable. Those larger team oriented projects have now drawn to a close. The self-evaluation shows that, to date, the number of publications, presentations and students supported per project did not increase with the large size and scope of the project. In fairness to the nature of the projects, they may have not had enough time to run to fruition. Also, as mentioned above, it is far too soon to judge the impact of these larger multi-investigator studies and it may be too early to even fully tabulate publications and presentations. However, returns to date suggest the more traditional model of small-scale projects continues to be more productive for Michigan Sea Grant.

A major finding of the self-evaluation of Michigan Sea Grant research is that self-reporting appears the best method for cataloging the products of the studies. The investigators are careful in their documentation and often have a measure of pride in their results. However, achieving more complete compliance to self-reporting is a major challenge. University based investigators are willing to invest considerable effort on research proposals, substantial effort on presentations and peer-reviewed publications, but often little more than token effort on reporting to project sponsors. The fact that Michigan Sea Grant had reports from only slightly more than half of the 75 projects supported are a testimony to

the problem of compliance in reporting. Constant saber rattling eventually shakes most of the reports free, but never achieves 100% compliance. Investigators whose renewal proposals are declined more often than not become dissatisfied with Sea Grant and fail to remain in the program as active proposal writers and to deliver completion reports. Other investigators seem to believe that highly detailed; long reports are a necessary precursor to receiving follow-on research support. Perhaps Michigan Sea Grant has failed to convey to these individuals that a simple, easy to read three to four page report rich in information is all that is required in most instances, leaving their creative energies for publications and presentations. These findings clearly show that Michigan Sea Grant needs to work more diligently with investigators during the course of their research projects to convey the value of succinct reporting.

The final finding is a brief footnote that reporting after the project end date is a long-term proposition. Contact with investigators seven or eight years after the project end date has routinely turned up publications supported in part by Michigan Sea Grant but not listed in completion reports because they had not yet materialized. Again, much of this self-reporting is predicated on the good will of the prior investigator and that often wanes with time.

CONCLUSIONS AND RECOMMENDATIONS

The overall conclusion of the research self-evaluation is that Michigan Sea Grant research has proven successful in the small number of areas where it has carefully invested its funds. The small single investigator or two investigator projects appear to realize the most return for the funds invested. During the past decade, Michigan Sea Grant has invested in a small number of research topics, namely fishery biology, naval architecture and marine engineering, environmental studies, non-indigenous species and a few miscellaneous topics. The concept of focusing on a few productive areas where Michigan Sea Grant funds can make a difference appears well founded.

Self-reporting is an effective tool to evaluate the outcome(s) of research in terms of products such as publications, presentations and students supported. However, self-reporting by investigators greatly suffers from lack of compliance, and will require careful monitoring by Sea Grant administrative staff. Even in the face of pressure and dunning threats, 100% compliance is not achieved.

Finally, and perhaps most importantly, the major impact of research is clearly a long-term proposition. Major advances from research in knowledge base, quality of life and understanding of our world are gleaned from Sea Grant research. However, it often takes a decade or more to determine the full outcomes and impacts.

As to recommendations for the future, Michigan Sea Grant now appears to be following a productive path with its investment of research funds. The switch in 1996 back to smaller single investigator and two investigator projects adequately funded appears sound based on prior results from the early 1990s.

The commonly accepted model of peer review for selection of research proposals remains one of the best approaches. However, in Michigan this tends to favor the University of Michigan and Michigan State University investigators who have more proposal writing experience over faculty from smaller schools in Michigan. A program of encouraging/rewarding investigators from smaller universities is needed.

The self-reporting program from research results remains effective, but as mentioned numerous times above, needs a creative fix to boost compliance. Toward that end, with the understanding that a program review once every four years is now a part of the Sea Grant culture, Michigan Sea Grant understands the merit of more complete compliance in reporting. More energy will be invested in this issue.

As an adjunct, the complex and ephemeral task of identifying social and economic benefits of research will also require adjusting the research reporting mechanism.

EDUCATION

INTRODUCTION AND METHODOLOGY

One of Sea Grant's most lasting contributions is the students who are educated about Great Lakes and marine science and policy through the program's support of their research and studies. As these students receive their degrees and pursue their careers, some assume leadership roles, some help develop new knowledge and some apply their skills in managing resources.

Staff members compiled a list of all known Michigan Sea Grant supported students and the degrees they received. This information is in a separate report as is a list of all Michigan Sea Grant's Marine Policy Fellows and their appointments (located in Section 2 of this notebook, following the Overview). Brief biographical sketches of selected students and their professional accomplishments complete this section.

STUDENTS SUPPORTED

Michigan Sea Grant supported more than 100 undergraduate and graduate students through its research projects during this decade. The exact number is not yet known due to incomplete reports from principal investigators, but at least 40 earned degrees while doing Sea Grant research, and many have since co-authored at least one peer-reviewed journal article.

MARINE POLICY FELLOWS

Michigan Sea Grant nominated dozens of graduate students for Sea Grant's national Marine Policy (Knauss) Fellowships during this decade. Eighteen of these nominees were chosen and participated in the program. They worked for a year in the nation's capital with Congressional offices, committees and task forces of the House and Senate and for federal agencies such as NOAA and the U.S. Environmental Protection Agency.

STUDENT BIOGRAPHIES

The following brief biographies are examples of what Michigan Sea Grant's students have accomplished and their perspectives on their Sea Grant experience:

Russell Brown was funded by Michigan Sea Grant from 1987 to 1994, while completing Masters and Ph.D. programs in fisheries biology at Michigan State University. During his years of graduate study he received several awards for his fisheries research. Dr. Brown has published numerous papers and written a book chapter on commercial fisheries in the Great Lakes. After completion of his degrees, Dr. Brown began working as a fishery research biologist with the National Marine Fisheries Service in Woods Hole, Massachusetts, where his work focuses on assessment of depleted groundfish stocks and management strategies for stock rebuilding in Georges Bank. He has participated in the

1997 National Research Council review of New England groundfish assessments and the 1998 International Council for the Exploration of the Sea (ICES) Annual Science Conference in Lisbon, Portugal. Dr. Brown serves as the scientific advisor for the U.S. delegation to the North Atlantic Salmon Conservation Organization annual meeting and is the Secretary/Treasurer of the Southern New England chapter of the American Fisheries Society. Dr. Brown says of his experience with Michigan Sea Grant, "much of my success in the international fisheries arena can be traced to my exposure to binational issues related to Great Lakes fisheries during my graduate education."

Mary Hovinga received her PhD in Epidemiology in 1990 from the University of Michigan, where she conducted research on the long-term effects of fisheaters' exposure to PCBs and DDT. Since then, Dr. Hovinga has become an associate professor in the School of Public Health at the University of Alabama-Birmingham, where she teaches courses in General and Environmental Epidemiology. Her research focuses on the distribution and causes of mental retardation, as well as the effects of heavy metals such as PCBs and DDT, on human health. She is currently developing a statewide surveillance system to determine the frequency and distribution of mental retardation in Alabama. Dr. Hovinga serves on several committees and is an elected member of the Governing Council of the American Public Health Association.

Craig Czarnecki worked for Sea Grant in 1991 as a Sea Grant Extension assistant working on zebra mussel issues. In 1993 he served as a Sea Grant Knauss fellow to Senator John Glenn's office and worked with the Great Lakes Task Force. Mr. Czarnecki said, "Working with Michigan Sea Grant helped me define my career options and contributed heavily to my choice of careers and to the options available to me." He received dual master's degrees in Environmental Science and Public Administration from Indiana University in 1993. Since then he has worked on aquatic nuisance species at the Chesapeake Bay Commission, as a CITES permit biologist and a fisheries biologist with the U.S. Fish and Wildlife Service. Mr. Czarnecki received numerous awards for outstanding work from the U.S. Fish and Wildlife Service and is now the field office supervisor at the East Lansing Ecological Service.

Lisa Williams received her PhD in Fisheries and Wildlife in 1993 from Michigan State University, and was supported by Michigan Sea Grant from 1988 to 1989. She has been a natural resource damage assessment specialist with the U.S. Fish and Wildlife Service since 1993. Dr. Williams is also an adjunct assistant professor with MSU's Department of Fisheries and Wildlife. Her research interests include the analytical chemistry of polychlorinated biphenyls (PCBs), the fate and effects of organochlorine compounds in fish and wildlife of the Great Lakes, and risk assessment for fish and wildlife. Dr. Williams is a member of several organizations including the American Fisheries Society and the Society of Environmental Toxicology and Chemistry, and has won numerous awards during her academic and professional careers. Dr. Williams cites her work with Michigan Sea Grant as helping her to link science and communications, and says, "The experience provided me with both guidance and opportunities to present my results to the public through meetings and press conferences."

Donna Francis was funded by Michigan Sea Grant from 1990 to 1993. She received her PhD from the School of Natural Resources at the University of Michigan. While at the University, she received several awards and fellowships, including the National Science Foundation International Research Fellows Award. Dr. Francis is currently a postdoctoral research associate at Harvard University. She is a member of organizations such as the American Society of Limnology and Oceanography and the International Association for Great Lakes Research. Dr. Francis worked on a variety of research projects through Sea Grant and cites the diversity as being important to her growth as a scientist. She said, "The diversity of research experiences I had while working on Sea Grant projects was not only invaluable to a career in aquatic research and teaching, but also richly rewarding and enjoyable.

Michael Donahue has served since 1987 as Executive Director of the Great Lakes Commission, an eight-state compact agency responsible for policy research, development and advocacy on a range of Great Lakes issues. Dr. Donahue is also adjunct professor of Natural Resources and Environment at the University of Michigan, and has lectured extensively throughout the United States and Canada. Previous positions include director of the U.S. Office and head of research for the Center for the Great Lakes. Dr. Donahue is U.S. Chairman of the International Joint Commission Science Advisory Board, and has been a member of more than a dozen regional agencies, organizations and research institutes. He has authored more than 150 professional papers, book chapters and journal articles. He received three degrees from the University of Michigan, including a doctorate in Urban, Technological and Environmental Planning. Dr. Donahue was supported by Michigan Sea Grant from 1984 to 1986. "Michigan Sea Grant played a vitally important role in my academic training and professional life," he said. "Sea Grant funded my doctoral research, research that opened the door to many policy leadership and academic opportunities. Professionally, I look to Sea Grant for cutting edge, policy relevant research, as well as information/education services so important to the policy process."

CONCLUSIONS AND RECOMMENDATIONS

Michigan Sea Grant has fulfilled its responsibility to provide support for students who are conducting research with principal investigators. It has also been successful in recruiting qualified nominees for the Marine Policy Fellows program. Furthermore, many of these students have achieved distinction in their marine and Great Lakes-related careers.

The program should maintain its focus in this area and should continue to recruit high quality candidates to the fellowship program.

OUTREACH - EXTENSION

INTRODUCTION AND METHODOLOGY

Sea Grant Extension (SGE) is the component of Michigan Sea Grant's outreach that provides educational programming and technical assistance to agencies, organizations, institutions and individuals involved with a variety of Great Lakes issues. During the past decade, SGE has served the program, the Great Lakes and the nation with many different methods and products.

SGE's performance was evaluated in two ways. First, a survey was conducted contacting 368 clientele and partners who have had experience with SGE during the past 20 years. Second, the programming objectives stated in SGE proposals from 1988-1998 were reviewed to ascertain whether the objectives had been achieved and with what economic and social benefits. Also included was information from previous evaluations of some individual projects and programming areas. This report presents short summaries of the results of these two evaluation activities. Greater detail on the survey and the analysis of objectives, accomplishments and benefits appears in separate reports that are available for review.

CONTEXT, STAFFING, STRUCTURE, METHODS

Context - SGE operates in the context of a very large state situated in the middle of an even larger ecological region. A complex array of Great Lakes institutions and issues are continually waxing and waning, with competing organizational voices vying for the attention and allegiance of diverse audiences. SGE also operates in the context of a long-standing Sea Grant program, the partnership of Michigan's two leading institutions of higher education, busy administrators, faculty researchers and subject matter specialists in different disciplines, and Extension colleagues throughout the state and region. In this environment, establishing and maintaining Michigan Sea Grant's credibility while conducting important programs is essential and challenging.

Staffing - Core SGE staffing has fluctuated slightly during the past decade, ranging from a low of 6 FTEs to its current high of 9. In addition to core staff, SGE has hired several professionals to work on separately funded, short-term projects. Graduate assistants have further augmented SGE's outreach work. The staff currently consists of a program leader, a campus specialist, an associate, six field agents and a program assistant.

Structure - The program leader, associate, field agents and program assistant are employed through Michigan State University Extension (MSUE), while one campus specialist works at the University of Michigan (UofM). The program leader is a member of Management Team.

Methods - SGE's educational programming has taken several forms during the past decade. In addition to writing and distributing educational materials and newsletters,

conducting workshops and demonstrations, making presentations, participating in organizations and committees, and offering individual consultations, SGE has used the Internet effectively. SGE has expanded its capacity for reaching the public by using its MSUE colleagues in Sea Grant work.

CLIENT-PARTNER SURVEY

Michigan Sea Grant Extension (MSGEx) conducted a mail survey of 368 clientele and professional partners in the Spring of 1999 to gain insights from them on the following issues: contacts with Sea Grant Extension; staff members' performance; SGE's programming effectiveness; SGE programming's impact on themselves; and their primary role in the Great Lakes community.

Usable responses to the eight-question, four-page questionnaire totaled 199, for an effective response rate of 63 percent. The greatest percentage of respondents (30) were classified as coastal businesspeople or educators (23 percent). The rest were agency staff/resource managers (11 percent), non-governmental or not-for-profit organizations (10 percent), recreational users (9 percent), researchers (3 percent), elected government officials (2 percent) or other. From their responses, it is reasonable to conclude the following:

Contacts with Sea Grant Extension

Michigan Sea Grant Extension has established fairly long term, in-depth relationships with these clientele/partners, and the survey respondents have been in relatively frequent personal contact with Sea Grant Extension staff members. The responses also indicate that these clientele are taking advantage of Sea Grant Extension's various types of programming and outreach. Seventy-nine percent had received a SGE newsletter or other educational materials; 73 percent had participated in a workshop or conference; 93 percent had interacted with a SGE staff member individually; 32 percent had participated as a volunteer in a SGE project/program; 23 percent had been involved in experiential learning with youth; and 42 percent had worked with an SGE staff member on a project or committee, while 12 percent described other types of interactions.

Staff Members' Performance

Sea Grant Extension staff members received consistently good or excellent ratings on their knowledge, skills and professionalism. The combination of excellent and good ratings totaled 95 percent or greater on knowledge of Great Lakes issues and useful resources, communication skills, commitment to follow-up, objectivity, fairness, taking a lead in positive change, providing technical assistance, and the overall quality of interactions.

Programming Effectiveness

This group also rated Michigan Sea Grant Extension's overall programming effectiveness quite high. The combination of excellent and good ratings totaled 96 percent for overall

quality of SGE programs, 97 percent for overall quality of SGE materials, and 93 percent for overall effectiveness in meeting the needs of the Great Lakes community. The combination of excellent and good ratings for individual programming areas topped 90 percent for the Great Lakes Education Program (96), sport fishing (95), aquatic nuisance species and educational materials (95), charter fishing (94), teacher workshops (94), fisheries management (92) and water quality (92).

Significant percentages of the respondents said they did not have enough experience to compare Michigan Sea Grant Extension with other agencies, organizations and institutions that have some similar Great Lakes responsibilities, but those that did ranked Michigan Sea Grant Extension quite high. Mean scores for SGE were particularly high (between better and much better than) when respondents compared SGE with the Sierra Club, the U.S. Army Corps of Engineers, the International Joint Commission, the U.S. Environmental Protection Agency, and the Michigan Department of Environmental Quality.

Programming Impact on the Individual

The vast majority of respondents (97 percent) said they had gained knowledge about the Great Lakes. Eighty-three percent said that they had changed their attitudes, and 79 percent said they had changed their actions as a result of their involvement with SGE. Seventy-seven percent said that they had been able to solve their problems, and 92 percent been able to help educate others. In the final analysis, 72 percent said Sea Grant Extension has made a difference to them.

Comments

Many respondents took advantage of the opportunity to provide written comments on several of the questions. The comments seemed candid, and the vast majority were quite positive, some praising individual staff members for their work.

Conclusions and Recommendations

It is clear that SGE has done a good job with those already involved with the program. The overall recommendation to be made from this study is for Michigan Sea Grant Extension to "keep up the good work," and we will do our best to continue the good work with those already involved with the program, to maintain their trust and confidence. It is also important to seek out unserved clientele and identify their needs.

REVIEW OF SEA GRANT EXTENSION PROGRAMMING AREAS, GOALS, ACHIEVEMENT OF OBJECTIVES, AND LESSONS LEARNED

Extension's programming during this period focused on the following five major areas: coastal community development coastal business management, Great Lakes resources management, water safety and youth education. Brief background information on these

areas is presented, along with the goals, a summary of the objectives and an assessment of whether SGE was successful in achieving the objectives. More specific information about objectives, accomplishments and benefits is presented in portfolios on selected projects and in a separate report, which is available for review.

Coastal Community Development

Hundreds of communities dot Michigan's Great Lakes shoreline--ranging in size from metropolitan Detroit, where approximately half the state's people live, to tiny villages along Lake Superior. During the past decade, SGE's programming in this area has focused on the following: community waterfront development, underwater preserves, and tourism planning, development and promotion.

Goal - Sea Grant Extension's goal in coastal community development has been to improve coastal ecosystem health and the economic quality of life for coastal communities by strengthening community leadership, promoting development and wise land-use decision making, identifying barriers, and increasing communication and collaboration links.

Community Waterfront Development - The waterfront can be a coastal community's greatest asset, providing residential and recreational opportunities and attractions for tourists. However, taking full advantage of this competitive edge requires vision, well-informed planning and appropriate implementation. Of SGE's fifteen specific objectives for community waterfront development, all of them were at least partially accomplished, and four were exceeded.

Underwater Preserves - Approximately half of Michigan lies under Great Lakes water, with numerous areas of both geological and historical significance, including shipwrecks and unique rock and mineral formations. These resources are now protected by state law, which was written based upon Sea Grant research findings and Extension efforts from the late 1970s. SGE's 20 objectives for underwater preserves during this decade focused on creating new preserves and new diving resources within existing preserves, developing technology to access and conserve underwater resources, and enhancing the leadership skills of those involved in local preserves. SGE accomplished or partially accomplished all of its objectives for this focus area, and exceeded at least seven.

Tourism Planning, Development and Promotion - Michigan's Great Lakes coastal zone provides an estimated 200 million person-days of recreation/tourism activity annually and accounts for roughly \$5 billion in direct spending within the state each year. SGE's primary objectives for this focus area were increasing marine clientele's involvement in local and regional tourism organizations and educating MSUE colleagues to conduct tourism programming. SGE achieved all of its seven specific objectives in this focus area and exceeded one.

Lessons Learned - Michigan Sea Grant Extension (MSGE) accomplished most of its stated coastal community development objectives during the ten year period, exceeded a few, and made significant progress toward the rest. At least one notable accomplishment

occurred outside the scope of the stated objectives with the establishment of MSU's Center for Maritime and Underwater Resources Management. SGE's strength seems to be in using very limited resources to facilitate interaction among a variety of sometimes conflicting groups to accomplish projects of mutual benefit. Its weakness is in trying to serve so many communities with such limited staff. SGE did exercise the flexibility to change focus, to transfer responsibility for programming or projects to others as they developed the capacity to conduct them. MSGE should continue to look for opportunities to develop local leaders so that they can design and achieve their own objectives. This strategy will make it possible for MSGE to focus elsewhere when other pressing priorities require it.

Coastal Business Management

Of the tens of thousands of coastal-related businesses in Michigan, many are family-owned and most are small to medium-sized. However, their collective impact on the economies of coastal communities is sizable. Many people previously employed in large businesses or industries have started small businesses, but many of them have little training or experience in some critical aspects of business management. SGE has targeted its business programming toward marinas and boating, charter and recreational fishing businesses, commercial fishing, aquaculture and fish processing operations.

Goal - SGE's goal in business management programming has been that people involved in coastal enterprises will identify and clarify their business goals and objectives and will increase their efficiency in achieving them. Coastal businesses will take advantage of new technology and develop additional markets. They will maximize and demonstrate their economic impact on the community, while maintaining appropriate awareness and involvement in developing/sustaining a healthy environment.

Marinas and Boating - Michigan's marinas and boating industries are among the most important components of the state's recreation and tourism. The state leads the country in numbers of registered watercraft--901,000+ (approximately one for every five households in the state), with almost a quarter of a million being kept or used on the lakes as of 1994. The most recent (1994) statewide survey identified 626 Great Lakes marinas with 59,000 slips for recreational boats. It appears that the easy days of marina development and expansion in Michigan are over, although opportunities vary by location throughout the state. SGE's 12 objectives in this focus area targeted developing a national network, helping create new knowledge about the Michigan marina and boating industry, facilitating interactions between marina developers and state regulators, and providing educational experiences for Michigan boaters. SGE achieved all but one of its 11 specific objectives in this focus area and accomplished several things not specified in its proposals.

Charter and Recreational Fishing - The charter boat industry plays an important role in Michigan's sport fishery. Charter boat activity is concentrated in a few communities, where it has had an impact of as much as \$21 million annually on local economies and has stimulated some communities to develop facilities and infrastructure to capitalize on the markets generated by charter fishing. Since the late 1980s the number of Michigan charter boat operations has declined from about 1,000 to 500 and seems to be stabilizing around

that number. The industry has also taken steps to better understand the dynamics of the resource, develop better communication with policy makers and the public, and improve the business skills of its constituents. SGE has achieved or exceeded all but one of its 14 specific objectives in this focus area, in which it sought to help the industry learn more about itself and its market, to encourage industry leaders to develop knowledge and skills to participate more effectively in fisheries management.

Commercial Fishing - Michigan's commercial fishery has a complex history affected by ecological changes in fish species as well as political battles for harvesting rights. The commercial fishery today has two major components: nearly 300 Native American treaty operations and approximately 100 state-licensed operations, which harvest as much as 11 million pounds of fish annually. The industry is facing problems such as conflicts with sport anglers, fears related to contaminants, loss of some traditional markets, foreign competition, and regulations that have limited the marketability and competitiveness of some Michigan fish products. SGE's 15 specific objectives in working with this industry during this period have focused on educating and training individuals and fishing organizations, building leadership, facilitating product and marketing improvements, working on regulatory issues, and participating actively and constructively in Great Lakes fishery management. SGE has achieved or exceeded all but one of the stated objectives and accomplished some things that were not specified as objectives.

Aquaculture - Less than one percent of the \$800 million worth of fish consumed by people in the North Central United States is produced in the region. The Michigan aquaculture industry has grown during the past decade and is now regulated under the Michigan Aquaculture Development Act as an agricultural enterprise. The industry has identified a need for information on water quality, recirculation technology, alternative feed sources, triploidy, fish processing technology, HACCP, marketing, and development of business plans to help obtain limited capital. SGE's 18 specific objectives in this focus area involved working with the North Central Regional Aquaculture Center, Sea Grant colleagues and other partners to develop and disseminate information and educational materials that provide a better foundation for aquaculturists; developing leadership of aquaculture organizations; providing technical guidance to prospective aquaculturists; helping write the Michigan's aquaculture plan and implement the state's Aquaculture Development Act. SGE succeeded in meeting all but one of its aquaculture objectives, and accomplished some additional work, too.

Lessons Learned - Michigan Sea Grant Extension has invested a substantial percentage of its human and financial resources in working with coastal businesses to improve their operations and management. It has developed and provided extremely important information and helped educate people in individual businesses and industries as a whole to use a sound research-based approach to addressing issues and solving problems. People involved in charter and recreational fishing, commercial fishing, aquaculture and marina and boating industries say that they are significantly better off because of SGE. SGE has achieved all but a very few of its educational objectives, and has wisely reduced its efforts in the least productive area (charter diving). SGE was smart not to pursue its idea of launching an overall coastal small business initiative because a more favorable cost-benefit

impact can be achieved by targeting its programming toward particular business sectors. Michigan SGE has become widely respected among its peers and policy makers, as well as coastal businesses, for its success in developing the leadership skills of clientele. SGE should continue to participate in the important sphere of coastal business management. In addition to providing information and technical assistance to individual businesses, SGE should continue to develop clientele leadership so that industry leaders can better design and achieve their own objectives. This strategy will make it possible for MSGE to focus elsewhere when other pressing priorities require it.

Great Lakes Resources Management

The Great Lakes Basin ecosystem is extremely large and complex--six quadrillion gallons of fresh water, 94,000 square miles of land and 9,400 miles of coastline. Two countries--Canada and the United States--eight states, including Michigan, two provinces and thousands of local units govern the Great Lakes lengthy shoreline and their vast waters. Among the most critical Great Lakes issues Michigan has faced are: resource planning, water quality, the unintentional introduction of aquatic nuisance species, fishery management matters, shoreline erosion and coastal flooding.

Goal - SGE's goal has been that Great Lakes user groups will increase their awareness and understanding of the dynamics and interrelationships of the Great Lakes and their biological resources and that they will enhance their ability to anticipate and adapt to those changes beyond their control and to manage wisely those factors that they can influence.

Water Resources Management and Water Quality - The quality of Great Lakes water is the foundation for the health of the ecosystem and for most of the uses to which this incomparable resource is put. Water quality has been a concern in the Great Lakes region for more than a century. SGE's 26 specific objectives in this focus area have been aimed at educating citizens, colleagues and public officials to understand water quality issues, encouraging them to participate actively in pollution prevention and cleanup activities and in monitoring water quality parameters, and to become involved in public decision-making about water quality. SGE accomplished all but one of its objectives in this focus area.

Fisheries Management - The Great Lakes fishery consists of more than 175 species of fish, including yellow perch, whitefish, lake trout and salmon. Many biological and abiotic factors, as well as human influences, combine to affect the amounts and types of plant and animal life that can live in the Great Lakes. To cope with changes and problems in the fishery, stakeholder and management groups are cooperating on a number of issues, such as habitat enhancement, exotic species, disease and contaminants. SGE's 14 specific objectives in its fisheries management programming during this decade have focused on building a better base of information about the fishery and educating a vast and varied public, enhancing fishery stakeholder groups' leadership skills and encouraging participation in fishery management decisions, and supporting the development and use of techniques to enhance the resource. All of these objectives have been met.

Fish Waste Composting - Approximately 11 million pounds of fish are taken by the Michigan commercial fishery annually. More than half of that volume eventually enters the waste stream, along with a comparable amount from Michigan's sport fishery. Every year, tons of this offal go to landfills, and dumpsters at some coastal marinas reek with fish waste. SGE's eight programming objectives for fish waste composting during the past decade were: to introduce the composting concept to logically prospective users and encourage them to develop ecologically and economically beneficial methods of using the resulting product; to resolve the technical and regulatory aspects of developing the finished product so that greenhouses could experiment with using it as fertilizer. Although SGE made considerable efforts on fish waste management during the decade and accomplished some of its objectives, the full-fledged implementation of fish waste composting and product development was stymied by the regulatory issues that proved to be too difficult to resolve satisfactorily and which became a disincentive for business people to pursue this option.

Great Lakes Water Levels, Shoreline Erosion and Coastal Flooding - Extreme fluctuations of Great Lakes water levels occur at unpredictable intervals. Property owners struggle to preserve their stretches of shoreline during periods of high water levels. Government officials face the dilemmas of their constituents, try to protect public facilities during high water and lose the use of other facilities during periods of low water. Millions of dollars in property damage has occurred, and significant expenditures for re-engineering to private property and public infrastructure have been required due to these fluctuations, which promise to be a permanent challenge to the region's coastal residents. SGE's nine specific objectives for this focus area during the decade have involved anticipating the issue, attempting to stay prepared for the inevitable fluctuations in water levels and to provide necessary information and assistance to coastal property owners upon request. SGE accomplished all but two of these objectives, discontinued formal programming with coastal contractors and did not measure whether public officials and private property owners actively prepared for the next major fluctuation in lake levels.

Aquatic Nuisance Species - The impact of aquatic nuisance species on Michigan's nearly 3,300-mile shoreline and 11,000 inland lakes has been significant. Of special concern have been the introductions and spread thought to originate with the discharge of ocean-going and inter-lake ballast water. Species such as the Eurasian ruffe and gobies (round and tubenose) have gained some public attention, but the zebra mussel has caused the greatest public concern because of its effect on people's ability to withdraw Great Lakes water, its impact on recreational facilities and its unknown effects on Great Lakes ecology. Estimated annual costs to industry alone have ranged near \$10 million per year since the mussel's 1986 discovery. SGE's six specific objectives for this focus area involved educating Great Lakes water users, helping reduce their control costs while maximizing their effectiveness, and helping shape research programs to address water users' critical needs. Core staff members have been heavily involved, but much of SGE's in exotic species work has been funded by separate grants. With this support, SGE has accomplished virtually all of its objectives in this area.

Lessons Learned - SGE's core programming in Great Lakes resources management has achieved some outstanding results, as it has succeeded in developing well-informed citizen leaders capable of dealing with a variety of resource management issues and has gained entree into some of the select circles of Great Lakes public policy decision making. With the supplemental funding for working on aquatic nuisance species problems, SGE has expanded its sphere of influence and, more importantly, created a public demand for information that bespeaks its credibility and may well lead to other productive avenues of programming. Michigan Sea Grant has chosen three particularly sensitive resource management areas as targets for its research and outreach during the next few years. SGE would do well to continue to apply the lessons it has learned in developing and sustaining its credibility in the resource management areas in which it has already succeeded and be ready to enlarge its spheres influence in the areas of trophic change and wetlands education.

Water Safety

Millions of people work and play on and in Michigan's Great Lakes waters each year, so water safety is clearly important to Michigan residents and visitors alike. However, water-related accidents in the state claim an average of 160 lives per year and many people are poorly prepared to prevent or to respond to them. Among water safety issues SGE addressed were drowning, hypothermia, recreational diving, and emergency response for rescue and recovery operations.

Goal - SGE's goal in water safety has been to reduce the incidence and severity of water-related accidents through preventive education, enhancement of rescue response and management of injured individuals.

Hypothermia and Cold Water Near-Drowning - Michigan's Great Lakes waters can be dangerous due to large waves and strong currents and their relatively low year round temperatures. As Sea Grant research has shown, hypothermia is certainly a hazard, but cold water can actually be beneficial to people who are drowning in it, reducing body tissues' need for oxygen and slow pulmonary functions to the minimum required for survival, thus prolonging the lives of people who are submerged. SGE's accomplishments in educating several thousand emergency medical professionals about the program's life-saving research are well known. During the past decade, SGE's objectives in this focus area have been to respond to requests for programs to help educate recreational water users, law enforcement and emergency medical personnel about the basic concepts of prevention and treatment of these water accidents. SGE has accomplished all but one of its objectives, that being developing an annotated list of the latest information in cold water safety.

Dive Safety - Exploring geological and historical resources lying at depths greater than 130 feet can be hazardous to recreational divers who exceed their capabilities. However, divers today are doing just that and many are using gas mixtures other than air. Initially, few sources of reliable information on such "technical" diving existed. In 1992, several fatal accidents were associated with the sport, and the accident rate rose over the next few years. Now at least three national certifying agencies specifically devoted to technical

diver training exists, and thousands of divers are now trained and certified in this type of diving. During the past decade, SGE set six specific objectives for its work in this important area, which involved increasing its own knowledge, monitoring technological advances, helping recreational divers understand the implications of technical diving, and advising diver education organizations. During this particularly sensitive time in the history of diving, SGE has provided national and international leadership and accomplished all of its objectives.

Diver Education - Recreational diving has continued to grow throughout the 1990s, and diver education has undergone a rapid evolution, with emphasis on attracting more people to diving, selling more sophisticated diving equipment and reducing the number of educational hours/requirements needed to become a certified diver. Underwater education is a valid aspect of engineering and technology, recreational management, physical sciences and life sciences. However, instructor training and certification are available at very few universities. SGE's six specific objectives in this area have focused on providing expert guidance to diver education organizations and universities, developing and disseminating diver education materials, and providing in service training to SGE staff. SGE has accomplished five of these objectives, but has had mixed results in obtaining university cooperation in developing academic diving safety programs.

Public Safety Diving - Water rescue and recovery operations require highly skilled divers and well trained emergency medical personnel. In numerous instances, inadequately trained rescue personnel have been killed when assigned to hazardous situations. Interest in properly training and equipping public safety divers is increasing, along with increasing interest in legal and liability issues associated with public safety diving. However, an increase in water-related activities and an apparent decrease in funding for many dive rescue teams have strained the operational efficiency and response capability of some teams. SGE's objective in this important area has been that water rescue personnel will be familiar with the techniques they need to use to do their work safely, and much has been accomplished toward achieving it.

Lessons Learned - Michigan Sea Grant has made a fundamental and world-renowned contribution to developing water-related life saving techniques, and SGE's dissemination and application of these techniques is equally important. Although it is difficult to calculate the number of accidents prevented, equally worth noting is the program's leadership in attempting to prevent tragic accidents by advising diver training agencies, developing educational materials for scuba divers and conducting training for public safety rescue/recovery divers. Michigan Sea Grant has made a very strategic investment of resources and a significant contribution in a critically important field. As Michigan Sea Grant has succeeded in institutionalizing the life saving cold water near-drowning rescue techniques developed through its research, it can legitimately relinquish leadership in this particular area, but should attempt to stay abreast of new developments. It has also achieved virtually all of its stated objectives during the past decade, with the exception of developing an annotated bibliography of the best currently available water safety materials to use as a reference. As for diving safety, diver education and water rescue programming, Sea Grant is currently in a crucial position of leadership, particularly in providing guidance

for the education of recreational divers who want to engage in "technical diving" and the continuing education of public safety divers.

Youth Education

Because Michigan lies almost entirely within the Great Lakes Basin, virtually every resident has some connection with the lakes. Many young people live in coastal counties and others have recreational experiences with the lakes, but many do not understand this connection. Young people are already making decisions that will affect the lakes, and they need to understand the importance of the resource, as well as the implications of their own behavior and decisions. Tomorrow's adults face significant challenges in meeting the needs of their generation without compromising the resource needs of future generations.

Goal - SGE's goal in its youth education programming is that Great Lakes citizens and decision makers of the future will be well-prepared for their roles and responsibilities. SGE has focused its efforts on providing young people with education on a variety of Great Lakes issues through camp programs, classroom presentations, vessel based experiences, teacher/youth leader training and producing educational materials.

Camp Programs - Non-formal experiential Great Lakes education is important to young people who need to develop knowledge and leadership skills to make wise choices in their relationship with Great Lakes resources. SGE's stated objective in this focus area has been to help young teens develop their Great Lakes and natural resources leadership skills, become involved in local natural resources community service projects, and develop their career and personal interests in natural resources ecology and management. SGE has achieved this objective.

Classroom - Michigan young people also need formal education in Great Lakes issues as they prepare to assume responsibility for managing Great Lakes resources and as management of those resources becomes more complex. This situation may even intensify as Great Lakes resources are increasingly in demand, but it is uncertain whether such education will become mandatory in Michigan. SGE's two specific objectives in this focus area have involved supplementing classroom education by providing Great Lakes programming to thousands of students, and it has had good success in meeting these objectives.

Vessel Based - Michigan students are usually introduced to their Great Lakes heritage as they study the state's history in the fourth grade. SGE's six objectives in this focus area have included developing, implementing and expanding an experiential vessel-based education program for young people, teachers, parents, and volunteers; observing significant changes in participants' knowledge, attitudes, skills, and aspirations that result from such an experience; and providing excellent materials for participating teachers. Sea Grant research on this program has documented SGE's success in achieving those objectives.

Teacher/Leader Education - Some educators are voluntarily teaching about the Great Lakes in conjunction with earth science, biology or even social science courses, even though Michigan schools are not yet required to offer an environmental curriculum that emphasizes either water resources or the Great Lakes. Many teachers do not educate themselves or their students about these important topics, but they and leaders of youth organizations need to gain adequate knowledge about the lakes and have suitable materials on Great Lakes topics to provide high quality educational experiences. The two objectives in this focus area have been to assist in teacher and youth leader education and training about the Great Lakes, and SGE has met these objectives.

Educational Materials - Michigan Sea Grant has documented a need for well-prepared Great Lakes educational materials. At in-service programs and through mail surveys, teachers have expressed their hunger for such items and their willingness to participate in curriculum development teams. To fulfill part of this need, SGE's objective has been to develop suitable materials on selected Great Lakes subjects, and it has succeeded in producing award-winning materials that have been quite well received by educators and others.

Lessons Learned - It is safe to say that Michigan Sea Grant Extension has had a significant beneficial impact on Great Lakes education in Michigan and likely throughout the rest of the Great Lakes region. Participants in the Great Lakes and Natural Resources Camp, the Great Lakes Education Program, the Purple Loosestrife Project, the Exotic Species Day Camp, as well as users of such outstanding publications as the field guides to Great Lakes coastal plants and wetlands and *Discovering Great Lakes Dunes* can attest to the difference Sea Grant has made in youth education. Furthermore, the program has achieved virtually all of its objectives in this area and helped facilitate at least one notable accomplishment beyond the scope of the stated objectives--the establishment of the marine-oriented Sankore charter school in Detroit. Sea Grant's vision for 2005 states, "Sea Grant will be the national leader in marine and aquatic education," and sets the following goal: "(in order) to improve science and mathematics education, teacher training and K-12 curriculum development will be enhanced." Great Lakes education is one of the top priorities in Michigan Sea Grant's strategic plan for 2000-2005. If Sea Grant Extension contributes as much to the achievement of those objectives as it has accomplished in the past decade, Michigan's youth will be much better educated and prepared to take on the challenges of Great Lakes resource use and management.

AWARDS

SGE has been widely acclaimed for its programming accomplishments during the past decade, winning numerous statewide, regional and national awards from Sea Grant and Extension colleagues and from industry associations. Among the SGE programs thus recognized have been the CoastWatch web site and the Great Lakes Education Program.

LEADERSHIP

SGE staff members have provided leadership to the Sea Grant Network during this decade by serving as chair of the Great Lakes Sea Grant Network Program Leaders, chair-elect and chair of the Sea Grant Extension Assembly. Other noteworthy roles included advisor to the Great Lakes Fishery Commission; officer of the Michigan Association of Extension Agents, the Michigan Underwater Preserves Council, Michigan Alliance of Environmental and Outdoor Education, the Grand Traverse Bay Watershed Initiative; board member of the North Central Regional Aquaculture Center; and co-chair of the American Heritage River (AHR) nomination drafting team and the AHR implementation team. Sea Grant Extension personnel also played leading roles in organizing the 6th International Conference on Zebra Mussels and Other Non-Indigenous Species, the International Symposium on the Biology and Control of Ruffe, and the MarinaNet Collegium.

PROFESSIONAL DEVELOPMENT

During this decade, Sea Grant Extension staff members have participated in many professional development events. Three have earned advanced academic degrees--two PhD's and a master's degree.

CONCLUSIONS AND RECOMMENDATIONS

Michigan Sea Grant Extension is a mature, productive, beneficial outreach program. Michigan Sea Grant Extension has earned the respect and appreciation of its clients and partners and has accomplished the vast majority of its stated objectives during the past decade, benefiting many agencies, organizations and individuals throughout the state, the Great Lakes region, the nation and even internationally, and has won numerous awards for many of its achievements. Michigan Sea Grant Extension should continue to sustain its high quality programming with high priority clientele on important issues and continue to scan the environment for new and emerging issues so it can be prepared to respond to new Great Lakes issues and challenges as they develop.

OUTREACH - COMMUNICATIONS

INTRODUCTION AND METHODOLOGY

Communications is the component of Michigan Sea Grant's outreach that produces informational materials about the program and educational products about Great Lakes issues. It also works through the mass media to provide the public with program information and contacts. During the past decade Communications has served the program, the Great Lakes and the nation with many different methods and products and with varying degrees of success.

Communications' performance was assessed by staff members in two ways:

- reviewing the accomplishments and benefits from communications proposals submitted to the National Sea Grant Office during this period to assess whether goals and objectives were met and whether benefits resulted;
- reviewing the *upwellings* reader survey conducted by communications in 1997.

This section of the Michigan Sea Grant self-evaluation report describes the structure and function of Communications, reviews its accomplishments and benefits, lists some important products and impacts, and compares these achievements with the goals and objectives as stated in the Communications proposals from 1988-1998 to see if these were met. Findings, conclusions and recommendations are presented at the end of this section and also summarized in the Executive Summary of this report. Greater detail is presented in separate reports that are available for review.

CONTEXT, STAFFING, STRUCTURE, METHODS AND MEANS

Context - Michigan Sea Grant Communications operates in the context of a very large state situated in the middle of an even larger ecological region. A complex array of Great Lakes institutions and issues are continually waxing and waning, with competing organizational voices vying for the attention and allegiance of diverse audiences. In this environment, establishing and maintaining the program's visibility and credibility is essential and challenging.

Communications also operates in the context of a long-standing Sea Grant program, the partnership of Michigan's two leading institutions of higher education, busy administrators, researchers in different disciplines, and a far-flung and productive Extension staff. Effective internal communication is also essential and challenging.

Staffing - Michigan Sea Grant's communications staffing level has fluctuated during the last decade--from 3.75 FTEs to its current level of 6 FTEs. Communications has employed a dozen different people during this period. Only two of them have been in the group during the entire period and the other four current staff members less than three years.

Interns have also played an important role in communications, producing some excellent items as they learn from Sea Grant professionals.

Structure - Communications reflects the program's partnership structure, with staff at the University of Michigan and Michigan State University. Currently, five people, including the Assistant Director/Communications Manager, are employed at the UofM in Ann Arbor, while one person works at MSU in East Lansing.

The most significant of three structural changes in communications during the decade was combining the positions of assistant director and communications coordinator. The communications coordinator is now a full-fledged member of the management team, in a parallel position with the Extension program leader.

Methods - Communications has taken advantage of the dramatic changes in technology that have occurred during the past decade--from desktop publishing, to communicating electronically, to producing instructional videos, to providing public access to Michigan Sea Grant through the World Wide Web. It also uses some traditional tools such as display units at events where Sea Grant's informational and educational materials are exhibited.

Means - The Communications staff at UofM has performed most of its work in house--writing, editing, design and layout, photography, mailing list maintenance, web design and publications distribution. UofM's News and Information Services has provided media support, and the UofM staff relies on production and printing services at the university or uses vendors in the community. Through the MSU staff member's adjunct relationship with Agriculture and Natural Resources Communications Services, the program has access to and has heavily used some free services--media list maintenance, news release production and distribution (including postage), and publications distribution. Production services for audio-visual programs, including television, and publications are also available at modest cost, and Communications has also used them to Sea Grant's advantage.

Communications' production budget is quite small relative to the program's needs, but staff members have been quite successful in obtaining extramural funds--grants, buy-ins, in-kind contributions, etc.--to make it possible to produce more and higher quality materials. This support has ranged from a few hundred dollars' worth of in kind services to nearly \$200,000 in cash for a large, multi-faceted project.

Communications has also continually cooperated with agencies, organizations, programs and institutions that have compatible goals in order to achieve results that would be difficult for Michigan Sea Grant to accomplish on its own. Collaborating with colleagues in Sea Grant programs throughout the network has been a particularly strong emphasis. The transaction costs involved in such arrangements vary, but the partnerships have been largely positive and productive.

GOALS AND OBJECTIVES

Goals - Communications has had several goals during the past 10 years, expressed in various words, but emphasizing the following:

- Increasing the public's awareness and knowledge of Great Lakes issues;
- Increasing the public's awareness of Michigan Sea Grant as a significant supporter of Great Lakes research and producer of important new knowledge;
- Increasing the public's awareness of Michigan Sea Grant's outreach programs and products.

Objectives - Proposals have also presented a variety of objectives, related primarily to specific projects or products, along with some plans to measure and evaluate accomplishments. The following sections assess the accomplishments and benefits of the primary objectives.

PROGRAM SUPPORT

Communications' primary "clients" are the three major components of the program-- administration, research and Extension. Helping these clients reach their audiences with appropriate products delivered through suitable channels is the critical service Communications performs.

Administration - During this period, Communications regularly produced Michigan Sea Grant's directory--*People and Projects*--as well as reports, proposals, plans, letterhead and business cards, for the most part in a timely fashion. Communications has also prepared fact sheets and other materials about the program's accomplishments and benefits for members of Congress and their staffs. For a few years, Communications produced fact sheets and briefing books on significant Great Lakes topics for state legislators and their staffs, but discontinued this practice. Communications produced materials and helped organize special events such as Michigan Sea Grant's 20th anniversary in 1990. Communications' new position on the management team has made it possible to dialog with other administrators more effectively.

Research - Communications pays page charges and purchases reprints for articles on Sea Grant research published in refereed professional journals. During the past decade, Communications has supported 48 articles. Communications has worked on a case-by-case basis with principal investigators and Extension to produce a few technical reports during the past decade when the target audience for the material would not be likely to appreciate or understand it if it were to appear in a professional journal. Staff members also look for opportunities to publicize research projects and results that are of wide public interest and importance in *upwellings* and on the program's web site, as well as through the print and broadcast news media. Of particular note during this period was the success in publicizing the findings of a project which examined the long term health effects of consuming fish contaminated with PCBs.

Extension - This component of the program is Communications' partner in outreach and staff members from both groups have tried individually and collectively to develop a closer working relationship during this period. Progress in this area has fluctuated over time and will require continuing attention.

Examples of some particularly successful efforts conducted with Extension are the following:

- publicity and media coverage - Presidential designation of the Detroit River as an American Heritage River, transient boater studies, marina and boating studies, CoastWatch, HACCP programming, the exploration of *Edmund Fitzgerald* and other Great Lakes shipwrecks, Extension's ANS programming, Great Lakes and Natural Resources Camp;
- editing - reports on Grand Haven's waterfront development and Michigan's charter fishing industry, underwater preserves studies, an issue of the *MarinaNet News* newsletter, a report of the Great Lakes Collegium on marina and boating research needs, reports and publications for watershed initiatives;
- publications - *Eating Great Lakes Fish*, *Freshwater Fish Preservation*, field guides to Great Lakes coastal plants and wetlands, a folder and series of fact sheets on environmental risk and toxic substances, a collection of essays on zero discharge and virtual elimination of toxic substances, new curriculum materials for the Great Lakes Education Program, *Discovering Great Lakes Dunes*, Great Lakes map/brochures, fact sheets on aquatic nuisance species (ANS);
- display - aquatic nuisance species (ANS);
- consultation - news releases on the Inter-Tribal Fisheries Assessment Program's contaminant testing of Native Americans' commercially caught fish;
- video productions - an award-winning instructional video on zebra mussel veliger monitoring, the award-winning television program and educational materials package--*The Life of the Lakes: The Great Lakes Fishery*--and *CoastWatch: An Introduction*.

In addition to these efforts, Communications continues to provide support to Extension by writing proposals and reports. These products have benefited from Communications' skills, though the amount of time it has taken to complete some of them has been disquieting to those anxiously waiting to use them. The results from these products are difficult to assess without specific evaluation data, but anecdotal reports on many of them have been quite favorable.

Cooperating with Others - A logical extension of and source of assistance for providing communications support for Michigan Sea Grant is to cooperate with other Sea Grant programs. Michigan's leadership in regional and national communicators groups has resulted in better communication between those groups and Sea Grant directors and Extension program leaders. Michigan's good rapport with other programs has resulted in support for this program's products such as: *The Life of the Lakes: The Great Lakes Fishery*, *Detecting Zebra Mussels: A Monitoring Program for Citizens*, and *CoastWatch: An Introduction*. Participation in the national media relations project has extended this program's outreach well beyond what it might have been able to accomplish on its own.

The same can sometimes be said for joining forces with other organizations that have mutually compatible goals. Projects such as the Great Lakes Information Network, the Great Lakes Educational Resources Directory, and *Reporting on Risk* are illustrations of how well this has worked. It is important to carefully assess such projects for their potential benefit to the program's mission to serve the public and compare that with the inevitable transaction costs.

PRODUCTS

Marketing - Communications has learned a lot about marketing during the past decade, becoming increasingly astute in identifying, segmenting, and characterizing audiences, as well as ascertaining how best to deliver the information Sea Grant has to meet the audiences' needs. Full integration of Michigan Sea Grant research, Extension and Communications has occurred in areas such as fisheries (*The Life of the Lakes: The Great Lakes Fishery*), risk communication (*Reporting on Risk* and *Eating Great Lakes Fish*) and vessel-based education (the Great Lakes Education Program's new curriculum), resulting in products that have been very well received by the defined audience and well-respected by colleagues.

Product Pricing and Revenue - Some smaller publications and other products are distributed free, and others are sold at modest prices. No set formula has been used in pricing products, but important factors have been the prices of comparable products and recovering production and postage/handling. Because Sea Grant is a not-for-profit organization, the moderate charge for some of its products helps recover the costs incurred in producing them and helps defray the cost of producing materials that are distributed free of charge.

upwellings - The program's free quarterly newsletter presents the broad array of Michigan Sea Grant's research findings, Extension activities and accomplishments, and communications products to a broad audience of approximately 2,500 people in a popular style. It has consistently been the largest single item in the publications budget and has sometimes consumed the largest single portion of Communications staff time in writing, editing and layout. Over the years, its readers have praised it in unsolicited comments and through reader surveys. A 1997 survey indicated that no major changes were necessary to satisfy the current readership, yielded overwhelmingly positive comments and produced some suggestions about making it even more useful. The first-ever survey of staff in 1997 suggested that *upwellings* feature more Michigan Sea Grant material. The new editor hired in early 1998 has given stronger emphasis to the program's major themes and staff efforts and accomplishments in these areas. A new design was developed in mid-1998, and the newsletter received a very positive review in the 1999 national Critique & Awards competition of the Agricultural Communicators in Education professional organization. A nine-page report is available to review.

Publications and Productions - During the decade, Communications produced 47 new titles. During this same period, Communications revised and reprinted 23 titles. Most of these were in direct support of administration, research or Extension, a practice that means

that the program is making increasingly effective use of its communications experts. Among the most successful products (in terms of serving the demonstrated needs of the audience, achieving large distribution and receiving awards) have been: *Reporting on Risk: a Journalist's Handbook*, *The Life of the Lakes: The Great Lakes Fishery*, *Detecting Zebra Mussels: A Monitoring Program for Citizens*, *Lightning and Boats*, *Discovering Great Lakes Dunes*, *Eating Great Lakes Fish*, the Great Lakes map/brochure series, and *A Field Guide to Great Lakes Coastal Plants*.

Promotion - Communications has used a variety of techniques to promote Michigan Sea Grant products. Among the most cost-effective have been the following: news releases, newsletters, publication lists and brochures, selective direct mail, displays and drawings at appropriate events, catalogs produced by other organizations. The program's World Wide Web site now features an on-line catalog and order form.

Distribution - The result of the promotional efforts of the past decade has been the distribution of more than 250,000 journal articles, technical reports, fact sheets, brochures and pamphlets, books and booklets, audio-visual programs, slides, graphics and program materials. Of particular importance during this period was establishing a computerized database at UofM to track product distribution and more fully utilizing the MSU Bulletin Office data systems.

PUBLICITY

Media Relations - Contacting reporters and editors is one of the traditional means for achieving wide scale visibility for an organization, topic, message, product or personality, and Communications has used it quite successfully. Michigan Sea Grant has spent considerable time and money on this type of publicity, and has received very widespread, positive coverage in some notable instances: the program's involvement in the 1989 demonstration of new technology in exploring underwater cultural resources such as the wreck site of *Edmund Fitzgerald*, the 1989 release of research results on contaminants in chinook salmon caught by charter captains near Ludington, and the annual reports on zebra mussel infestation. The objective is more difficult to achieve on other topics, but communications does its best to help reporters and editors localize the story and provide review copies of new publications/products. Communications has also been quite responsive to inquiries from reporters and has participated actively in the national media relations project. Establishing a database for tracking media contacts is making it much easier to assess Communications' success in this area.

Media Education - Communications has also provided reporters with a very effective tool to assist them in reporting on environmental risk issues. As a result of using *Reporting on Risk: A Journalist's Handbook for Reporting on Environmental Risk*, several thousand reporters are now better educated about coverage of this important and controversial area.

Communications has also made considerable contributions to the annual Great Lakes Environmental Journalism Training Institute at MSU, an intensive introductory course in Great Lakes issues for 25 journalists from the region. Suggesting topics and speakers,

recommending site visits and providing Sea Grant materials has helped make this event a high quality experience for participants.

World Wide Web - Michigan Sea Grant is now taking great advantage of the Internet as a means of offering its information to audiences far and wide. Communications and Extension collaborated closely in developing the first home page in 1996. Communications has worked hard to make it more attractive, more user-friendly, and interactive, and in early 1999, a new edition of the site was unveiled. It now features current news, special projects, research, funding opportunities, and contact information for staff members.

PROFESSIONAL DEVELOPMENT

Communication staff members have engaged in various activities and programs to maintain and enhance their professional skills--workshops, conferences, short courses, reading and professional organizations. An important transition has occurred in communications--from a staff whose members had only bachelor's degrees to one in which at least three have master's degrees. More highly educated staff members have a better background for working in the world of academe and have qualifications comparable to the Extension staff. They also have the potential for contributing their expertise in Sea Grant programming topics to the communications work at hand.

AWARDS

One way to measure the results of communications' work is by the yardstick of its respect among professional peers and others. In that sense, the Michigan staff has achieved quite a bit, receiving state, regional and/or national awards for the following products: *The Life of the Lakes: The Great Lakes Fishery*, *Detecting Zebra Mussels: A Monitoring Program for Citizens*, *CoastWatch: An Introduction*, *Discovering Great Lakes Dunes* and *Reporting on Risk: A Journalist's Handbook on Environmental Risk*.

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Communications has accomplished a lot during the past decade--reaching millions of people with important Great Lakes information. It has produced some very successful materials--well received, widely distributed and greatly respected.

It is difficult to tell whether Communications reached the goals set in the early years of the decade because they were written more like mission statements and are not easily measured. The objectives written to support those goals were actually activities and methods, and Communications conducted many of them. During the early years of the decade some activities took much longer than expected and others did not happen--sometimes because program priorities changed, sometimes because of staff shortages, and sometimes for no documented reason.

During the past 5-6 years, communications has been writing proposals with more focused, internally integrated and measurable objectives. That is very positive. Another positive

sign has been a distinct upsurge in the staff's productivity and completion of more projects in a timely fashion.

It has been and will continue to be challenging to establish priorities among the many competing demands on Communications' time and resources. This is especially crucial when new program priorities emerge and Communications is asked to "do its part" in making the new programming effort succeed. A shift of this sort occurred early in this assessment period when the issue of aquatic nuisance species emerged rapidly, and Communications was nearly overwhelmed with the demand for new materials. The result was a delay in completing other products.

Functioning sustainably also involves attention to maintaining and upgrading professional skills, which takes time and money. That should be encouraged and supported, financially and otherwise. A "train the trainer" approach can be quite beneficial, as one person shares with the rest the materials and insights and possibly the new skills gained through the experience.

It's also important for staff members to balance their work with other important spheres of their life so that work does not become all-consuming. Burnout, illness and reduced productivity are counterproductive in the long run, and some Communications staff members have learned that lesson the hard way. It is in the program's and the person's best interest to function sustainably, and maintaining a sense of humor and perspective is crucial.

Communications has learned the following important lessons from the past decade to make it more successful in the next:

- Work toward greater integration with all the program's components, developing consensus on priorities, and conducting projects with respect for the expertise and needs of internal partners.
- Work in a collaborative mode within communications, building upon each person's strengths.
- Focus on priority projects, resisting the temptation to be distracted toward less important work.
- Build evaluation into projects from the outset so that it is possible to measure what's been accomplished and so that lessons learned can be applied to the other projects.
- Learn about and use new tools wisely, focusing on the work to be accomplished and assessing carefully which tools will be most cost effective.
- Continue to build partnerships with external agencies, programs, organizations and institutions that have mutual objectives and compatible strategies, when collaborating will benefit the program and the public.
- Leverage the limited funds that Sea Grant can provide by obtaining external financial resources to enhance the work that needs to be done.