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30 Years of
Superior Science

Minnesota Sea Grant

PROGRAM GUIDE 2005-2007




Sea Grant
Minnesota



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■ Mission Statement

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 2005, Minnesota Sea Grant funded eight 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 2005 research awards collectively totaled \$566,641 with an additional \$585,132 designated to support 10 graduate research assistants.

Pinpointing Sources of Bacteria that Contribute to Beach Closures



Thematic Area:

Coastal Communities and Economies

Funding

\$98,000

Personnel:

Randall Hicks

Michael Sadowsky

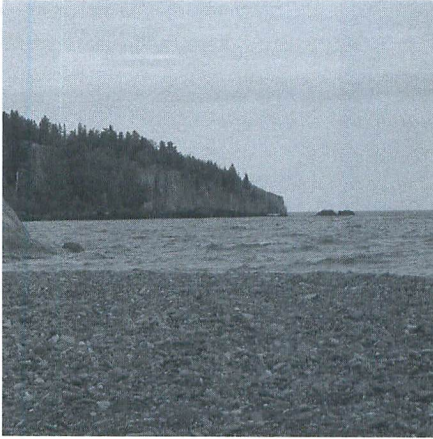
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Lake Superior beach closures have been causing concern since the Minnesota Pollution Control Agency's Lake Superior Beach Monitoring program began in 2003. This project builds on previous Sea Grant research by increasing the size and scope of a DNA fingerprint database for *E. (Escherichia) coli*, which may be causing the water quality problems. Researchers plan to collect *E. coli* from the Duluth-Superior Harbor during spring, summer, and fall. By conducting genetic fingerprinting analyses on the *E. coli* samples, they hope to gain a better understanding of beach contamination sources and seasonal variations. They will compare contamination sources between open water, nearshore sediments, and effluent from the Western Lake Superior Sanitary District to identify similarities in contamination patterns. Results will contribute to public policy decisions.

Developing More Efficient Monitoring Methods for Rocky Coasts



Thematic Area:

Coastal Communities and Economies

Funding:

\$80,000

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Researchers will develop a more cost-effective method for monitoring the macroinvertebrate communities (spineless insects, worms, etc.) living on rocky surfaces in Lake Superior by using artificial substrates (baskets of cobble). The researchers will compare this sampling method to more traditional methods and will refine their method to assess aquatic invertebrate community responses to shoreland development at seven sites along Minnesota shoreline. Traditional monitoring methods involve taking grab samples of sediment, which does not work on the hard surfaces that make up more than half of Lake Superior's nearshore areas. Researchers will use the data to establish benchmarks of environmental conditions for Minnesota's Lake Superior rocky shores.

Understanding the Links Between Lake Superior's Animal Life, Upwellings, and Temperature



Thematic Area:

Ecosystems and Habitats

Funding:

\$33,544

Personnel:

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Thomas Hrabik

Brian May

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This project seeks to increase our understanding of how Lake Superior's physical and biological processes interact. Researchers hope to determine what mechanisms control biological productivity in the lake and answer basic questions that have confounded scientists and resource managers for years. They will examine how the lake's physical properties, such as temperature and currents, impact animal life (zooplankton and fish) and establish whether productivity is higher in cold eddies or warm eddies. Ocean research suggests that nutrients delivered by offshore upwellings drive productivity; whether upwelling rates in Lake Superior are enough to enhance biological productivity will be addressed.

A Step Towards Defining the Carbon Cycle in Lake Superior



Thematic Area:

Ecosystems and Habitats

Funding:

\$82,999

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Does Lake Superior absorb carbon dioxide or emit it into the atmosphere (is it a sink or a source)? We don't know. To find out, researchers plan to moor instruments in Western Lake Superior to measure seasonal variability in thermal structure and the distribution of oxygen and carbon dioxide. The results will help them develop and test a mathematical model for predicting annual temperature and gas cycles. Researchers will also evaluate what kind of carbon cycling happens in the lake through their observations and the model's predictions. Understanding the carbon cycle will help us better determine the lake's response to climate change and external factors.

Investigating the Relationship Between Dissolved Phosphorus and Oxygen Released by Sunlight in Lake Superior



Thematic Area:

Ecosystems and Habitats

Funding:

\$90,000

Personnel:

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Kristopher McNeill

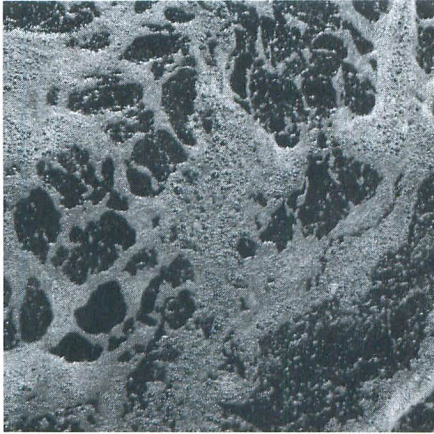
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When sunlight hits surface water, particular forms of oxygen are released from chemical bondage. A microbial ecologist and a chemist will explore the relationship between these oxygen forms and the availability of phosphorus to organisms living in Lake Superior. Their research will generate the first Great Lakes measurements of “reactive oxygen species” (such as singlet oxygen and hydrogen peroxide) that are produced when ultraviolet wavelengths interact with organic matter in the water. The researchers will determine the ability of these oxygen species to fragment organisms’ RNA and DNA, which can be abundant sources of phosphorus in aquatic systems. The specific effect of reactive oxygens on the breakdown and availability of dissolved organic phosphorous is unknown. However, these reactions could be influenced by global change, affect carbon balances, and contribute to lake eutrophication.

Defining Potential Effects of Endocrine Disrupters in Wastewater on Female Fish and Fish Populations



Thematic Area:

Ecosystems and Habitats

Funding:

\$46,734

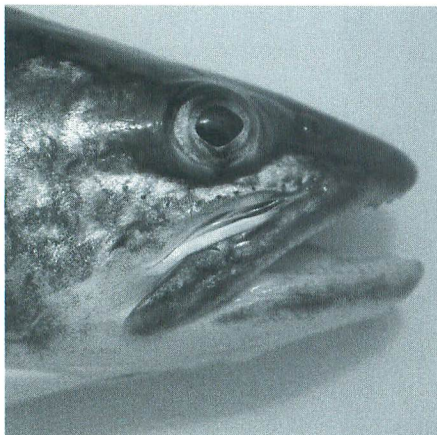
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Building on their work concerning the effects of endocrine disrupting chemicals (EDCs) on fish, researchers will tackle three questions. First, they will determine if female fathead minnows suffer reproductive abnormalities when exposed to wastewater effluent containing EDCs. Second, they will attempt to link female-specific reactions to particular estrogens or androgens in the wastewater. Third, they will determine if EDCs might reduce the viability of populations by disrupting gene flow. The effluent from many Great Lakes sewage treatment plants and paper mills contains EDCs. Such wastewater lowers the reproductive potential of male fish in the laboratory. This project will be one of the first to address how EDCs in effluent might affect fish at the population level.

Calculating Biomass and Energy Flow from Plankton to Lake Superior's Top Predators



Thematic Area:

Fisheries

Funding:

\$53,364

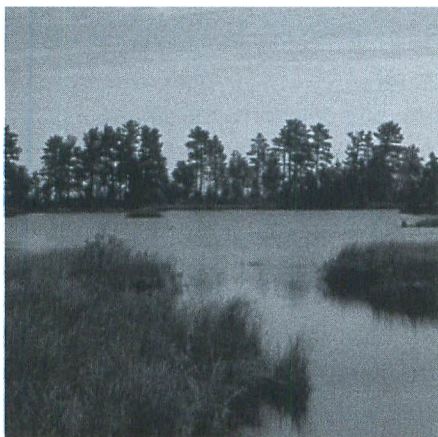
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Researchers plan to estimate phytoplankton, zooplankton, and fish biomass as a function of the organism's body size in three regions of Lake Superior. They will compare predator demand and prey supply among these areas by calculating the relative rates of energy transfer up the food chains. Of the three locations, researchers speculate that biological production will be greatest near the Duluth-Superior Harbor but that the rate of energy flow will be most efficient northeast of the Apostle Islands where there are fewer nutrients, but also fewer invasive species and anglers. A portion of Minnesota's North Shore will also be investigated through a combination of fieldwork and remote sensing. Results will aid efforts to manage Lake Superior fisheries.

A New Approach for Identifying Environmental Estrogens in Great Lakes Estuaries



Thematic Area:

Biotechnology

Funding:

\$82,000

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Estrogens and estrogen-mimics accumulate in aquatic environments through wastewater effluents, pesticides, detergents and other common trappings of human activity. Researchers plan to create a new way to capture estrogen-like compounds from water samples using resin composed of tiny glass beads coated with cloned estrogen receptors. This resin will bind with a broader variety of estrogen mimics and will be more economical to use than current methods for quantifying environmental estrogens. After perfecting the estrogen extraction process, the researchers will analyze water from five estuaries around the Great Lakes, including the Duluth-Superior Harbor. Hormone imbalances created by environmental estrogens can harm reproductive and immune systems and lead to deformities and sterilization in animals.

■ 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 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 Minnesota Sea Grant Web site (www.seagrants.umn.edu) features extensive 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 we went online in 1996. Over 348,000 visitors accessed our site in 2004. 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 300 contacts by reporters in our last funding cycle.



These contacts resulted in media stories reaching a potential of 25.9 million people with an advertising equivalency of \$238,600.

Minnesota Sea Grant outreach staff work from a four-year implementation plan with objectives and actions based on goals from our strategic plan. The implementation plan is revised halfway through its intended life.

■ Special Sea Grant Outreach Competition

The National Sea Grant College Program has awarded \$218,545 to Minnesota Sea Grant for a project involving aquatic invasive species. 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 effort:

Extending and Evaluating the National *Stop Aquatic Hitchhikers* Campaign Along Key Invasion Corridors in Three Upper Midwest States

In collaboration with Wisconsin Sea Grant and Department of Natural Resources (DNR), Iowa DNR, Minnesota DNR, and many other partners, this project features the *Stop Aquatic Hitchhikers!* logo and messages in a multi-media campaign targeting resident and non-resident boaters and anglers along ten highways. These highways are considered invasion corridors and lead to and from waters infested with aquatic invasive species waters in Minnesota, Wisconsin and Iowa.



**STOP AQUATIC
HITCHHIKERS!™**

■ Extramurally Funded Projects

Minnesota Sea Grant staff also team with non-Sea Grant institutions, agencies, and businesses to pursue ideas in keeping with Sea Grant's mission. Since our previous program guide was published, Minnesota Sea Grant has been involved in nine extramurally funded projects, totaling over \$700,000. Other proposals are pending.

North Central Regional Aquaculture Center (NCRAC)

Years: 2002-2004

Funding: \$1,500

Funding Agency: Michigan State University (USDA)

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! and Liquid Science Speaker Series

Years: 2002-2004

Funding: \$27,816

Funding Agency: Minnesota Department of Natural Resources Lake Superior Coastal Program

Partners: U.S. Environmental Protection Agency Mid-Continent Ecology Division, North House Folk School

Objective: Bring the latest water-related research findings to Minnesota coastal residents by organizing, promoting, and hosting five speakers who delivered a total of 15 talks in Duluth and Grand Marais, MN.

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

Years: 2003-2004

Funding: \$50,954

Funding Agency: City of Duluth

Partners: NRRI and the University of Minnesota Extension Service

Objectives: 1) Install stream sensors and integrate real-time sensor data with historic and current monitoring data for four representative watersheds in the Duluth metropolitan area; 2) Gather historical water quality and biological data from agency and academic research programs for all 42 Duluth urban streams, incorporating the results of ongoing City operations and agency and academic studies; 3) Combine these data with appropriate watershed-based land use and cultural data into a GIS-linked database; 4) Develop advanced interactive data visualization tools to animate and simplify the presentation and interpretation of complex, real-time stream data; 5) Place these data into a Web, kiosk, and programmatic framework that provides public access to data and the educational materials required for data interpretation; 6) Develop curricula to accompany the data for area high schools and Lake Superior Community College; 7) Implement mechanisms for incorporating public input into the decision-making process.

Peer Review of Mercury Portion of the Watershed Assessment and Risk Management Framework Model

Years: 2003-2004

Funding: \$37,774

Funding Agencies: Electric Power Research Institute, Minnesota Power, Southern Company, and the Tennessee Valley Authority

Partners: Syracuse University, Fisheries and Oceans Canada, National Oceanic and Atmospheric Administration, Environmental Protection Agency, U.S. Geological Survey, University of Maryland and Tetra Tech, Inc.

Objectives: Critically assess the Watershed Assessment and Risk Management Framework Model's: 1) theoretical basis, 2) data requirements and parameter estimation, 3) performance and uncertainty measures, 4) documentation, and 5) management applicability.

AIS-HACCP Training Initiative

Years: 2003-2005

Funding: \$246,000

Funding Agency: Great Lakes Protection Fund

Partners: Great Lakes Sea Grant Network

Objective: Inhibit movement of aquatic invasive species, fish pathogens, and parasites into uninfested waters through the Aquatic Invasive Species - Hazard Analysis and Critical Control Point (AIS-HACCP) planning process. Two significant pathways for spread will be targeted: 1) the movement of equipment used by federal, state, tribal, and private resource personnel, and 2) through the transfer of baitfish and fish raised for stocking into public and private waters.

Aquatic Plant Guide

Years: 2003-2005

Funding: \$5,000

Funding Agencies: National Sea Grant College Program and the U.S. Fish and Wildlife Service

Partners: Sea Grant programs in Connecticut, North Carolina, and Illinois-Indiana, North Carolina State University, and the University of Florida

Objective: Produce and publish a national invasive aquatic and wetlands plant guide with the help of a national steering committee composed of representatives from the aquatic plant industry and state and federal agencies.

Coastal Area Impervious Surface Assessment and Education

Years: 2003-2004

Funding: \$34,393

Funding Agency: Minnesota Department of Natural Resources Lake Superior Coastal Program

Partners: NRRI, UMD Geographic Information Sciences Laboratory, Minnesota Department of Natural Resources Assessment Division

Objective: Determine the accuracy of various methods of assessing impervious surfaces in Northeastern Minnesota, estimate impervious surface amounts for coastal Lake Superior watersheds from the early 1990s and 2002-2003, and make this information available to the public and local government officials.

Walk, Ride and Runoff

Year: 2005

Funding: \$2,000

Funding Agency: Minnesota Department of Natural Resources
Lake Superior Coastal Zone Program

Partners: Lake Superior Zoological Society, Spirit Mountain
Recreation Area, and the Regional Stormwater Protection Team

Objective: Hold a competitive bike-and-running team race and a
non-competitive community walk involving water quality education.
The event was held May 21, 2005, at Spirit Mountain in Duluth, MN.

Great Lakes Center for Ocean Science Education Excellence

Years: 2005-2010

Funding: \$295,394

Funding Agency: National Science Foundation

Partners: Cooperative Institute for Limnology and Ecosystems
Research, Great Lakes Environmental Research Lab, Great Lakes Sea
Grant Network, Bay Mills Community College, College of Exploration,
University of Wisconsin Extension, UMD Department of Education

Objectives: 1) Facilitate collaboration between Great Lakes researchers,
educators, and students in grades 4-10; 2) Assist researchers in
accessing educational organizations and using appropriate pedagogy;
3) Enhance teacher capabilities for accessing science information and
delivering high-quality educational programs; 4) Integrate ocean and
Great Lakes research into existing science education materials; 5)
Make current Great Lakes research findings available to the public
to encourage science literacy; 6) Increase access to Great
Lakes/ocean science information in underrepresented groups; 7)
Facilitate direct student connections to Great Lakes/ocean science
experiences; and 8) Collaborate with existing Centers for Ocean
Science Education Excellence in synergistic ways.

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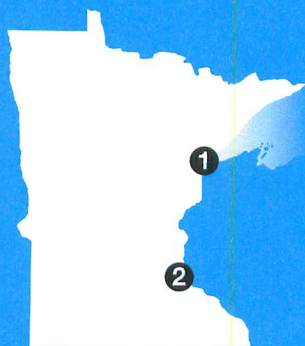
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