GREAT LAKES NEWS FROM
MICHIGAN SEA GRANT COLLEGE PROGRAM

upwellings

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Annual Report 2003
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Michigan

upwellings

An upwelling occurs in a lake or ocean when strong, steady winds push warm in-shore surface water away from shore causing colder, nutrient-rich water to rise.

Upwellings is published quarterly by the Michigan Sea Grant College Program. Michigan Sea Grant, a cooperative program of the University of Michigan and Michigan State University, supports understanding and stewardship of the Great Lakes through research, outreach and education. Michigan Sea Grant is funded by the National Oceanic and Atmospheric Administration (NOAA) and the State of Michigan.

Suggestions for articles or editorial correspondence regarding this or future issues of *upwellings* are welcomed.

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Value of Partnerships

As the new Director of Michigan Sea Grant, I am pleased to introduce this issue of *upwellings* - our 2003 annual report highlighting selected program accomplishments for March 1, 2003 through February 28, 2004.

As I have only been on board since January, most of these accomplishments were made under George Carignan's thoughtful leadership as Interim Director since September 2000. I join the Michigan and National Sea Grant Programs in recognizing his efforts and thanking him for the program's enhancements under his leadership.

Research, outreach and education activities over the past year are presented within the context of the program's current strategic initiatives: Sustainable Coastal Communities, Fisheries and Trophic Change, Coastal Wetlands, Aquatic Nuisance Species and Great Lakes Education.

Within these broad areas, strategic collaborations with state and federal partners in 2003 have directly benefited the Great Lakes region and the State of Michigan.

Among the highlights:

- The first sessions of the Great Lakes Fisheries Leadership Institute took place in Michigan and other Great Lakes states, a region-wide initiative developed by the Great Lakes Sea Grant Network in cooperation with multiple federal and state partners;
- Michigan Sea Grant, Michigan Office of the Great Lakes and the Great Lakes Commission sponsored the first of several Great Lakes Restoration workshops currently planned in other Great Lakes states to identify restoration priorities;
- With National Sea Grant funding, Sea Grant researchers are making progress understanding the ecosystem impacts of aquatic nuisance species (ANS) and preventing the introduction of ANS via ballast water.
- The Michigan Clean Marina Program, a unique partnership encompassing Michigan's boating industry, academic institutions and the regulatory community, was officially launched in December;
- Collaborating with state and federal agencies and representatives of citizen groups, Michigan Sea Grant facilitated a task force to identify and clarify issues related to wetlands on Great Lakes bottomlands.

These are just a few of the many program accomplishments in 2003. In this next year, we anticipate exciting changes that include adopting a new strategic plan and inaugurating support for integrated assessments that tie best available science to important management and policy decisions.

Donald Scavia
Michigan Sea Grant Director

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LAPORTE

Unplanned development along Great Lakes shorelines can fragment special coastal habitats that support a diversity of native plants and wildlife.

Sustainable Coastal Communities

With more than 3,000 miles of shoreline, the state of Michigan plays a key role in protecting and enhancing Great Lakes resources. A growing number of communities around the state recognize the strong link between healthy natural resources and economic prosperity. In 2003, Sea Grant extension staff collaborated with citizen organizations, state agencies, coastal businesses and shoreline communities to develop and fund programs that protect valuable coastal resources and stimulate economic opportunity.

Planning for Water Quality

Planning commissioners and members of zoning boards make important decisions that guide community growth and development. As part of MSU Extension's popular Citizen Planner program, a course series in land use planning, Michigan Sea Grant extension staff taught educational components on water quality and related land-use topics to 245 public officials at several sessions around the state. The officials represented the coastal counties of Grand Traverse, Macomb, St. Clair Ottawa, Sanilac and Tuscola and made up approximately 26 percent of the citizens trained statewide.

In follow-up evaluations of the citizen planner program, graduates noted positive changes in the process for reviewing development proposals and improved communication and interaction with neighboring communities. In the coming year, Sea Grant expertise will be applied to long-term evaluation of the Citizen Planner program. Researchers hope to shed light on the connections between sound land use practices and the sustainability of coastal community economies, ecosystems and social structures.

For more information see: www.msue.msu.edu/cplanner/ or contact Mike Klepinger at klep@msu.edu or (517) 353-5508.

Study Shows Coastal Growth Pressure and Planning Gaps

Although significant improvements in land use planning along Michigan's shorelines have occurred during the past several years, serious gaps remain, according to a Michigan Sea Grant report released in August 2003. The *Status of Planning and Zoning in Michigan's Great Lakes Shoreline Communities*, authored by extension specialist Mike Klepinger is based on a 2002 survey of the state's coastal jurisdictions and sheds light on land use planning tools and strategies currently in use and the obstacles faced.

The report shows that shoreline properties receive a disproportionate amount of development compared with inland real estate, and sprawling development is fragmenting coastal habitat, especially wetlands and sand dune ecosystems. Michigan's Land Use Leadership Council used the Sea Grant report to assist in the development of more than 150 recommendations to the governor on actions to make the best use of Michigan's land use resources.

For more information contact Mike Klepinger at klep@msu.edu or (517) 353-5508.

BRENNER

Detroit River waterfront renewal projects incorporate greenways initiatives, soft engineering and habitat restoration.

Detroit Waterfront Renewal

The Detroit River, an American and Canadian Heritage River, is being transformed from industrial waterway to valued natural resource. An important transportation route, the river also provides drinking water to approximately five million people and boasts the only International Wildlife Refuge in North America.

Michigan Sea Grant extension agent Mark Breederland, now extension agent for Northwest Michigan, chaired the steering committee of the Greater Detroit American Heritage River (AHR) Initiative through mid-December 2003. The Initiative provides an essential role in prioritizing, coordinating and securing funding for numerous waterfront greenways and redevelopment projects.

Detroit River International Wildlife Center

Led by Sea Grant extension, the Greater Detroit AHR Initiative provided assistance to Wayne County's parks division in obtaining a $50,000 coastal zone management grant for planning a Detroit River International Wildlife Center. Plans call for the center to be constructed on a 40-acre parcel on the lower Detroit River near Humbug Marsh, which was officially acquired in 2003 for conservation purposes.

Discover Our Wild Side

Michigan Sea Grant extension contributed to the development of the publication *Discover Our Wild Side*, produced by partners of the Detroit International Wildlife Refuge for the 2003 centennial celebration of the National Wildlife Refuge System. The 23-page publication highlights the water resources, wildlife, heritage and recreational opportunities in Southeast Michigan. See the publication online: www.mac-web.org/Publications/discoverourwildside.pdf

Soft Engineering

Michigan Sea Grant extension co-sponsored and moderated a soft engineering conference on Belle Isle in Detroit in October 2003, highlighting ecological principles and practices to stabilize shorelines. More than 75 engineers, landscape architects and regulatory personnel from around the state participated in the conference, which incorporated a hands-on component that illustrated state-of-the-art installation techniques and resulted in an additional 150 feet of demonstration shoreline along the Detroit River.

For more information contact Mark Breederland at breederm@msue.msu.edu or (231) 922-4628.

Detroit River Sturgeon Habitat Project

A project to create spawning reefs in the Detroit River for the threatened lake sturgeon was announced by the City of Detroit and the Detroit Recreation Department in November 2003. The sturgeon habitat project is funded by grants from NOAA's Great Lakes Coastal Restoration Program, through the Michigan Coastal Zone Management Program, and the Great Lakes Fishery Trust with additional support from multiple partners. Michigan Sea Grant will manage and implement the $427,000 project that will include educational displays at Belle Isle.

For more information contact Jennifer Read at jenread@umich.edu or (734) 936-3622.

BRENNER

Lake sturgeon, a threatened species in Michigan, once reproduced abundantly in the Detroit River.

Michigan Clean Marina Program Begins

The Michigan Clean Marina Program, sponsored by Michigan Sea Grant, the Michigan Boating Industries Association (MBIA), and the Michigan Department of Environmental Quality (MDEQ), officially began in December 2003. The program was developed to protect water resources and fish and wildlife habitat by promoting environmentally sound marina and boating practices.

The Michigan Clean Marina program is a voluntary stewardship program open to all public and private marinas in the state. Clean Marina program members enhance their business' public image by promoting environmentally sound practices and save money by adopting best management practices.

For more information contact Chuck Pistis at pistis@msue.msu.edu or (616) 846-8250.

Hot Topics

Rip Currents

In the wake of multiple drowning deaths in southern and northern Lake Michigan, Michigan Sea Grant outreach staff teamed up with the Mackinac County Water Safety Review Team and the Pier Safety Task Force to assist with public outreach promoting water safety. Efforts include production of Web and print publications, beach signs, workshops and media outreach.

Michigan Sea Grant is also working with the National Weather Service and the U.S. Life Saving Association (USLA) to raise awareness of rip currents in the Great Lakes and oceans. Rip currents are powerful currents that can develop rapidly and pull swimmers offshore. According to USLA, rip currents account for some 80 percent of lifeguard rescues.

For more information see: www.miseagrant.umich.edu/rip

Restoring the Great Lakes

In partnership with the Michigan Office of the Great Lakes and the Great Lakes Commission, Michigan Sea Grant sponsored a public workshop to identify priorities for ecosystem restoration and protection, as well as implementation opportunities. The Michigan workshop is one in a series of state workshops designed to identify, refine and establish the scientific basis for region-wide restoration priorities. The larger effort is assisting the Council of Great Lakes Governors in refining their draft priorities and will inform federal restoration legislation being considered by Congress. This project and another by the Northeast-Midwest Institute to identify lessons learned from other large-scale ecosystem restoration efforts, is being funded by the National Sea Grant Program and administered by Michigan Sea Grant.

For more information contact Jennifer Read at jenread@umich.edu or (734) 936-3622.

Fisheries and Trophic Change

Understanding Great Lakes ecosystems is critical for successful fisheries management. New Sea Grant research employs state-of-the-art statistical modeling and genetic structuring techniques to enhance knowledge of Great Lakes fish communities. These projects complement work by extension staff to assist Michigan's fishing industries and to broaden fisheries knowledge and leadership among Michigan citizens.

A New Perspective on Saginaw Bay

Lake Huron's Saginaw Bay, the largest bay in Michigan, is ecologically productive and provides an important nursery area for many species of fish. Surrounded by agricultural and urban areas, the Bay has withstood a barrage of impacts ranging from industrial pollution and urban runoff to excessive nutrients and invasive species.

The Bay is also remarkable, according to University of Michigan researcher Sara Adlerstein, because long-term data are plentiful—from information on zooplankton and phytoplankton that make up the lower aquatic food levels to annual surveys of top predators such as walleye and yellow perch.

With Sea Grant funding, Adlerstein and University of Michigan researcher Ed Rutherford are employing statistical modeling techniques to analyze disparate data and create a complete ecosystem view. This broad perspective will shed light on the impact of exotic species on the Saginaw Bay fish community, especially walleye and yellow perch.

BRENNER

Sea Grant research will explore the impact of exotic species on the Saginaw Bay fish community, especially walleye and yellow perch.

Research Projects

Ecosystem Mosaics: Modeling Pattern and Process Using Remotely Sensed Imagery
Judith Wells Budd,
Michigan Technological University

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

Impacts of Exotic Species and Trophic Change on Fish Community Structure, Population Dynamics and Food Web Linkages in Saginaw Bay, Lake Huron
Sara Adlerstein, University of Michigan
Edward Rutherford, University of Michigan

Spatial Genetic Structuring of Forage Fish in the Upper Great Lakes: Evidence for a Subdivided Forage Base and Implications for Structuring in Predatory Fish Species
Kim Scribner, Michigan State University
Wendy Stott, U.S. Geological Survey, Great Lakes Science Center

The Use of cDNA Microarrays to Identify Genes Involved in the Immunotoxicity of Benzo (a)pyrene in the Rainbow Trout
Mohamed Faisal,
Michigan State University

Additional Projects

Ship Induced Wave Effects in Rivers and Estuaries
Okey Nwogu, University of Michigan

Water Quality and Public Health Risks in the Great Lakes
Joan Rose, Michigan State University

The researchers will look specifically at the factors that control fish community structure and population, feeding habits, and variation in spatial distribution and abundance.

"The project really looks at the ecosystem from basic environmental conditions to the whole food web," says Adlerstein. "The data are there and waiting to be analyzed... It's a matter of putting the whole picture together."

With assistance from Ph.D. student Brian Chilcott, project researchers have begun gathering environmental data, fish survey data and data on the lower food web levels. While project results will be relevant to Saginaw Bay, an understanding of ecological processes will be significant to similar ecosystems in the Great Lakes.

For more information contact adlerste@umich.edu or (734) 764-4491.

The Life of the Lakes: A Guide to the Great Lakes Fishery

Michigan Sea Grant Communications produced the revised edition of *The Life of the Lakes: A Guide to the Great Lakes Fishery* in September 2003. The publication was used as the primary curriculum for fisheries leadership institute workshops and is also marketed to the public. More than 600 copies of the booklet have been distributed.

The Life of the Lakes, which features more than 30 photos and illustrations, employs an ecosystem approach to show how social, environmental and technological changes have influenced Great Lakes recreational and commercial fisheries over time. The publication was authored by Michigan State University's Shari Dann and Brandon Schroeder, now Michigan Sea Grant extension agent for Northeast Michigan.

For more information contact Elizabeth LaPorte at elzblap@umich.edu or (734) 647-0767.

LAPORTE

Brandon Schroeder, Great Lakes Fisheries Leadership Institute coordinator, and Angie Bowen of the U.S. Fish and Wildlife Service collaborate on workshop materials.

Great Lakes Fisheries Leadership Institute

Michigan citizens representing more than 20 fisheries and conservation organizations took part in Sea Grant's inaugural Great Lakes Fisheries Leadership Institute—a certificate program designed to enhance fisheries leadership skills among citizens and foster effective interactions with management agencies.

The Michigan component of the Institute included several two-day workshops organized by Michigan Sea Grant extension. Through classroom learning and relevant field trips, the Institute presented fisheries issues specific to lakes Huron, Michigan, Erie and Superior.

A state-level meeting held in Lansing in October covered public access issues, procedures for working with the state legislature, information on the various agencies with management responsibilities and fishing regulations. Educational components created by Michigan Sea Grant staff provided overviews of Michigan's commercial fishing industry and institutional arrangements for Great Lakes fisheries management.

For more information contact John Schwartz at schwartj@msue.msu.edu or (517) 355-9637.

Charterboat Industry Contributes to Michigan's Coastal Economy

One important segment of Michigan's recreational fishery is the charter fishing industry. A report released in November 2003, co-authored by Michigan Sea Grant extension agent Chuck Pistis, shows that Michigan's charter fishing industry is generating greater revenues than it did eight years ago, despite having fewer captains.

The report shows that there are 468 charter captains in the state, and they received an estimated total of $10.1 million in fees in 2002. According to Pistis, charter fishing clients also contributed significantly to the economies of Michigan's coastal communities in 2002, spending an estimated $19.8 million on food, lodging and other local purchases in Michigan's Great Lakes ports. Responding charter captains indicated that the most important concerns facing their industry are the economy, the impacts of exotic species, boating equipment/operating costs and reduced fish abundance.

BRENNER

Charter fishing clients spent an estimated $19.8 million in 2002 on food, lodging and other local purchases in Michigan's Great Lakes ports.

For more information contact Chuck Pistis at pistis@msue.msu.edu or (616) 846-8250.

Whitefish Marketing

Enhancing the sale and distribution for lake whitefish, Michigan's biggest commercial catch, is a high priority for many of the state's commercial fishing operations. Michigan Sea Grant extension agents Ron Kinnunen and Chuck Pistis worked with industry representatives and the Michigan Department of Agriculture to explore new approaches to marketing Great Lakes whitefish including broader retail sales through the Select Michigan Program.

A new project selected for National Sea Grant funding will allow expanded activities in the coming year encompassing logistical distribution processes and third-party quality certification. Economic and marketing issues at the heart of the industry were highlighted in the October 2003 issue of Michigan Sea Grant's newsletter *Upwellings,* distributed to more than 3,000 people.

For more information contact Ron Kinnunen at kinnunen@msue.msu.edu or (906) 226-3687.

Coastal Wetlands

Forming an ecological buffer between land and water, coastal wetlands are an important component of a healthy and diverse ecosystem. Ongoing Sea Grant research projects are broadening our understanding of coastal wetland processes and their market value. As Great Lakes water levels remained close to historic lows in 2003, Sea Grant staff also partnered with other organizations, agencies and shoreline residents to find common ground over issues related to new wetlands growth on Great Lakes bottomlands.

Emergent Wetlands

A multi-party Shoreline Task Force, facilitated by Michigan Sea Grant and Michigan State University Extension, identified and clarified shoreline maintenance issues related to emergent wetlands along Michigan's Great Lakes coastline. Convened at the invitation of state representative Joseph Rivet (96th District) and the U.S. Army Corps of Engineers-Detroit District, the task force completed a consensus document and set of recommendations in April 2003.

The document identifies opportunities to allow shoreline property owners to access and enjoy their waterfront while maintaining the ecological value of these new wetland areas. Scientists recognize that these wetlands are part of the natural long-term water cycle and provide many ecological benefits including erosion control and critical habitat for fish and wildlife.

A set of recommendations was directed to pertinent regulatory agencies, including the U.S. Army Corps of Engineers and Michigan Department of Environmental

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Public education about the ecological benefits of coastal wetlands is an important part of Sea Grant outreach. For more information see: www.miseagrant.umich.edu/wetlands

Research Projects

Effects of Great Lakes Marsh Fragmentation on Fish Assemblages
Paul Webb, University of Michigan
James Diana, University of Michigan

Estimating Non-market Values for Great Lakes Coastal Wetlands
Michael D. Kaplowitz,
Michigan State University
Frank Lupi, Michigan State University
John P. Hoehn, Michigan State University

An Evaluation of Seasonal and Temporal Variability in Potential Trace Metal Remobilization in coastal Wetlands Sediments Using Voltammetric Microelectrode Technology and Solid-Phase Extraction Techniques
Brent Lewis, Kettering University

Sedimentation and Emergent Plant Decay in Coastal Wetlands
Robert K. Neely,
Eastern Michigan University
Robert Sinsabaugh, University of Toledo

Quality among others, and identifies inconsistencies in the permitting processes governing shoreline activities.

As a result of task force work, the U.S. Army Corps of Engineers developed a regional permit that is now in place for Michigan and simplified its permitting process. According to Lieutenant Colonel Thomas Magness of the Corp's Detroit District, more than 300 residential property owners took advantage of the new one-page permit in 2003.

The Shoreline Task Force Consensus Document was presented to members of the Michigan legislature.

For more information contact Jennifer Read at jenread@umich.edu or (734) 936-3622.

Effects of Sedimentation

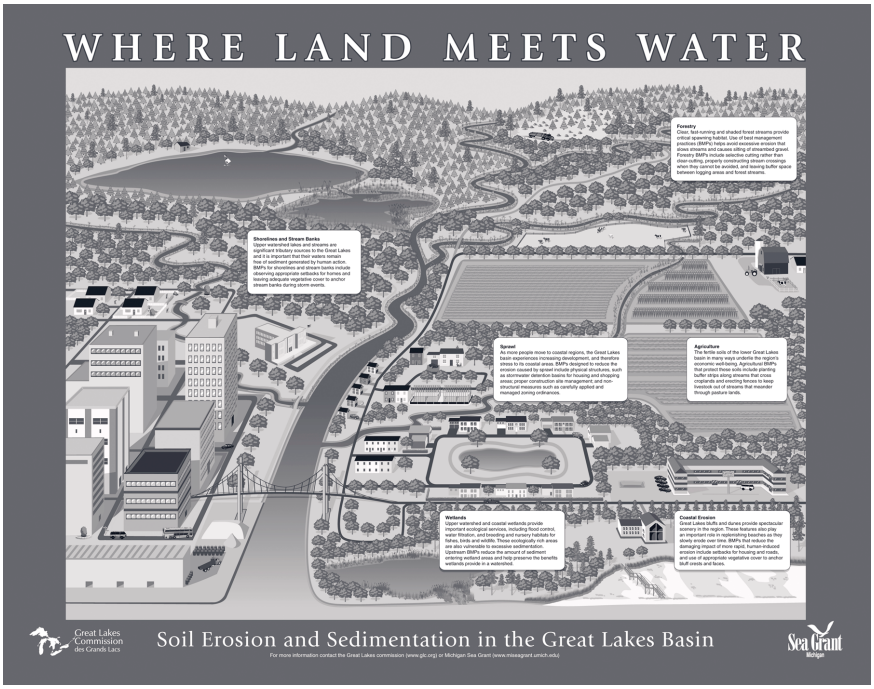
Accelerated rates of sedimentation, commonly caused by erosion, are especially harmful to wetland habitats. Wetland function depends largely upon microscopic organisms that assist in decomposing dead plant matter, or detritus. Excessive sediment can inhibit metabolic activity or limit access to plant matter.

In a study of two Lake Erie wetlands, researchers led by Robert Neely of Eastern Michigan University and Robert Sinsabaugh of the University of Toledo, monitored 30 specially designed enclosures to measure the effect of sedimentation on the rate of decomposition. Sites monitored were located at Lake Erie Metropark (high marsh) and Winous Point (low marsh).

In recent analysis, investigators found that plant decomposition and microbial activity at the two sites are strikingly different. Bacteria dominated microbial activity at the low marsh site, and because of the submerged conditions, algal communities on the detritus were prevalent. Conditions at the drier high marsh site were more conducive to fungal communities, which have a higher oxygen requirement.

According to researchers, differences in hydrology, or the frequency of inundation related to a wetland's elevation and proximity to the lake, appear to be the most important factors affecting rates of microbial metabolism and plant decay.

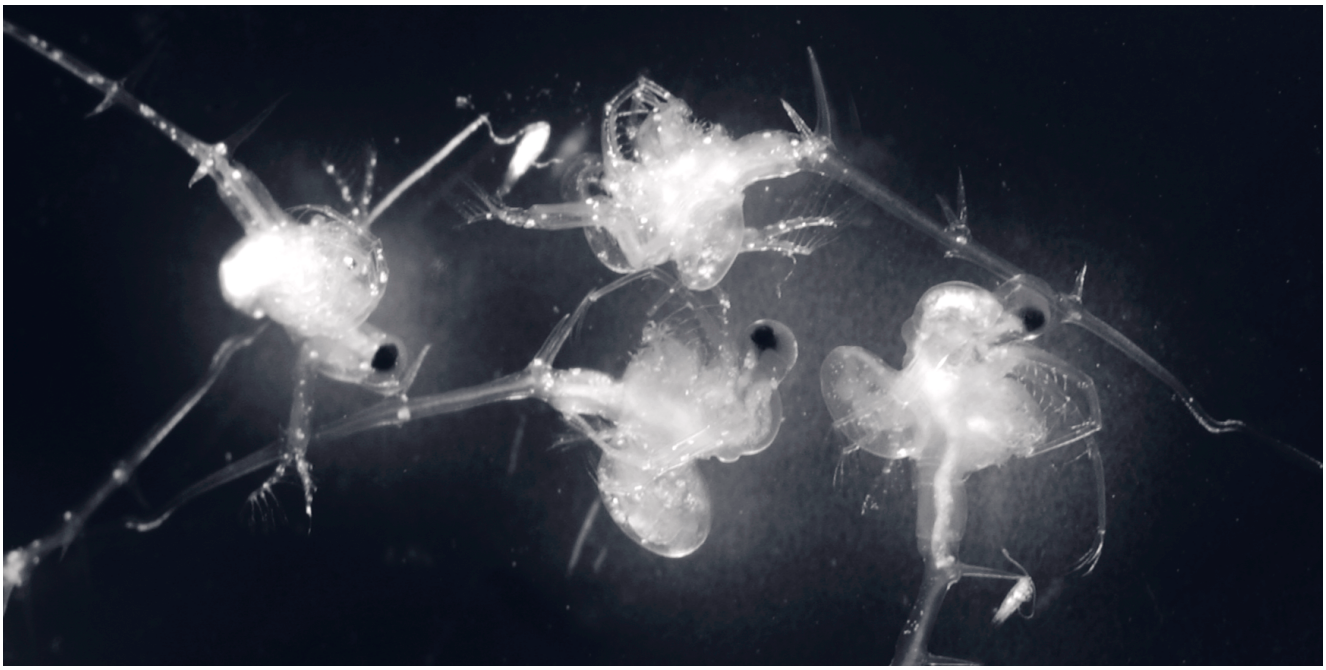
For more information contact Robert Neely at rneely@emich.edu or (734) 487-4344.



Where Land Meets Water

A full-color brochure, produced in partnership with the Great Lakes Commission, explains the problems caused by soil erosion and sedimentation in a typical watershed in the Great Lakes basin. The brochure features an illustrated 17- by 22-inch poster, created by Michigan Sea Grant graphic artist Dave Brenner, depicting various land uses and best management practices that can reduce water quality impacts.

See the brochure online: www.miseagrant.umich.edu/pubs/soilerosion.html



BRENNER

The spiny water flea (Bythotrephes longimanus) is an exotic species that preys upon native zooplankton in the Great Lakes.

Aquatic Nuisance Species

More than 160 nonindigenous species have entered the Great Lakes. Of these, some 10 percent are considered nuisance species, profoundly altering native ecosystems and processes. Many nonindigenous species arrived from foreign ports, harbored in the ballast water of ocean-going freighters. Innovative Sea Grant research employs marine engineering, DNA technology and economics to shed light on ways to prevent and control future invasions. Using research-based information, outreach has focused on reducing the impact of aquatic nuisance species and educating Michigan citizens.

Building a Better Ship

Rather than eliminating nonindigenous species carried in ballast water, a University of Michigan project takes a different approach—eliminating the ballast tanks that harbor foreign species. Led by marine engineer Michael G. Parsons, the project examined the cost and technical feasibility of building a ship that eliminates ballast tanks, replacing them with a series of slow flow ballast tubes, or trunks.

The ballast-free ship concept utilizes a varying flow of water through the tubes to change a ship's buoyancy and maintain optimum stability. When no cargo is on board, the structural tubes are opened to the sea, and the flooding lowers the ship to its required ballast drafts. The pressure difference between the entrance to the tubes near the bow of the ship and the exit openings near the stern produces a slow flow of water. The flow ensures that the ballast trunks are always filled with "local" sea water—eliminating the transfer of foreign ballast water and nonindigenous species.

Results of Computational Fluid Dynamics studies and model tests have shown that the trunk operation will result in a modest increase in required ship power. The need to lower the ballast tubes below the ballast draft for flooding to occur raises the cargo hold and requires that the hull become deeper to accommodate the same cargo volume. However, according to researchers, the new hull configuration can be accomplished by adding a few hundred tonnes of hull weight. The extra costs would be offset by the elimination of a ballast water treatment system and the ballast piping within a ship's cargo region.

For more information contact Michael Parsons at parsons@engin.umich.edu or (734) 763-3081.

Research Projects

Identification of Adhesion Molecules in the Zebra Mussel (Dreissena polymorpha)
Mohamed Faisal,
Michigan State University

The following aquatic nuisance species research projects managed by Michigan Sea Grant are supported by National Sea Grant funds.

Aquarium Initiative
Michael Klepinger, Michigan Sea Grant

A Collaborative Approach to Advance Implementation of State Management Plans for Prevention and Control of Aquatic Nuisance Species in the Great Lakes Region
Michael J. Donahue,
Great Lakes Commission

Complex Interactions Between Zebra Mussels and Phytoplankton: Variation in Grazing Effects Across the Trophic Gradient
Orlando Sarnelle,
Michigan State University

Computational Fluid Dynamics Study of Ballast Exchange Effectiveness and Improved Ballast Tank Designs
Michael G. Parsons, University of Michigan

Strong Attachments

Among their many traits, zebra mussels have a remarkable ability to attach quickly and tightly to underwater surfaces using fine hairs, called byssal threads, and a complex mixture of adhesive proteins. Once established on underwater surfaces and inside water intake pipes in the Great Lakes and inland waters, zebra mussels filter nutrients, alter native habitat and contribute to harmful algal blooms and loss of native species.

In a project led by Mohamed Faisal of Michigan State University, researchers are using DNA technology to identify the adhesion proteins and processes of zebra mussels, which may lead to innovative control strategies.

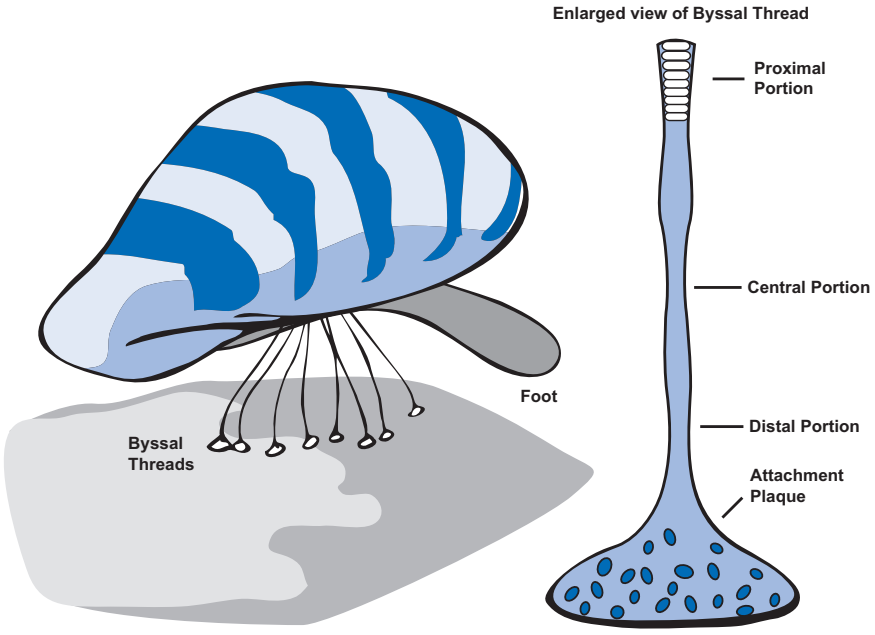
For more information contact Mohamed Faisal at faisal@ahdl.msu.edu or (517) 432-8258.

Where Are They Now?

Recently compiled monitoring data for 2003 show that zebra mussels have spread to an additional seven of Michigan's inland lakes, bringing the cumulative lake total to 184.

Michigan Sea Grant, in partnership with Michigan Lake and Stream Associations, the Michigan Department of Natural Resources and others, has been monitoring the movement of zebra mussels since 1992 with the help of citizen volunteers. Citizen monitoring helps increase scientists' knowledge and understanding of how and why invading organisms spread once they arrive in the Great Lakes basin.

To see a list of colonized lakes, see: www.miseagrant.umich.edu/ans/lakes.html



Fine hairs, called byssal threads, and a complex mixture of adhesive proteins help zebra mussels attach to underwater surfaces.

K. STEPNITZ

Galerucella beetles feed exclusively on Purple Loosestrife and have helped to control the invasive wetland plant.

Purple Loosestrife Project

Approximately 75 educators and community volunteers released *Galerucella* beetles in Michigan wetlands in 2003; the beetles feed exclusively on the invasive purple loosestrife plant. The activity is part of the Purple Loosestrife Project, an innovative biological control program co-developed by Michigan Sea Grant and Michigan State University (MSU) in 1997. Since the project began, hundreds of educators and thousands of students have released beetles in approximately 200 wetland sites.

Michigan Sea Grant extension specialist Mike Klepinger, who coordinates the project with entomologist Doug Landis of MSU, helped organized a special media day in Holland, Michigan in July. Project supporters, resource managers and representatives from regional media outlets learned about progress in controlling purple loosestrife at 24 specially monitored sites in lower Michigan.

New research findings indicate that plants native to Michigan have begun to re-emerge in some wetland locations following control of purple loosestrife. Researchers led by Landis and assisted by Klepinger and others reported that *Galerucella* beetles have established large populations in some mid-Michigan locations and caused 100 percent defoliation within a several-mile area, allowing many varieties of native plants to re-emerge. The research results were published in the September 2003 issue of the journal *Biological Control*.

For more information see: www.miseagrant.org/pp or contact Mike Klepinger at klep@msu.edu or (517) 353-5508.

Pen and Ink

One way to learn about invasive species is to write about them. In October 2003, more than 80 Michigan high school students participated in an essay contest sponsored by the Great Lakes Sea Grant Network and *The Muskegon Chronicle*. Students were asked to propose a creative, realistic and environmentally sound plan for managing an aquatic nuisance species in the Great Lakes. Essays were judged on creativity, accuracy, clarity and conciseness.

The winning essay, *Purple Loosestrife: A Beautiful Killer*, was written by Alyn Kiel, an 11th grade student at Montague High School in Montague, Michigan. Kiel and other essay winners were invited to the *Lake Michigan State of the Lake 2003* conference at the Lake Michigan Center, and Kiel's essay was published in the *Congressional Record*.

For more information contact Elizabeth LaPorte at elzblap@umich.edu or (734) 647-0767.

The Economics of Policy Options for Controlling the Introduction and Spread of Aquatic Nuisance Species in the Great Lakes
R. Horan, Michigan State University

Identification of Diseases and Host Defense Mechanisms in the Zebra Mussel (Dreissena polymorpha)
Mohamed Faisal,
Michigan State University

Impacts, Barriers and Control of Round and Tubenose Gobies in the Great Lakes
David Jude, University of Michigan

A Paradigm Shift in Ballasting: The Possibility of a Ballast-Free Ship
Michael G. Parsons, University of Michigan

Supported by: Thomas Lamb, Ana Sirviente, University of Michigan

Miltiadis Kotinis, Ph.D. Candidate, University of Michigan

Preventing New Introductions of Invasive Aquatic Plants from Water Gardening and Shoreline Restoration
Michael Klepinger, Michigan Sea Grant

Great Lakes Education

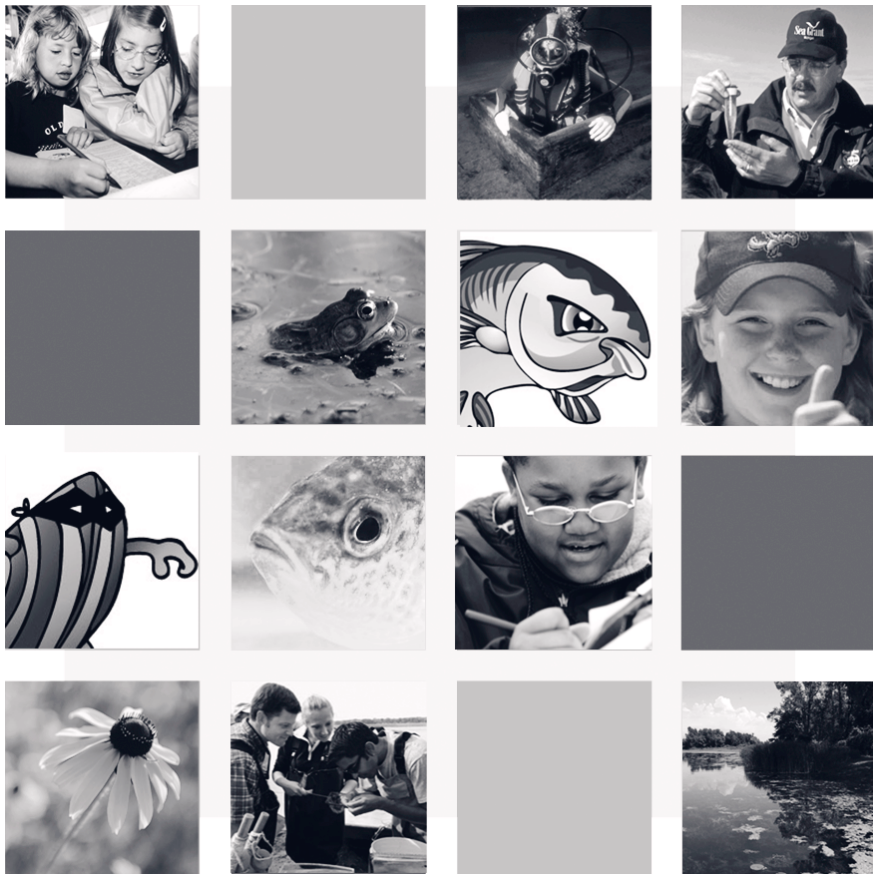
Learning about the Great Lakes can take many forms that might involve participating in a summer program, visiting a museum or simply clicking on a Web link. Michigan Sea Grant took advantage of creative educational opportunities in 2003 to bring the excitement and wonder of the Great Lakes to diverse audiences within and beyond the region. These activities complemented ongoing education programs for Michigan's K-12 students that emphasize participation and hands-on learning as a way to stimulate interest and encourage lifelong stewardship of the region's freshwater resources.

Online Educational Lessons

Michigan Sea Grant communications finalized a series of online educational lessons for students and teachers based on the award-winning curriculum for the Great Lakes Education Program.

Designed as a pilot series, the four lessons explain the fundamentals of freshwater concepts on water temp-erature, benthic life, water chemistry (oxygen and carbon dioxide) and the aquatic food web. In developing the lessons, special emphasis was placed on meeting state educational standards for Michigan science education.

See the lessons online: www.miseagrant.umich.edu/education



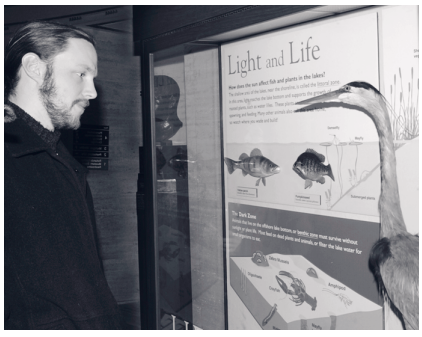
Michigan Sea Grant's new education web site features online lesson plans, K-12 camps and programs, and fellowships information. See: www.miseagrant.umich.edu/education

Life of the Lakes Exhibit Explores Biodiversity

A new "Life of the Lakes" exhibit at the University of Michigan (UM) explores the science of the Great Lakes, including the role of people in lake health and biodiversity. The exhibit, co-sponsored by Michigan Sea Grant and the UM Exhibit Museum of Natural History, focuses on the Great Lakes ecosystem.

Michigan Sea Grant graphic artist Dave Brenner designed the museum exhibit panels, which are based on content from the popular *Life of the Lakes* booklet and poster. The publication was designed and produced by Michigan Sea Grant in September 2003. (Read more about *The Life of the Lakes* on page 6.) A special public cable access program about the exhibit aired in southeastern Michigan in February, featuring Communications Director Elizabeth LaPorte.

For more information see: www.miseagrant.umich.edu/education/exhibit.html



Michigan Sea Grant's Life of the Lakes exhibit explores the science of the Great Lakes.

All Hands on Deck

Hands-on learning remains the cornerstone of the Great Lakes Education Program (GLEP) for fourth-grade students in southeast Michigan. Coordinated by Michigan Sea Grant extension agent Steve Stewart, GLEP introduces students to freshwater concepts in the classroom and provides hands-on learning via educational "schoolship" cruises on the Clinton River, Lake St. Clair and the Detroit River.

A total of 4,562 students, 160 teachers, 635 adult chaperones and 45 volunteers participated in GLEP in 2003. The cumulative total of GLEP participants since 1991 is 44,909.

The Huron-Clinton Metropolitan Authority provides facilities and staff at Lake Erie Metropark, which allows GLEP organizers to offer a half day of wetlands education to complement the vessel-based GLEP experience. The Downriver Career Technical Consortium, based in Woodhaven, pledged $12,000 to support the participation of 20 GLEP classes during the spring 2003 season, and Wayne County provided free dock space valued at $1,000.

For more information contact Steve Stewart at stewart@msue.msu.edu or (586) 469-7431

California Bound

Leopard sharks, sea cucumbers and barracuda were among the ocean creatures that two Michigan teenagers experienced in July 2003 during a unique, week-long educational program on Catalina Island off the coast of southern California.

With financial support and assistance from Michigan Sea Grant, the students attended the annual Summer Science Program for High School Women sponsored by the University of Southern California (USC) Sea Grant College Program.

LAPORTE

A fourth-grade student takes notes during a Great Lakes Education Program cruise. More than 4,000 students from Southeast Michigan participated in the program in 2003.

Mary Sims of Big Rapids and Latoya Hatcher of Detroit were among 21 students from several states who took part in the USC program. The program provides an opportunity to explore the field of oceanography through an interactive series of activities and research. Participants interact with women mentors in a variety of marine related careers such as marine policy, research science, education and diving safety.

For more information contact Elizabeth LaPorte at elzblap@umich.edu or (734) 647-0767.

BRENNER

Huron High School team members collaborate on a bonus question during the regional competition of the National Ocean Sciences Bowl.

National Ocean Sciences Bowl

Eighty high school students from 11 high schools across the region competed in February 2004 at the seventh annual regional competition of the National Ocean Sciences Bowl, sponsored in part by Michigan Sea Grant.

The event is one of 24 regional competitions held around the nation designed to promote literacy in science and mathematics through improved understanding of the world's oceans and Great Lakes. Linworth Alternative Program from Worthington, Ohio won this year's Midwest competition. The team will represent the region at the National Ocean Sciences Bowl on April 24, 2004 in Charleston, South Carolina.

For more information see: www.glerl.noaa.gov/pr/nosb/cur

Great Lakes and Natural Resources Camp

Forty-seven Michigan teenagers, ages 13-15, participated in the 4-H Great Lakes and Natural Resources camp, supported in part by Michigan Sea Grant. The week-long camp is held in northern Michigan and provides an opportunity to learn about Great Lakes coastal processes, fisheries, wetlands and many other Great Lakes topics.

Michigan Sea Grant extension provides educational support for the camp, which has been shown to increase students' awareness and understanding of natural resources ecology and management, foster leadership skills and stimulate career interests. To date, more than 900 students have participated in the camp.

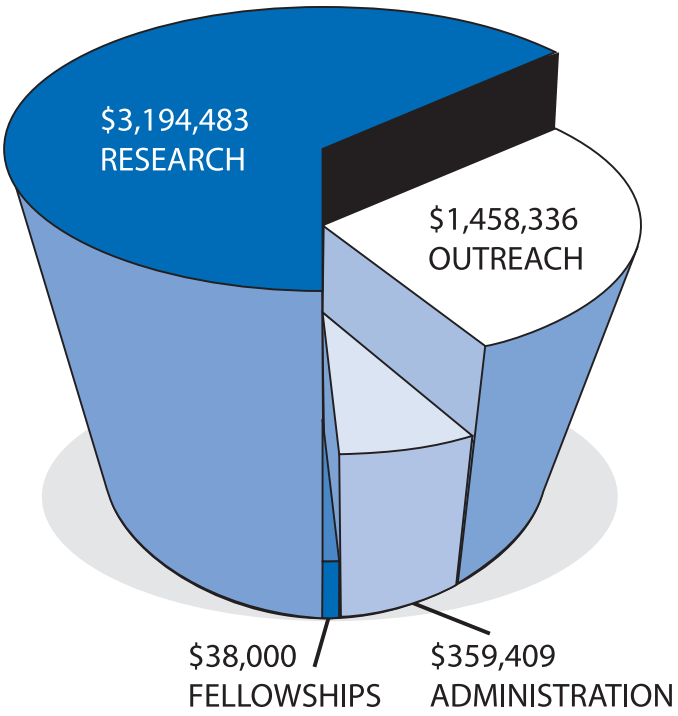
For more information on the 2004 camp contact Program Leader Judy Ratkos, 4-H Youth Development at ratkos@msue.msu.edu or (517) 432-7613
see: www.miseagrant.org/greatlakescamp





Student education is an important part of the Michigan Sea Grant mission. In 2003, Michigan Sea Grant supported more than 40 graduate and undergraduate research assistants on a variety of projects relating to Great Lakes fisheries, coastal wetlands and aquatic nuisance species.

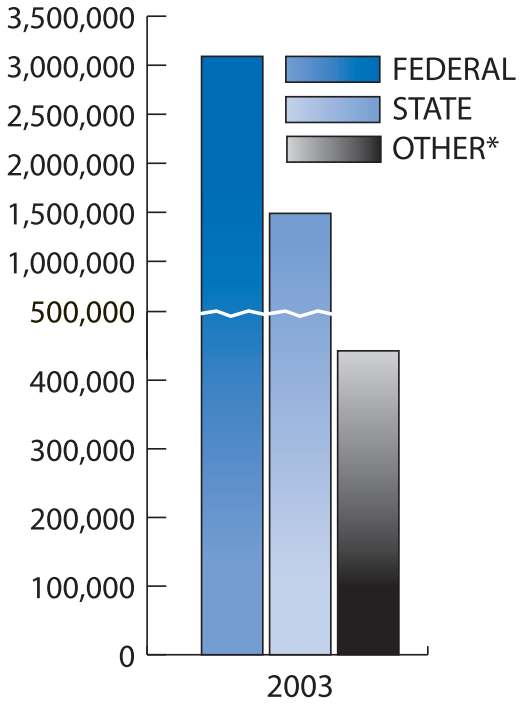
Michigan Sea Grant Annual Program Funding
March 2003 - February 2004



Total Program Funding: $5,012,228

Totals for research, outreach and administration include matching funds from non-federal sources. Fellowship funds supported a Michigan student selected for the Great Lakes Commission/Sea Grant Fellowship.

Program Funding by Sources



**Government and private grants in addition to core federal and state funding.*

MICHIGAN SEA GRANT

Sea Grant Michigan

contact us

Michigan Sea Grant (www.miseagrant.umich.edu) is dedicated to the protection and sustainable use of Great Lakes and coastal resources. Michigan Sea Grant provides Great Lakes science-based information and technical assistance to residents and communities in coastal regions around Michigan.

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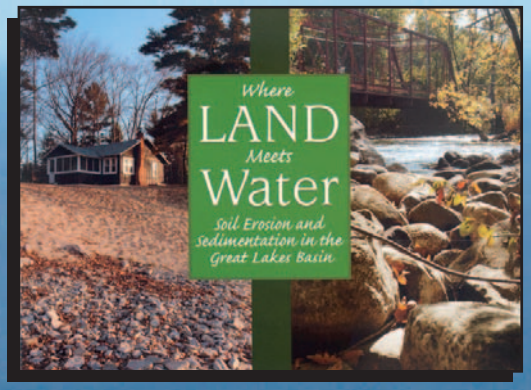
MICHIGAN STATE UNIVERSITY EXTENSION



Where Land Meets Water: Soil Erosion and Sedimentation in the Great Lakes Basin

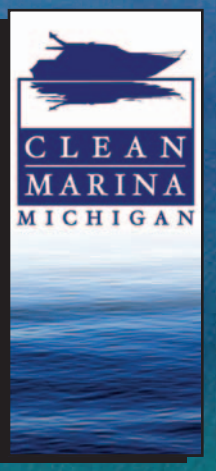
Produced in partnership with the Great Lakes Commission, this publication addresses the various types of erosion and sediment that occur in the Great Lakes Basin, and features a beautiful poster.

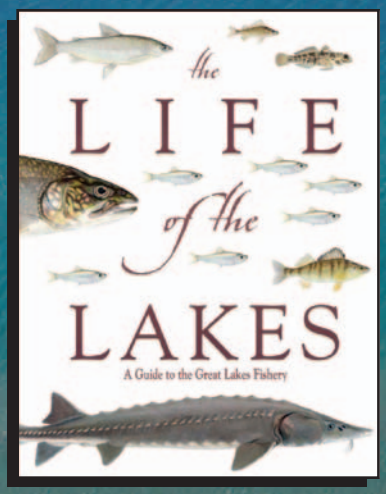
Hot Off the Press

Michigan Sea Grant communications distributed 83,500 publications and products in 2003. An average of 200,000 people per month visited the program web site, **www.miseagrant.umich.edu/pubs**

Clean Marina Program brochure

The brochure was produced in partnership with the Michigan Department of Environmental Quality and the Michigan Boating Industries Association. This publication is targeted to commercial and public boating facilities to address pollution prevention and waste reduction, and highlights strategies that marinas can employ to protect water quality and save money.





Life of the Lakes: A Guide to the Great Lakes Fishery

Produced by Michigan Sea Grant this booklet features beautiful color illustrations, diagrams and photographs. Content focuses on economic, environmental and historical issues related to Great Lakes fisheries. Great for anglers, K-12 educators, natural resource managers, and anyone interested in Great Lakes issues.

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