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# Minnesota Sea Grant

Program Guide  
2003-2005



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*The University of Minnesota is an equal opportunity employer and educator.*

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Minnesota  
Sea Grant works with  
people and communities  
to help maintain and  
enhance the  
environment and  
economies along  
Lake Superior  
and Minnesota's  
inland waters by  
identifying needs,  
funding research,  
and translating results.



# Research



Minnesota Sea Grant funds research projects with money we receive from the National Sea Grant Office and the University of Minnesota. We award this money biennially, for one- to two-year projects that improve the understanding, use, and management of water resources, particularly those related to Lake Superior and Minnesota's inland waters. In 2003, Minnesota Sea Grant funded nine proposals that address our thematic areas.

Typically, lead investigators are affiliated with an academic institution in Minnesota. Scientists, a technical panel, and Minnesota Sea Grant's advisory committee review the proposals. The 2003 research awards collectively totaled \$678,500 with an additional \$527,434 designated to support 10 graduate research assistants.

## How Physical and Chemical Stresses Affect Survival of Spiny Waterflea Eggs

The spiny waterflea (*Bythotrephes longimanus*) is a voracious predatory zooplankton that is an aquatic invasive species in the Great Lakes, including Lake Superior. Current control efforts for this pest focus mainly on the adult life stage, even though the resting egg stage is more likely to be accidentally dispersed by recreational boaters on their equipment. Resting eggs might be viewed as “super eggs.” They have a hardened outer shell and are designed to withstand harsh environmental conditions. They can hatch months to years after incubating in lake sediments. Researchers plan to conduct lab experiments that will simulate different methods (extreme temperatures, drying, chlorine, and salt) boaters could use to kill any resting eggs on their equipment. Lake managers and policy specialists will find the results useful in containing the spread of this invasive species.

Thematic Area:

Healthy Coastal Ecosystems  
for a Healthy Economy

Funding:

\$54,867

Personnel:

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## Fortified with Iron—Enhancing the Break-down of PCBs in Great Lakes Sediment

To explore ways to speed the break-down of PCBs in the Great Lakes, researchers will team elemental iron with microscopic organisms that dechlorinate PCBs in contaminated sediment. Previous studies found that particular microorganisms in Baltimore Harbor's sediment degrade PCBs more quickly when corroding iron releases hydrogen gas, which is food for these microorganisms, into the water. The researchers anticipate that similar microorganisms live in Lake Superior's PCB-contaminated sediments and will also respond to iron. They hope to stimulate PCB dechlorination in less-contaminated sediments by seeding them with iron and the Baltimore Harbor microorganisms. Speeding the ability of natural microorganisms to dechlorinate PCBs might complement or replace expensive and controversial dredging procedures and increase the ability of remediation personnel to manage contaminated sediment.

Thematic Area:

Healthy Coastal Ecosystems  
for a Healthy Economy

Funding:

\$37,844

Personnel:

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## What the Nose Knows—Determining What Lures Steelhead Trout Home

Steelhead trout, a variety of rainbow trout, are prized recreational fish. Exactly what draws them to their native streams to spawn remains a mystery, but knowing these factors could help fishery biologists better manage this migrating species. Researchers plan to build upon a previous Sea Grant study to develop a remote telemetry system that will allow them to continuously record impulses from nerves in the nose (olfactory nerves) of free-swimming steelhead trout in a lab setting. An electrode will be implanted into the olfactory nerve of several steelhead trout. Impulses from the regenerated nerve will be matched to different scents that the fish are exposed to and their associated behaviors. Eventually, researchers hope to use this technology in natural aquatic habitats to determine which cues are important to steelhead during stream migration.

Thematic Area:  
Addressing Minnesota's  
Fisheries Problems

Funding:  
\$66,170

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## Taking Stock of Steelhead Stocking

Working with the MN Department of Natural Resources' (DNR) Lake Superior Area and French River Fish Hatchery, researchers will use mating records, captures at fish weirs, and genetic data to compare the reproductive success of hatchery-stocked steelhead trout to that of Lake Superior's naturalized steelhead. Simultaneously, they will examine the survival rate of juvenile steelhead produced by naturalized parents, hatchery parents and mixed crosses in isolated reaches of North Shore rivers. Building on a previous Sea Grant study, the researchers hope to guide the MN DNR's rehabilitation program for Lake Superior steelhead and examine the genetic and ecological effects of supplemental stocking on naturalized populations.

Thematic Area:

Addressing Minnesota's  
Fisheries Problems

Funding:

\$72,607

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## Lake Trout Lairs and Nurseries—Discovering What Determines Reproductive Success

A team of researchers will identify habitat characteristics favored by spawning and juvenile lake trout over two shoals of the Apostle Islands in Lake Superior through remote sensing technology. This study will generate new information about how interactions among substrate size and stability, water movement, and sedimentation influence the reproductive success of lake trout. An understanding of water conditions coupled with high-resolution GIS information about habitat selection and use will help natural resource managers direct efforts to manage populations of these commercially-important native fish. The researchers will also analyze the diets of fish in the areas where juvenile lake trout gather to examine how young trout fare both in competition and as prey.

### Thematic Area:

Addressing Minnesota's Fisheries Problems

### Funding:

\$70,000

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## Watching the Wake of Storms in Lake Superior and Beyond with Remotely-Activated Water Quality Samplers

Researchers plan to develop a device that automatically collects water quality samples in response to signals from sensors that could be miles away. A prototype sensor-sampler system will activate water sampling in Lake Superior's St. Louis River Estuary when the sensor detects storm-induced changes in the water's conductivity and turbidity. After the researchers couple the system with equipment allowing them to collect samples from a variety of depths, they will move the sensor-sampling system to an inland lake to measure the extent to which storms stir bottom sediments and mix deeper high-phosphorus water to the surface where it can cause algae blooms. These characteristics, which can affect natural resource personnel's success at managing water quality and restoring aquatic systems, will be the criteria for comparing the new sampling system to more traditional and labor-intensive monitoring techniques.

Thematic Area:

New Technologies and  
Aquatic Science Literacy

Funding:

\$90,000

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## Using Fathead Minnows to Screen for Estrogens and Androgens in Rivers

*This project is also funded through a National Sea Grant research competition. See full description on page 12.*

Thematic Area:

Communities and Urban Coasts

Funding:

*See page 12.*

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## The Impacts of *E. coli* from Soil on the Lake Superior Watershed

This project seeks to determine whether *E. coli* bacteria (*Escherichia coli*), an indicator of fecal pollution, comes from humans or from sediments that erode into the Duluth-Superior harbor and Lake Superior. Although sewage or treated effluents are often blamed as sources of *E. coli*, many of these bacteria filter into aquatic environments from livestock in agricultural areas, warm-blooded animals in natural ecosystems, as well as from soils and sediments. As a result, the extent of human influences on coastal ecosystems and health risks may be over-estimated. Researchers will look at whether *E. coli* released into natural environments from soils and sediments survive and persist, and will identify what factors might influence their survival and reproduction. Using DNA fingerprinting, they hope to build on a previous Sea Grant project by identifying the original sources of *E. coli* found in the sediment, soil and nearshore environments of Lake Superior and to estimate the impact this has on fecal coliform measurements in the lake and harbor. Results will be useful to regional wastewater plant operators and government agencies both locally and in other coastal regions.

Thematic Area:

Communities and Urban Coasts

Funding:

\$100,000

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## Male Minnows and Estrogen Exposure—Does it Pose a Threat to Their Reproductive Health?

Male fathead minnows will be raised in water with concentrations of estrogen-mimicking compounds similar to those that researchers find to be released by sewage treatment plants and pulp mills along the Great Lakes. The researchers will examine whether these relatively low levels of estrogen-mimicking chemicals change any aspect of the minnows' development—particularly by monitoring the presence of a female yolk precursor protein, vitellogenin. Based on a combination of field and laboratory studies, the researchers plan to determine if typical effluent from treatment facilities will impair the ability of small populations of male fish to reproduce.

Thematic Area:

Communities and Urban Coasts

Funding:

\$67,000

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## ■ Special Sea Grant Research Competitions

Occasionally, the National Sea Grant College Program issues requests for proposals that focus on specific areas. Minnesota Sea Grant encourages and assists researchers competing for this funding. Examples of recent initiatives include:

- Aquatic Invasive Species Research and Outreach
- Marine Biotechnology
- Oyster Disease Research

For the latest requests for proposals from the National Sea Grant Program, visit the National Sea Grant Web site ([www.nsgo.seagrant.org](http://www.nsgo.seagrant.org)) or contact Minnesota Sea Grant.

Minnesota research currently supported by these special competitions includes:

### Improving Wastewater Treatment with Membrane Aeration Technology

Developing and evaluating membrane aeration technology for municipal wastewater treatment is the focus of this collaboration with the 3M Corporation. Research indicates that gas-permeable membranes can deliver oxygen directly to the microorganisms that process waste and remove nutrients from wastewater. This study investigates the effectiveness of the membranes under dynamic conditions and creates modules that are appropriate for the wastewater treatment market.

#### **2001 Sea Grant Technology Program**

2001-2003 Funding:

\$150,000

Additional Funding:

**\$300,000** from The Water Environment Research Foundation

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## Using Fathead Minnows to Screen for Estrogens and Androgens in Rivers

Through this project, researchers hope to identify which genes in the fathead minnow (*Pimephales promelas*) respond to estrogens and androgens. These compounds may occur in runoff from agricultural lands and sewage treatment plants. Researchers will develop a sensitive and specific genetic test and determine its effectiveness in evaluating the presence of estrogens and androgens in rivers. This test will provide a means of early detection of environmental stressors, allowing natural resource managers a timely way to reduce the impact of these contaminants and preserve the health of the ecosystem.

*This project is also funded through Minnesota Sea Grant's research program. See page 8.*

### **2003 Sea Grant Biotechnology Research Program**

2003-2004 Funding:  
\$210,000

Additional Funding:  
\$120,000 from Minnesota  
Sea Grant

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# Outreach



Minnesota Sea Grant staff are dedicated to seeking and communicating information that could enhance Lake Superior and Minnesota's inland aquatic resources and economies. They convey community, agency, and business needs to university scientists and provide the results to resource users, managers and decision-makers. In addition to providing research-based information through workshops, conferences, presentations, the award-winning *Seiche* newsletter, Web sites, publications, and the news media, Minnesota Sea Grant facilitates public policy discussions and forums. Staff cooperate with other Sea Grant programs, universities, agencies, tribal interests, the public, and industry on issues of mutual concern.

Minnesota Sea Grant creates publications based on funded research projects and offers over 530 written, visual, electronic, and other products that make aquatic science accessible and relevant to multiple audiences. We fill over one thousand orders for publications annually. Most orders come from people who have seen our publications advertised through news releases, in our *Seiche* newsletter and other outlets. The Web is an increasingly popular way that people use to reach us and to place publications orders. The most popular topics requested concern exotic species and water-related educational material.

The Minnesota Sea Grant Web site ([www.seagrant.umn.edu](http://www.seagrant.umn.edu)) features 820 pages of information about our research programs, publications, and outreach activities. The number of times the site has been accessed by the public has almost doubled every year since 1996 when we went online. Over 70,000 visitors accessed our site in 2002. Our news releases and the *Seiche* are posted on the site, usually before they get printed and mailed.

Our strategic media relations program is another method we use for outreach. In cooperation with the National Sea Grant Media Relations Program and the University of Minnesota News Service, we generated over 300 contacts by reporters in our last funding cycle. These contacts resulted in media stories reaching a potential of 30.2 million people with an advertising equivalency of \$381,000.

Minnesota Sea Grant outreach staff work from an implementation plan that addresses objectives and actions over a four-year period based on goals from our strategic plan. Every four years we develop a new implementation plan and revise it after two years.

A new Fisheries Extension Enhancement from the National Sea Grant Program provided \$15,000 to our budget for one year and reprogrammed \$20,000 to strengthen our fisheries activities:

## Fisheries Extension Enhancement

Years: 2002-2003

Partners: MN DNR, North Shore Charter Captains Association, Western Lake Superior Trollers Association, Institute for Social, Economic, and Ecological Sustainability.

Objectives: 1) To develop a salmonid identification guide cooperatively with the MN DNR. This identification guide will help anglers quickly identify Lake Superior salmonids so they can apply the correct fishing regulations which vary among species. 2) To produce *Marine Biotech Briefs* to educate the public and mass media about marine genetically modified organisms and the marine biotech industry safety program.

## ■ **Special Sea Grant Outreach Competitions**

The National Sea Grant College Program has allocated \$321,209 to Minnesota Sea Grant for four projects involving aquatic invasive species and fisheries. The money, which came through Sea Grant from an appropriation by Congress based on the National Invasive Species Act of 1996, funds the following two-year efforts:

### **Preventing New Introductions of Invasive Aquatic Plants from Water Gardening and Shoreline Restoration**

Funding: \$152,860

Minnesota Sea Grant, in collaboration with Michigan Sea Grant and the Wisconsin Department of Natural Resources, will involve state agency staff, plant nursery and landscaping industry representatives, water gardening enthusiasts, and shoreline property owners in developing an educational model to prevent the spread of invasive aquatic plants.

### **A National Aquatic Nuisance Species Outreach Campaign for the Aquarium Industry and Hobbyist Consumers**

Funding: \$133,349

This project is a collaborative effort involving the Pet Industry Joint Council, the U.S. Fish and Wildlife Service, the International Association of Fish and Wildlife Agencies, and the Great Lakes Sea Grant Network to prevent the accidental spread of aquatic invasive species by aquarium hobbyists.

## Fisheries Extension Enhancement: Great Lakes Fisheries Leadership Institute

Funding: \$10,000

This project's goals are to develop a cohort of leaders with the knowledge and skills necessary to provide effective leadership on fisheries management issues, create a network of Great Lakes leaders from the broadest possible variety of backgrounds and organizations who can cooperate to effectively address and advocate regional needs, empower these fishery leaders to influence policy decisions and legislative initiatives, and multiply the ability of Great Lakes Sea Grant Extension to reach constituent audiences using a 'teach-the-teacher' model.

## Great Lakes Regional Fisheries Extension Enhancement: Great Lakes Fisheries Leadership Curriculum Development

Funding: \$25,000

This project's goals are to develop comprehensive, consistent curriculum for training emerging Great Lakes fishery leaders aimed at instilling the following essential skills and knowledge: 1) a thorough understanding of the processes which affect fisheries management decisions, 2) a basic knowledge of fishery genetics and how stocking programs can impact wild stocks, and 3) an understanding of native fish restoration issues based on the coaster brook trout model.

## ■ Extramurally-funded Projects

Minnesota Sea Grant staff also team with non-Sea Grant institutions, agencies, and businesses to pursue ideas that are in keeping with Sea Grant's mission. Minnesota Sea Grant is involved in 11 extramurally-funded projects, totaling nearly \$1.9 million. Other proposals are pending.

### Nonpoint Education for Municipal Officials

Years: 2001-2002

Funding Agency: NOAA Coastal Services Center

Partner: University of Wisconsin–Superior Extension

Objective: Develop the western Lake Superior Basin Nonpoint Education for Municipal Officials program (NEMO). NEMO is a national education program designed to inform local decision-makers and others on the link between water quality and land use. NEMO takes advantage of GIS and other visual display techniques to simplify the impacts of development into understandable results. Local land use decision-makers can improve planning efforts and decision making with the NEMO materials.

### Duluth Streams: Community Partnerships for Understanding Urban Stormwater and Water Quality Issues at the Head of the Great Lakes

Years: 2001-2003

Funding Agency: U.S. Environmental Protection Agency (EPA) EMPACT Program

Partners: NRRI, UMD Department of Education, City of Duluth, Western Lake Superior Sanitary District, Great Lakes Aquarium, and the Minnesota Pollution Control Agency

Objective: Deliver historical and real-time data about Duluth's watersheds to community members and students in ways that promote public input into decision-making processes.

## Managing Urban Runoff Using Real-Time Community-Based Monitoring

Years: 2001-2003

Funding Agency: U.S. EPA EMPACT Program

Partners: NRRI, Suburban Hennepin Regional Park District, Minnehaha Creek Watershed District, City of Plymouth, MN Bassett Creek Water Management Commission, Apprise Technologies, Inc.

Objective: Examine the consequences of using phosphorous-free fertilizers on a broad scale within an urban watershed.

## A Geomorphic-Trophic Hypothesis for Arctic Lake Productivity

Years: 2001-2004

Funding Agency: National Science Foundation

Partners: University of North Carolina-Greensboro Department of Biology, Utah State University Department of Fisheries and Wildlife, University of Kansas Department of Systematics and Ecology, University of North Carolina-Chapel Hill Department of Environmental Science and Engineering

Objective: Analyze whether landscape criteria, lake geomorphology, and food web configuration can be used to predict algal, invertebrate and fish productivity, and the distribution of production between the benthic and pelagic regions of Arctic lakes.



## Protocols for Selecting Classification Systems and Reference Conditions: A Comparison of Methods

Years: 2001-2004

Funding Agency: U.S. EPA STAR Program

Partners: U.S. EPA Mid-Continent Ecology Division, University of Windsor, University of Wisconsin-Superior, NRRI

Objective: Develop a set of scientifically-defensible classification systems for Great Lakes coastal ecosystems. The methods developed will be appropriate for large geographic regions with multiple distinct ecosystem types.

## Training Water Science Technicians for the Future—A National Online Curriculum Using Advanced Technologies and Real-Time Data

Years: 2001-2004

Funding Agency: National Science Foundation's Advanced Technological Education Program

Partners: University of Minnesota Duluth (UMD) Department of Education, NRRI, Lake Superior College, Apprise Technologies, Inc.

Objective: Expand the Water on the Web project ([wow.nrri.umn.edu](http://wow.nrri.umn.edu)) to community colleges and undergraduate institutions across the country.

## NEMO

Years: 2002-2003

Funding Agency: Minnesota Lake Superior Coastal Program

Partner: University of Wisconsin-Superior Extension

Objectives: Develop the western Lake Superior Basin NEMO program.

## North Central Regional Aquaculture Center Extension Project

Years: 2002-2003

Funding Agency: North Central Regional Aquaculture Center (NCRAC)

Partners: University of Minnesota Extension Service, Minnesota Department of Agriculture, Minnesota Aquaculture Association

Objectives: Strengthen linkages between NCRAC research and extension work groups, enhance the NCRAC extension network for aquaculture information transfer, develop and implement aquaculture education programs and materials for the North Central Region.

## Superior Science for You! Speaker Series

Years: 2002-2003

Funding Agency: Minnesota's Lake Superior Coastal Program

Partners: U.S. EPA Mid-Continent Ecology Division, Great Lakes Aquarium, MPCA, Large Lakes Observatory, North House Folk School, St. Louis River Citizen's Action Committee, NRRI Center for Water and Environment, WI and MI Sea Grant Programs, Northland College, USGS

Objective: To bring the latest research findings about Lake Superior to coastal residents by organizing, promoting, and hosting eight speakers who will deliver a total of 16 talks in Minnesota. Video archives of the talks will be available over the Internet, on CD, and through stories in a booklet produced at the end of the series.

## Western Lake Superior NEMO Project—Community Program

Years: 2002-2003

Funding Agency: Great Lakes Commission

Partner: University of Wisconsin-Superior Extension

Objectives: Work with a community in the Lake Superior Basin to analyze the community's land use data and plans, conduct a build-out scenario based on current zoning, deliver NEMO presentations in the community, and train local educators on the use of NEMO materials.

## Development of Environmental Indicators of Condition, Integrity, and Sustainability of the Great Lakes Basin

Years: 2002-2004

Funding Agency: U.S. EPA Estuarine and Great Lakes Initiative

Partners: NRRI, UMN Department of Mathematics and Statistics, UMN Division of Environmental and Occupational Health, University of Wisconsin-Green Bay Department of Natural and Applied Sciences, and other cooperators from Cornell University, University of Windsor, John Carroll University, University of Wisconsin-Madison, University of Michigan, U.S. EPA Office of Research and Development

Objective: Identify, evaluate, and recommend a portfolio of environmental indicators to measure the condition of the Great Lakes.

## ■ Advisory Committee

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