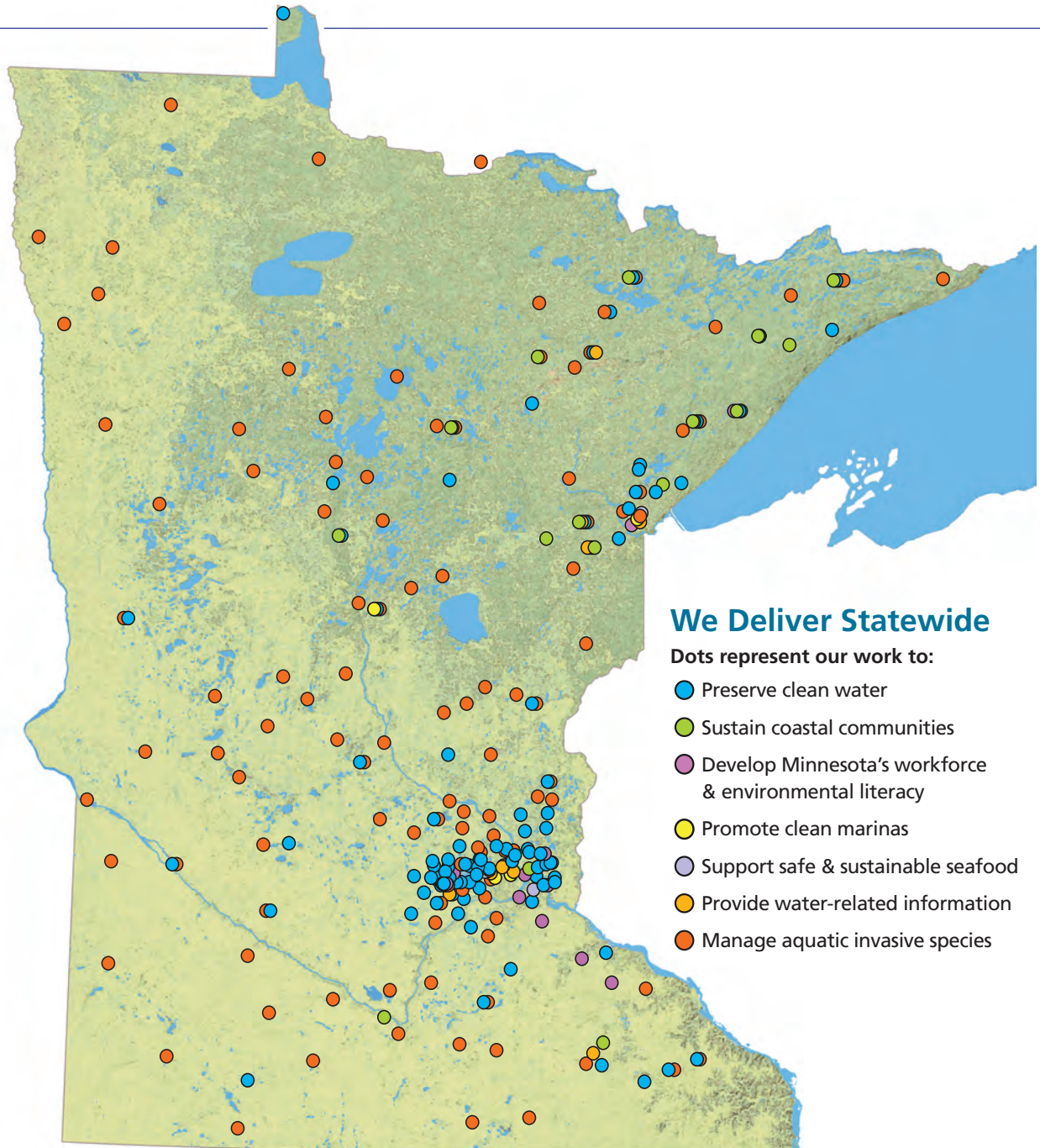


University of Minnesota Sea Grant College Program Briefing Book



November 19-21, 2019 ● 31 W. College St., Room 132 ● Duluth, Minnesota, 55812 ● www.seagrants.umn.edu



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Our Focus Areas

- **Healthy Coastal Ecosystems** (HCE)
- **Resilient Communities & Economies** (RCE)
- **Sustainable Fisheries & Aquaculture** (SFA)
- **Environmental Literacy & Workforce Development** (ELWD)

Program Setting in the University

Our Sea Grant program was named in 1977 and is a University of Minnesota (UMN) system wide program that maintains a central office on the Duluth campus and a satellite office at the UMN Twin Cities Water Resources Center. The University of Minnesota Duluth (UMD) campus is a mile from Lake Superior and six miles from the Port of Duluth-Superior, the largest dry-bulk port in the United States.

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

Introduction

Welcome to the University of Minnesota Sea Grant College Program


Minnesota Sea Grant finds the science stakeholders need and packages it so that they can use it to support the state’s and the region’s economy, environment, and education. If the needed science does not exist, we use our small granting program to build it and work with our partners and stakeholders to apply that science to solve coastal challenges. Although Minnesota is among the smaller Sea Grant programs, we have the dual responsibilities of tackling questions related to Lake Superior and coastal stakeholders across the state’s 10,000 lakes, 7,000 rivers and streams, and 13 million acres of wetlands. We work in partnership with business, industry, agencies, NGOs, educators, the public, and local-to-national governance to deliver on their water science and education goals.

Our mission embraces science from its origins in labs and fields to its incorporation in society’s social contract. We invest in merit-reviewed research and distribute the results through community outreach and engagement programs. Meaningful and sustained engagement has enabled us to form strong partnerships with leading coastal state research universities, with other National Oceanic and Atmospheric Administration programs, and with a wide range of public and private partners at federal, state, and local levels. We strive to identify and solve the highest-priority problems facing coastal communities.

The four years reflected in this document are a testament to Sea Grant’s integration of research and engagement to solve coastal challenges. We are creative and responsive in generating and disseminating scientific and technological advances to a wide range of audiences. Our science-based, honest-broker approach and history of collaboration with communities have made Sea Grant a trusted source of assistance. We serve as a catalyst for decision support by increasing knowledge among decision-makers and the public. We identify objectives, track program impacts, and leverage strategic partnerships to solve water-related challenges in the state and beyond.

I joined Minnesota Sea Grant in 2016 and am proud to be at the helm of a group of colleagues who are profoundly engaged in the future of sustainable water use along the Lake Superior coast and across the aquatic ecosystems of our state. As we look to the future, we seek to build on our long-standing NOAA Sea Grant reputation of being a program that ranked among the most productive despite our small staff and modest core funding.

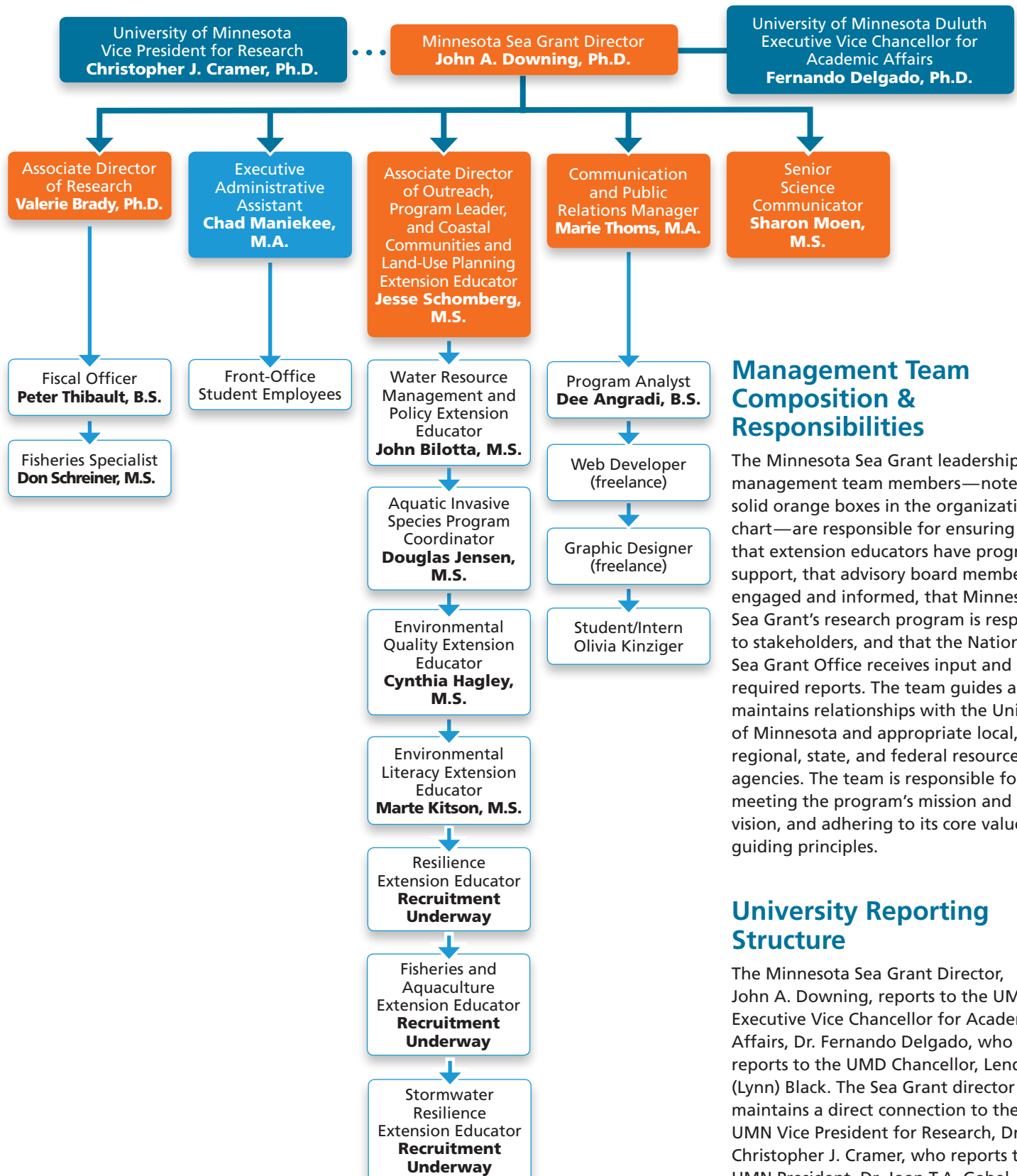
Sincerely,



John A. Downing, Ph.D.



Program Management and Organization



Management Team Composition & Responsibilities

The Minnesota Sea Grant leadership and management team members—noted by solid orange boxes in the organization chart—are responsible for ensuring that extension educators have program support, that advisory board members are engaged and informed, that Minnesota Sea Grant's research program is responsive to stakeholders, and that the National Sea Grant Office receives input and required reports. The team guides and maintains relationships with the University of Minnesota and appropriate local, regional, state, and federal resource agencies. The team is responsible for meeting the program's mission and vision, and adhering to its core values and guiding principles.

University Reporting Structure

The Minnesota Sea Grant Director, John A. Downing, reports to the UMD Executive Vice Chancellor for Academic Affairs, Dr. Fernando Delgado, who reports to the UMD Chancellor, Lendley (Lynn) Black. The Sea Grant director also maintains a direct connection to the UMN Vice President for Research, Dr. Christopher J. Cramer, who reports to the UMN President, Dr. Joan T.A. Gabel.

Advisory Board Membership and Function

From 2014 to 2017, our advisory board membership remained substantially unchanged. In 2017, we made strategic changes to reach new stakeholders and ensure appropriate turnover.

- **Expertise:** Our advisory board includes leaders from local, state, and federal government; industry and businesses; tribal resource management; nonprofit organizations; academic research; journalism; and tourism.
- **Function:** Our goal was and is to ensure we are best positioned to receive timely and relevant guidance while retaining a slate of members with institutional memory.
- **Recommendations:** Advisory board members identify water issues in Minnesota and make recommendations on what our program should address in ongoing activities and biennial requests for proposals.
- **Meeting Schedule:** The majority of advisory board business is conducted via email with at least two to three face-to-face meetings per year. The spring meeting is typically an update on extension and outreach work and a report on a funded research project. The fall meeting alternates between reviewing proposals that have been received and passed the Technical Review Panel scientific cutoff and brainstorming ideas to be incorporated into the next request for proposals.

Jeff Anderson*
Duluth Field and Constituent Services Representative
U.S. Representative Rick Nolan
Duluth, Minnesota

Julie Johnson Atkinson*
Senior Sales Manager
Visit Duluth
Duluth, Minnesota

Patty Gould St. Aubin*
President, Itasca Coalition of Lake Associations
President, Itasca County Board of Realtors
Grand Rapids, Minnesota

Steve Dahl
Commercial fisherman
Two Harbors, Minnesota

Suzanne Hanson
Regional Manager
Minnesota Pollution Control Agency
Duluth, Minnesota

Stephanie Hemphill*
Retired Environmental Reporter
Duluth, Minnesota

Dale Hoff*
Director
U.S. EPA Mid-Continent Ecology Division
Duluth, Minnesota

Andy Hubley*
Director of Regional Planning
Arrowhead Regional Development Commission
Duluth, Minnesota

Jane Kingston*
Member
Lessard-Sams Outdoor Heritage Council
St. Paul, Minnesota

Emily Larson*
Duluth Mayor
Duluth, Minnesota

John Lenczewski*
Executive Director
Minnesota Trout Unlimited
Minneapolis, Minnesota

Joe Mayasich
Director of Environmental Services
Western Lake Superior Sanitary District
Duluth, Minnesota

Don Pereira*
Retired Chief of Fisheries
Minnesota Department of Natural Resources
Cottage Grove, Minnesota

Erika Rivers*
Director, Minnesota State Parks and Trails
Minnesota Department of Natural Resources
St. Paul, Minnesota

Nancy Schuldt
Water Projects Coordinator
Fond du Lac Band of Lake Superior Chippewa
Cloquet, Minnesota

Jim Sharrow
Retired Director of Port Planning and Resiliency
Duluth Seaway Port Authority
Duluth, Minnesota

Heather Stirratt*
Great Lakes Regional Lead
NOAA Office for Coastal Management
Minneapolis, Minnesota

Nelson Thomas
Retired Ecologist
U.S. EPA Mid-Continent Ecology Division
Duluth, Minnesota

Erika Washburn
Reserve Manager
NOAA Lake Superior National Estuarine Research Reserve
Superior, Wisconsin

*2017 new member



Recruiting Talent

Process to Develop Requests for Proposal (RFP) Priorities

Minnesota Sea Grant seeks to identify promising research that aligns with our program's mission across a variety of disciplines and every two years we issue a call for research proposals. We use our small granting program to build the science that our stakeholders need. With attention to emerging issues and input from staff, we use the expertise of our extension educators to guide a facilitated discussion with our advisory board to identify research needs, opportunities, and priorities that align with Sea Grant's mission and strategic focus areas to develop requests for proposals.

Staff suggest research needs and priorities they hear from stakeholders that are relevant to Lake Superior and Minnesota's inland aquatic resources. We review the research needs of and projects funded by other Great Lakes organizations and agencies to avoid duplication and inform our prioritization. Additionally, the Minnesota and Wisconsin Sea Grant programs issue a joint RFP to fund a project of shared interest that has a Minnesota-based research team and a Wisconsin-based research team.

RFP Review Process and Composition of Review Panels

1. RFPs are sent to all appropriate research universities and four-year colleges in Minnesota and are publicized on our website, social media platforms, and via an instructional webinar. We consider proposals from all applicants unless they are led by a federal employee.
2. Applicants submit a pre-proposal that is reviewed by our staff for adherence to the RFP and alignment with our mission and vision. If a pre-proposal does not adhere to the RFP, then applicants are provided with suggestions to improve their proposal. Each applicant is assigned a Sea Grant extension educator to work with on their full proposal. All applicants who submit pre-proposals are eligible to submit full proposals.
3. Applicants submit full proposals for which Minnesota Sea Grant obtains three reviews focusing on scientific merit from topic experts located beyond Minnesota and Wisconsin to help avoid conflicts of interest.
4. Peer reviews and proposals are forwarded to the Minnesota Sea Grant ad hoc Technical Review Panel (TRP). Panel members are selected to match the technical disciplines represented in the proposals and are from outside Minnesota and Wisconsin to help avoid conflicts of interest. Since 2013, the Minnesota, Wisconsin, and Illinois-Indiana Sea Grant programs have collaborated to form a separate TRP to review social science proposals. This has resulted in more funded social science proposals and was identified as a best practice by a previous site review panel. The TRP considers all peer reviews for each proposal and ranks the proposals according to scientific merit and consistency with the RFP. The TRP determines which proposals are scientifically sound and will continue in the review process. Both panels meet via webinars that include our National Sea Grant Office program officer. Minnesota Sea Grant provides a modest honorarium to TRP members.
5. Proposals deemed to have sufficient scientific merit to warrant potential funding are then reviewed by our advisory board. The board rates and ranks the proposals for relevancy to Minnesota Sea Grant's mission, perceived community needs, and significance to stakeholders.
6. Minnesota Sea Grant staff provide comments and rank proposals.
7. Funding decisions are made by the Minnesota Sea Grant director in consultation with the associate director for research and are based on all reviews, rankings, and financial feasibility. The director submits a letter of intent to our national program officer, who confirms that the proposals were selected following proper protocols. We then submit the selected proposals to the National Sea Grant Office as part of our program's biennial omnibus proposal.

Grand Challenge Research

Minnesota Sea Grant is honored to be part of the University of Minnesota (UMN) system and a statewide leader in helping UMN meet the first of its five **Grand Challenges: Assuring Clean Water and Sustainable Ecosystems**. This challenge seeks to achieve adequate supplies of safe and clean water to sustain people, agriculture, and industry, while protecting water resources and ensuring the sustainability of environmental systems and the vitality of communities on rivers, lakes, and seas. The Grand Challenges are five interrelated areas where UMN is well-positioned to have great impact on the most critical challenges of our state and world.

<https://strategic-planning.umn.edu/grand-challenges-research>



Minnesota Sea Grant support is especially important for early-career scientists and can serve as career- and project-launching seed money. Our awards support graduate students and pay the wages of field and lab technicians. Our multi-tiered evaluation process was identified as a best management practice by our 2015 site review team. The reviewers noted that the process had been extremely useful in helping identify research proposals that were not just scientifically robust but would help solve the needs of the citizens of Minnesota.

Institutions Represented Throughout the RFP Process

The table below shows number of institutes and/or campuses within the UMN system, other academic institutions, and other entities (e.g., state agencies, soil and water conservation districts, nonprofits, businesses) submitting proposals. Numbers represent all entities collaborating on a proposal, not just the affiliation of the lead submitter. This table also includes the joint proposals with Wisconsin Sea Grant.

RFP year	2013			2015			2017		
	Pre	Full	Funded	Pre	Full	Funded	Pre	Full	Funded
Total submitted	18	17	6	42	28	6	41	17	4
Institutions represented	15	13	3	18	10	6	18	14	4
Home institutions*	15	16	3	40	27	6	39	13	4
New principal investigators**	14	12	3	27	18	5	26	11	2

Pre = pre-proposals
 Full = full proposals
 Funded = funded proposals

* Minnesota Sea Grant is a systemwide program of the University of Minnesota (UMN), which is the primary graduate-degree granting institution in the state. Thus, most proposals come from within the UMN system and are counted as being from our home institution.

** A new principal investigator (PI) is one who has not been funded since 2009.

New Versus Continuing Projects and Principal Investigators

To continue a Sea Grant-funded project, researchers must recompile in the biennial RFP process and thus all projects are treated as new. Our program offers no-cost extensions to projects in some circumstances. We encourage proposals from new and early-career researchers and may invite them to request program development funds to obtain preliminary data.

Minnesota Sea Grant funded six research projects in 2014-2016 for \$1,080,198 with an additional \$630,627 in graduate research assistant support (i.e., Sea Grant scholars). For a joint project with Wisconsin Sea Grant on the history of aquatic conditions in the St. Louis River estuary the researchers used their award to leverage more than \$1M in additional federal and state money for similar research. Researchers investigating the effect of sulfate on wild rice leveraged their Sea Grant-funded research to gain \$64K in additional funding from the Fond du Lac Band of Lake Superior Chippewa. Additional research funded in this biennium included two projects (\$30,400) funded by development funds.

Minnesota Sea Grant funded six research projects in 2016-2018 for \$819,608 with an additional \$706,473 in Sea Grant graduate scholar support. One of these projects was our joint project with Wisconsin Sea Grant on understanding methylmercury production and bioavailability. The project builds on work funded by the Minnesota Pollution Control Agency to understand how to increase wetland area in the St. Louis River estuary without increasing the form of mercury that most easily bioaccumulates in fish and humans.

How We Work with Our Partners

How We Help Save Lives

Our work on beach hazards messaging, communication and outreach exemplifies how we grow partnerships.

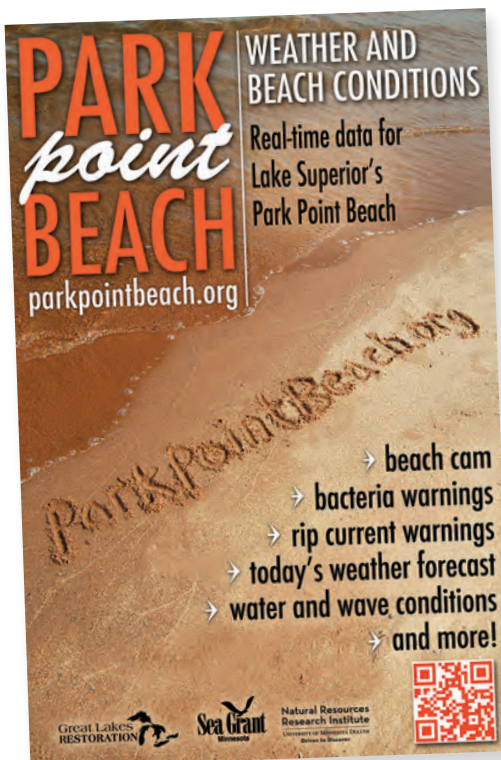
A drowning in 2003 prompted Minnesota Sea Grant to initiate rip current awareness efforts. The **Twin Ports Rip Current Workgroup** formed in 2009 through our conversations with the **National Weather Service Forecast Office Duluth**.

The workgroup includes the **Duluth YMCA**, **City of Duluth Fire Department** and **Parks and Recreation**, **Wisconsin Sea Grant**, **Minnesota Department of Health**, **Minnesota's Lake Superior Coastal Program**, the **Park Point Volunteer Surf Rescue**, **U.S. Army Corps of Engineers**, and other partners.

Beginning in 2014, the group designed and installed beach safety kits, implemented the rip-current warning flag system, and hosted annual Water Safety Expos. We led the group in educating 6th graders so that nearly all Twin Ports students over 12 years old have been through a rip-current awareness and response program.



Sea Grant Extension Educator Jesse Schomberg speaks at the Twin Ports Rip Current Workgroup press conference announcing installation of beach safety kits



We developed the **ParkPointBeach.org** website with **University of Minnesota Duluth Natural Resources Research Institute** in 2012 that incorporates real-time weather and beach hazard measures in a way that has made it the go-to information site for Duluth beachgoers. The site has been used as a model for other beaches in the Great Lakes and by tourism-related businesses in the Twin Ports. When the **National Weather Service Forecast Office Duluth** sought to improve rip current forecasting, we partnered with **Wisconsin Sea Grant** and the **University of Wisconsin Madison** to fund installation of new sensors to study rip current dynamics.

While partnering on the **Dangerous Currents Best Practices** project with the **NOAA Coastal Storms Program** and the **Great Lakes Sea Grant Network**, we helped coordinate beach hazards communication by distributing beach safety products, and helping to create the **Great Lakes Water Safety Consortium**. (RCE)

Key Partnerships:

Minnesota Sea Grant worked with more than 200 partners between 2014 and 2017. Our partnerships spanned focus areas, projects, and time. NOAA partnerships include 13 Sea Grant programs, the most significant of which is neighboring Wisconsin. Some of our most active partners are below.

NOAA

- Coastal Storms Program
- Great Lakes Sea Grant Network
- Lake Superior National Estuarine Research Reserve
- Minnesota Lake Superior Coastal Program
- National Weather Service
- Office of Coastal Management
- Wisconsin Sea Grant

Federal (Other)

- Aquatic Nuisance Species Task Force, (U.S. Fish and Wildlife Service, NOAA)
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service

State

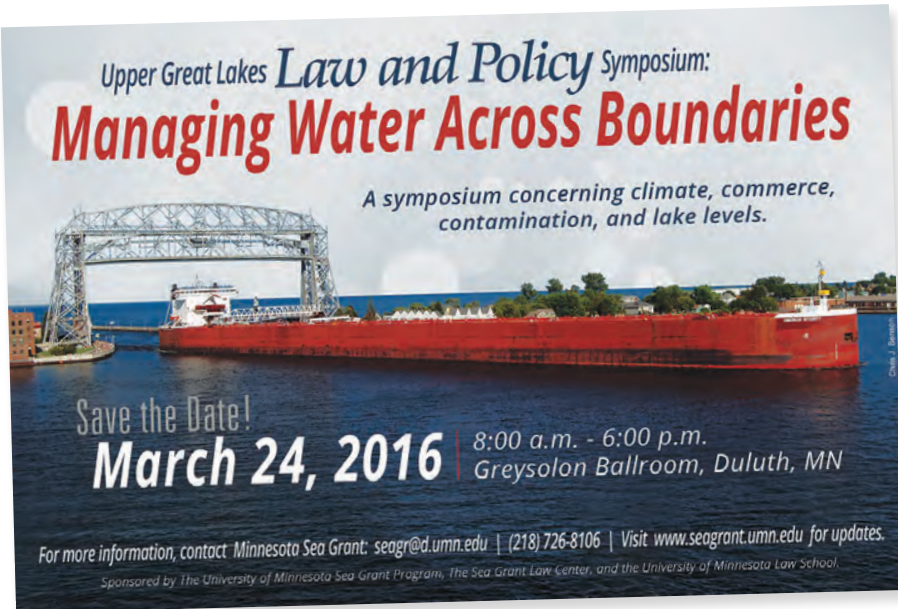
- Minnesota Department of Natural Resources
- Minnesota Pollution Control Agency
- University of Minnesota Duluth, Large Lakes Observatory
- University of Minnesota Duluth, Natural Resources Research Institute
- University of Minnesota Extension

Local

- City of Duluth
- Harbor Technical Advisory Committee
- Fond du Lac Tribal & Community College
- Great Lakes Aquarium
- St. Louis County

International

- International Joint Commission



How We Work with Partners to Co-Host Events

The Upper Great Lakes Law and Policy Symposium exemplifies the depth of conversation that happened because of our work with the **National Sea Grant Law Center** and the **University of Minnesota Law School**. We led the planning, fundraising, communication, and delivery of the symposium, which attracted 120 people including international visitors from the U.S. Department of State. The symposium propelled 10 law and policy students along their career paths, and resulted in a special issue of the 2018 Sea Grant Law and Policy Journal. (ELWD)

The **Great Lakes Ballast Water Collaborative** is an example of how we unite partners to help develop common understandings rooted in science. We helped initiate the collaborative in 2009 and remained active through 2017. The collaborative continues to

define and communicate the realities of ballast water management in cold, freshwater environments so that the **shipping industry, insurers of vessels, ballast water management system manufacturers, policy makers, scientists, and environmental nonprofits** can make progress toward controlling the spread of potentially invasive species. It helped to defuse litigious situations including threatened lawsuits against the **U.S. Environmental Protection Agency** (~\$2.5 million each). We helped organize and facilitate a 2014 meeting of the collaborative to discuss the **International Maritime Organization's Ballast Water Convention** and the **U.S. Coast Guard's** type-approval process among other subjects. Additional partners include: **International Joint Commission, Great Lakes Commission, St. Lawrence Seaway Development Corp., U.S. Maritime Administration, U.S. Great Lakes Maritime Task Force, Environment and Climate Change Canada, Transport Canada, Canadian St. Lawrence Seaway Management Corp.** (HCE)

We led planning on an additional 13 events that fall primarily in the Healthy Coastal Ecosystems focus area, six in Resilient Communities and Economies, and one in Sustainable Fisheries and Aquaculture.

"The Upper Great Lakes Law and Policy Symposium was exceptional"

Cathy Janasie, Research Counsel, National Sea Grant Law Center

"This is one of the best collaborations I've seen in my 25 years in environmental protection"

Mic Ishlam, Chairman of the Great Lakes Indian Fish and Wildlife Commission

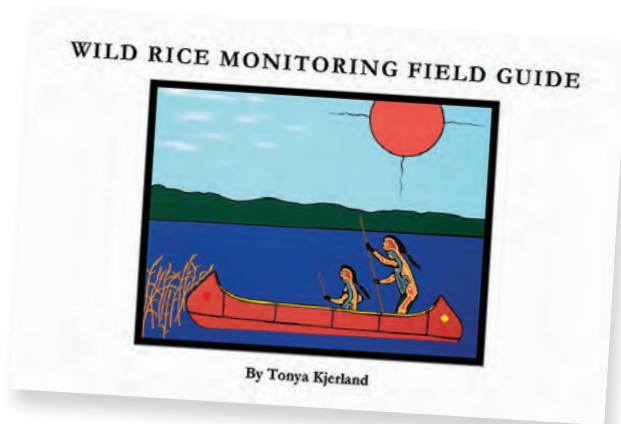
How We Work with Partners to Co-Create Research and Products

Wild rice served as a catalyst for several meaningful products and partnerships. We worked with a graduate student to produce the Wild Rice Monitoring Field Guide and the Wild Rice Monitoring Handbook in collaboration with the **1854 Treaty Authority, Fond du Lac Band of Lake Superior Chippewa, and Mille Lacs Band of Ojibwe**. The field guide and handbook help resource managers and tribes track the annual productivity of wild rice beds using methods designed to respect Native American and First Nation views. Both are important resources for standardizing wild rice monitoring in the region. Wild rice is also a topic of the website **St. Louis River Estuary: The Stories and the Science (stlouisriverestuary.org)**, which we jointly funded (2010-12) with **Wisconsin Sea Grant**. The website is used as

an outreach tool for restoration activities for the St. Louis River Area of Concern and received the Outstanding Program Award of 2015 from the Great Lakes Sea Grant Network. (HCE)

"The Wild Rice Monitoring Field Guide and the Wild Rice Monitoring Handbook set the benchmark..."

Nancy Schuldt, Water Project Coordinator, Fond du Lac Environmental Program



We produced 25 Great Lakes-wide aquatic invasive species educational products. Our program organized the printing and distribution of 136 versions and more than one million pieces of educational products designed to help control the spread of aquatic

invasive species (AIS). We did this as the principal investigator on three Great Lakes Restoration Initiative grants to support **Great Lakes Sea Grant Network**, the **Minnesota Department of Natural Resources** and other **partners'** outreach efforts to prevent the spread of aquatic invasive species. When St. Louis County, Minnesota, received \$680,000 from the Minnesota Department of Revenue to prevent the spread of AIS, they approached us to help develop a proposal process and write their aquatic invasive species prevention plan. (HCE)



Examples of How We Involve Our Stakeholders

Meeting People Where They Gather

Our program fosters a more scientifically literate society by meeting people where they gather and as they go about their days. For example, we reach some of our youngest stakeholders in their elementary schools through the Partners in Education program (PIE), a collaboration among Minnesota Sea Grant, the University of Minnesota Duluth (UMD) Center for Environmental Education, and the Great Lakes Aquarium in Duluth. Sea Grant provides funding for a graduate student coordinator and staff time for mentoring. UMD's Center for Environmental Education houses and supervises the graduate student coordinator and the aquarium provides training and curricula that meet Minnesota science standards. Between 2014 and 2017 the program served 5,900 students in the Twin Ports region and provided 105 undergraduate and graduate students with teaching experience and volunteer hours. (ELWD)

Stakeholders including boaters, anglers, beachgoers, and shoreline property owners, meet Sea Grant extension educators at community events, fairs, and festivals throughout Minnesota. Stakeholders might listen to The Sea Grant Files on the University of Minnesota Duluth's independent radio station during their 8 a.m. Tuesday commute. The episodes are posted as podcasts through iTunes and on our website. Stakeholders may also learn what we do for them through mass media as a result of our news releases, media advisories, and earned media from staff whose expertise is sought by local to international reporters. (ELWD)

Minnesota Sea Grant-funded researchers also join us in connecting with our stakeholders. For instance, one research team surveyed and interviewed residents, leaders, and visitors in coastal communities along the Minnesota shores of Lake Superior to assess their perspectives on changes in climate. The researchers reported support for green infrastructure and improvements to



Minnesota Sea Grant Associate Director Jesse Schomberg records an episode of the Sea Grant Files at the KUMD studio on the UMD campus

Stakeholders

Important Stakeholders 2014-2017:

Commerce

- Bait and food-fish aquaculture industry in Minnesota
- Duluth Seaway Port Authority
- Great Lakes Maritime industry
- Pet Industry Joint Advisory Council
- Water-based tourism industry

Recreation

- Beachgoers
- Boaters and anglers
- Lake Superior Chapter of Muskies, Inc.

Communities

- Counties, cities, and townships in the Lake Superior, St. Croix, and Mississippi watersheds of Minnesota

Education

- Great Lakes Aquarium
- K12 educators and students throughout the Great Lakes
- Great Lakes residents
- Minnesota residents
- UMN graduate and undergraduate students
- Visitors to Minnesota's north shore

Government

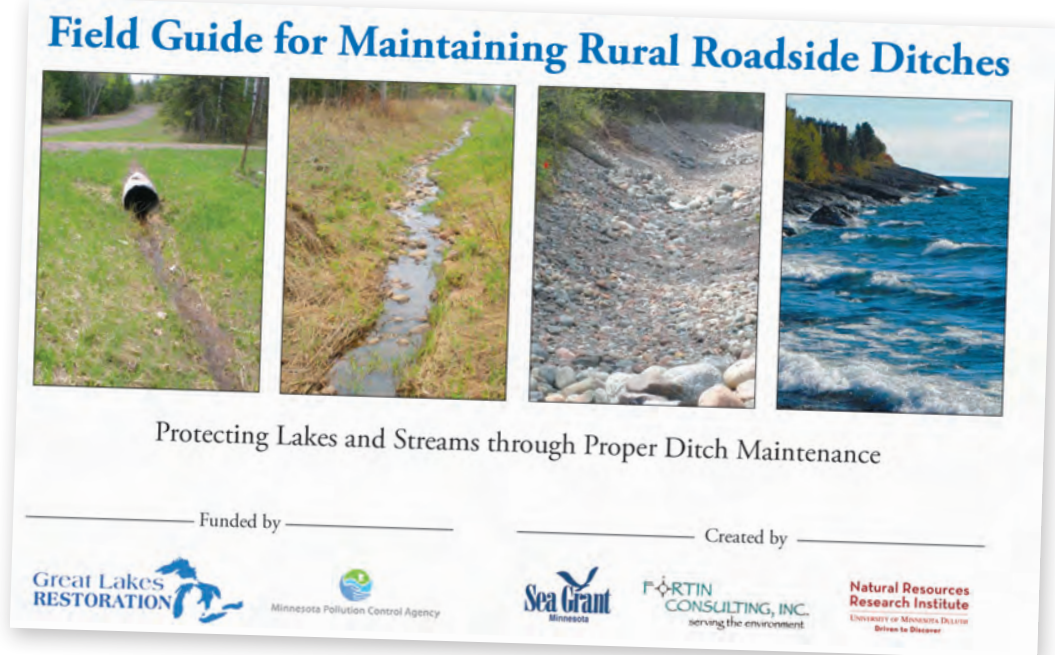
- Minnesota Department of Natural Resources
- Minnesota Pollution Control Agency
- National Weather Service
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency
- U.S. Coast Guard

Other

- County Soil and Water Districts
- Lake Associations
- Natural resource managers
- Researchers
- Watershed districts and watershed management organizations

Continued →

Roadside ditches act as waterways and can more than double stream drainage networks. Poorly maintained ditches transport excess dirt to streams. Minnesota road and natural resource managers requested a guide to help road crews properly maintain roadside ditches to reduce erosion and dirt in streams. Minnesota Sea Grant worked with the University of Minnesota Natural Resources Research Institute and other partners to develop this guide and provide training for road maintenance crews in northeastern Minnesota and northwestern Wisconsin. The Minnesota Association of Townships used this guide as a statewide training resource.



132% growth in Twitter followers



124% percent growth in Facebook followers



40,100 views and 1,225 hours spent watching Minnesota Sea Grant's YouTube Channel.

“The study is ... the first of its kind to document the extent of an individual muskie’s use of available aquatic habitats in the St. Louis River and Lake Superior. A data gap exists between the river and the lake, and this study will help fill that gap.”

Paul Piszczek, Fisheries Biologist, Wisconsin Department of Natural Resources

roads and culverts to accommodate changes in precipitation as well as momentum for individual and community action to prepare for and help reduce the impacts of climate change. The researchers presented these results to community, business, and tourism leaders to inform climate preparedness planning and we are using their results to guide future research and outreach. (RCE)

We are online and on social media with many of our stakeholders. From 2014-2017, our website www.seagrants.umn.edu had 2 million page views. (ELWD, HCE, RCE, SFA)

Inviting Stakeholder Participation

The Lake Superior Chapter of Muskies Inc. is a good place to look for some of our most engaged stakeholders and hear the latest word on Sea Grant-supported muskellunge research. Chapter members caught 60 muskies so that our researchers could outfit them with hydro-acoustic tags. Now the anglers are watching the results unfold as avidly as the scientists and natural resource managers. They want to find out whether muskies are using restored habitat and if they are venturing from the St. Louis River estuary into Lake Superior. Since 2013, the Lake Superior Chapter of Muskies Inc. has contributed \$500 each year to the annual \$1,000 Muskies Inc. — Minnesota Sea Grant Scholarship.

This research involves the Minnesota and Wisconsin Departments of Natural Resources and Minnesota Sea Grant. Muskies Inc. contributed time and more than \$15,000 to the effort. Outcomes are communicated through public events such as the River Talks speakers’ series sponsored by the Lake Superior National Estuarine Research Reserve and the Wisconsin and Minnesota Sea Grant programs, incorporated into a new exhibit at the Great Lakes Aquarium, and in a video available on our website. (SFA)



Providing Workforce Development

Minnesota Sea Grant considers students to be emerging professionals, a subset of the program's stakeholders, and works with them to develop their particular skills while supporting us. We count on a cadre of interns, student employees, undergraduate research assistants, Sea Grant graduate scholars, Knauss fellows, and volunteers to amplify the program's impacts, accomplishments, and messages. Our internship program serves university students interested in careers in environmental work, science, and science communication.

From 2014-2017, our students engaged in community outreach and event planning, participated in research and management activities, developed proposals, and conducted credit-based special projects. Undergraduates produced artwork, museum displays, videos, podcasts, and social media content. Because of their association with Minnesota Sea Grant they published in magazines, newspapers, newsletters, and professional journals. One undergraduate co-authored *Food-Fish Aquaculture in Minnesota: A Synthesis of the 26-27 April 2017 Workshop*. (ELWD)

Minnesota Sea Grant has joined forces with the student-run American Fisheries Society UMD subunit to clean beaches and staff informational booths. We help graduate students develop their careers by funding two years of research and academic work, and by offering annual fellowship opportunities including the Muskies Inc. – Minnesota Sea Grant Scholarship and the Minnesota Chapter of the American Fisheries Society best student paper award. Providing graduate students with research and outreach support and opportunities has resulted in a National Science Foundation Graduate Research Fellowship and employment in science communication, city planning, policy, fisheries, academia, research laboratories, environmental assessment and environmental nonprofits. (ELWD)



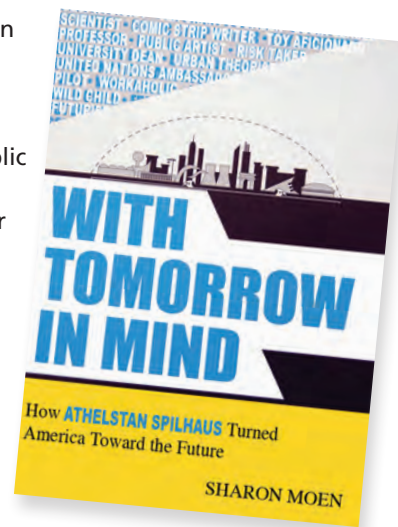
Summary of first food-fish aquaculture workshop in Minnesota (2017).

Creating New Opportunities for Stakeholders

Our 2017 Workshop to Explore **Food-fish Aquaculture in Minnesota** was the first in the state to explore the potential for developing food-fish aquaculture industries in cold climates. This by-invitation event was attended by 42 food-fish growers, regulators, and researchers. At our Lake Superior Fish Classics in 2011-2014, we provided opportunities for commercial fisherman, professional chefs, and the public to be part of a culinary competition and tasting event focused on sustainable fisheries in Lake Superior. We worked with Wisconsin Sea Grant and Lake Superior Magazine in 2014 to serve a sold-out crowd of 300. (SFA)

Using the colorful life of Sea Grant founder Athelstan Spilhaus, our senior science communicator wrote a biography, *With Tomorrow in Mind: How Athelstan Spilhaus Turned America Toward the Future*, to inspire science literacy. Our staff conceptualized exhibits with the Great Lakes Aquarium in Duluth so visitors could experience diatoms, paleolimnology, aquatic invasive species, and how research happens. (ELWD)

We also created opportunities for our educators, outreach staff, and public stakeholders to participate in community science (formerly called citizen science). We did this by co-founding the Lake Superior Regional Citizen Science Collaborative and co-hosting its 2017 Superior Citizen Science Symposium, and by serving on the CitSciMN 2017 Symposium planning committee. We were also the local leader for the nationwide City Nature Challenges in 2017 and 2018. (ELWD)



Biography of Athelstan Spilhaus, the founder of the Sea Grant College Program concept (2015)

Improving Great Lakes Literacy With K12 Educators (ELWD)

Whether on the water or on land, educators participating in our activities—uniting educators and scientists through the Center for Great Lakes Literacy collaborative—gained scientific competence.

Land-based Activities

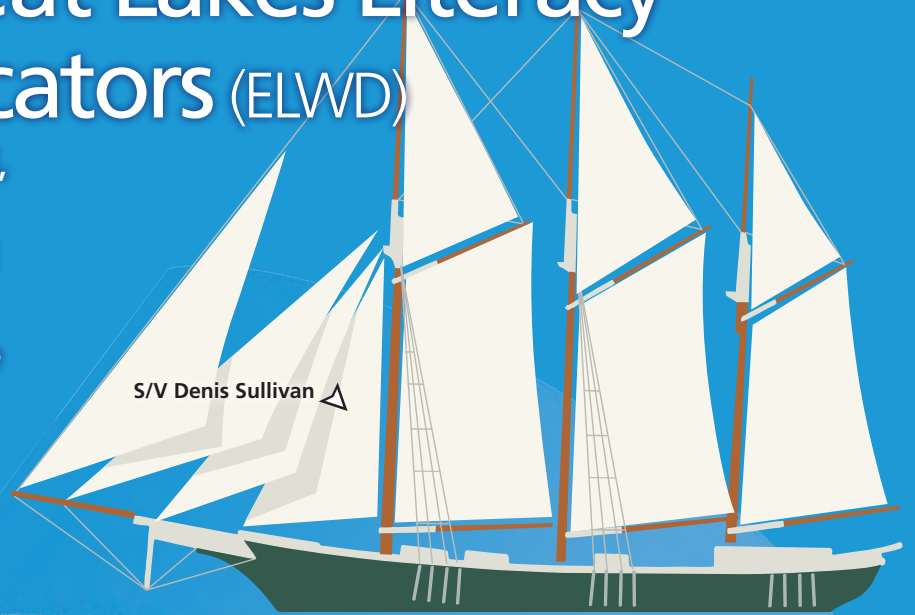
- 13 Great Lakes educators attended the 2017 International Association of Great Lakes Research annual meeting to learn about Great Lakes research (including Sea Grant-funded projects) and to talk one-on-one with researchers.
- Educators participated in four Great Lakes Awareness Day events during their Sea Grant shipboard science workshops that provided opportunities for the public to learn about Great Lakes issues.
- 85 educators participated in programs during which Sea Grant introduced them to scientists and to shipboard and laboratory research.

Scientists

- By working with educators, seven early-career scientists improved their capacity to link their research to societal challenges and public outreach.

“The best professional development experience I have participated in during my 25-year teaching experience.”

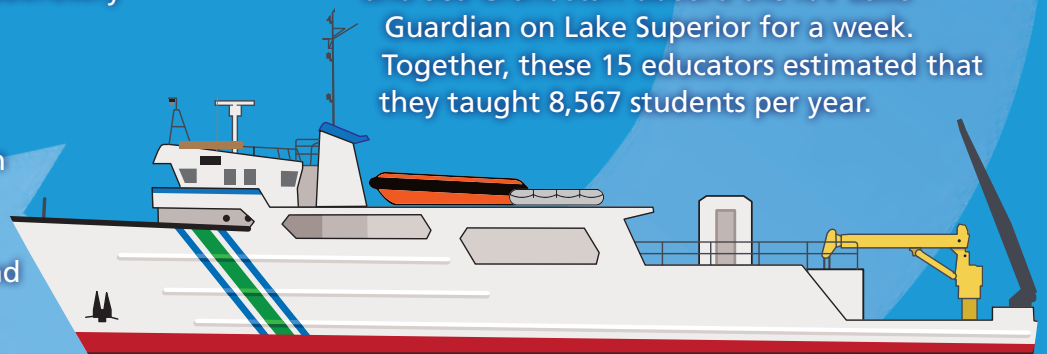
Shipboard Science Workshop educator/participant.



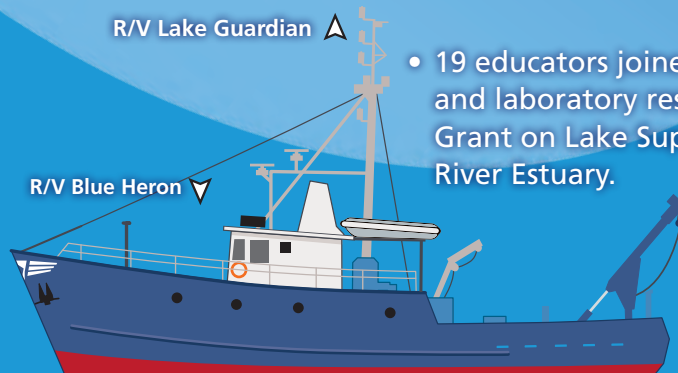
S/V Denis Sullivan

Ship-based Activities

- Sea Grant’s shipboard science programs transform teachers into motivated Great Lakes educators. Over the course of a week—and fueled by dynamic partnerships and the wind in their sails—24 Minnesota and Wisconsin educators were exposed to the skills of navigating the Great Lakes, gained knowledge of the region’s seafaring history, and practiced the science of lake ecology.
- 15 educators conducted research with scientists and Sea Grant staff aboard the R/V Lake Guardian on Lake Superior for a week. Together, these 15 educators estimated that they taught 8,567 students per year.



R/V Lake Guardian



R/V Blue Heron

- 19 educators joined a three-day shipboard and laboratory research experience with Sea Grant on Lake Superior and the St. Louis River Estuary.

Solving Industry Challenges Without Sacrificing the Environment (RCE)

Cost savings

- What's at stake? The Port of Duluth-Superior is an economic engine providing the surrounding community with about 7,880 jobs and \$1.4 billion in annual business revenue.
- Minnesota and Wisconsin Sea Grant (MNSG & WISG) and our Harbor Technical Advisory Committee partners facilitated conversations resulting in dredge material being reused instead of having to build a new containment facility that would cost about \$2M annually for 20 years.
- MNSG initiated a survey of property owners in the Port of Duluth-Superior that became the backbone of the port's land-use plan estimated to be worth \$22.5 Million annually.

- MNSG and WISG-supported research is leading to the development of non-toxic corrosion-resistant coatings that will protect freshwater port steel infrastructure.

Collaborations*

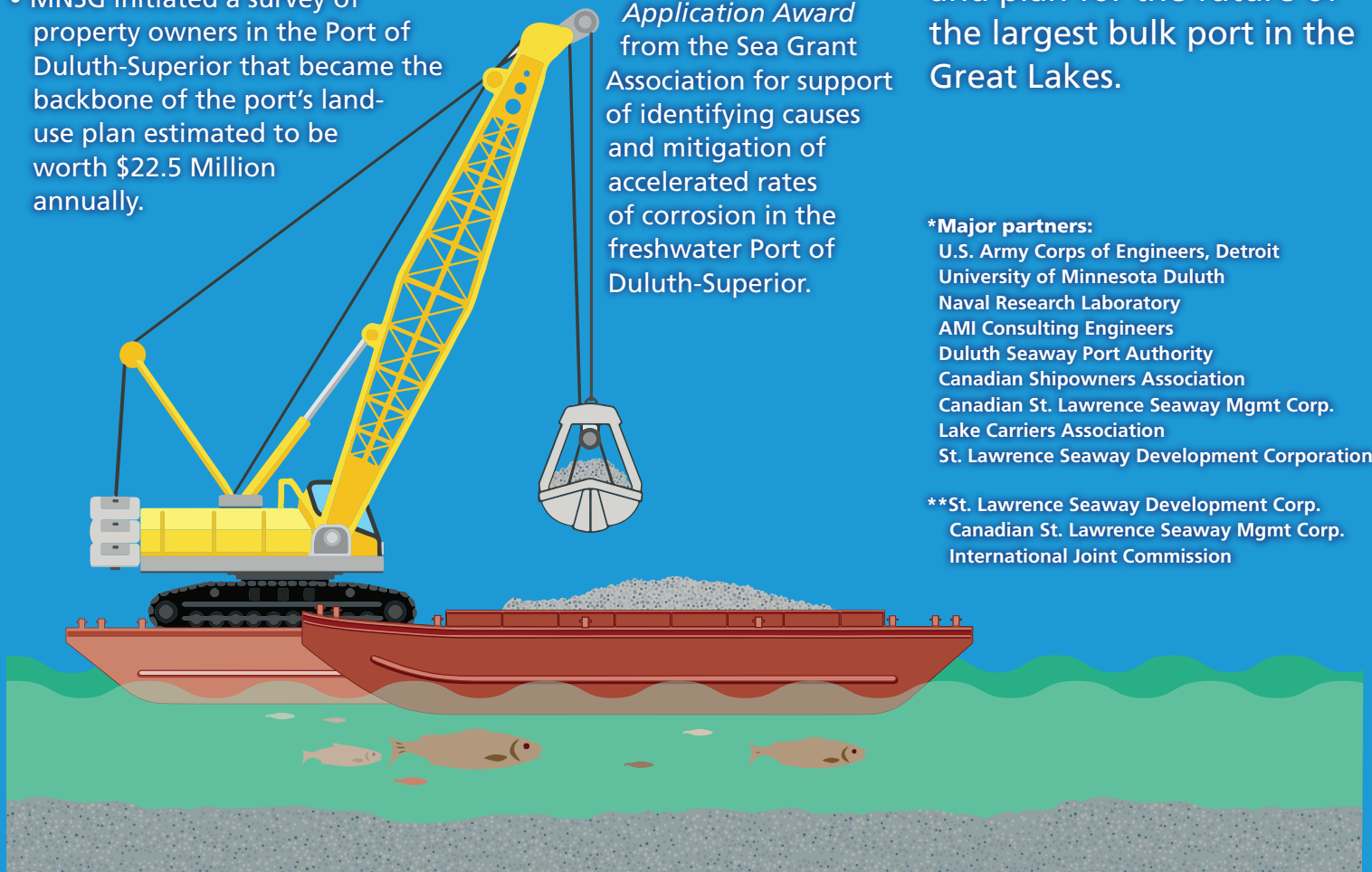
- MNSG instigated the creation of a one-of-a-kind Ballast Water Collaborative** to foster a reasoned and balanced approach to ballast water management.
- MNSG and WISG programs won the 2014 *Research to Application Award* from the Sea Grant Association for support of identifying causes and mitigation of accelerated rates of corrosion in the freshwater Port of Duluth-Superior.

Our maritime partnerships crossed federal research programs, international policy, regulatory and resource management agencies, academia, local governments, nonprofits and the shipping industry to coordinate an innovative dredging reuse program, improve ballast water management, conduct corrosion research, and plan for the future of the largest bulk port in the Great Lakes.

*Major partners:

U.S. Army Corps of Engineers, Detroit
 University of Minnesota Duluth
 Naval Research Laboratory
 AMI Consulting Engineers
 Duluth Seaway Port Authority
 Canadian Shipowners Association
 Canadian St. Lawrence Seaway Mgmt Corp.
 Lake Carriers Association
 St. Lawrence Seaway Development Corporation

**St. Lawrence Seaway Development Corp.
 Canadian St. Lawrence Seaway Mgmt Corp.
 International Joint Commission



Controlling Stormwater to Improve Community Resilience (RCE)

We put substantial effort into helping communities manage flooding and stormwater runoff. Through our *Nonpoint Education for Municipal Officials (NEMO)* program with UMN Extension, we help local officials and community leaders understand how management decisions and policies impact water quality.

The Watershed Game (WSG) helps local leaders and youth understand watershed management and is a joint program of Minnesota Sea Grant and University of Minnesota Extension.

- The WSG focuses on water quality goals and applying practices, plans, and policies to meet those goals.
- More than 150 facilitators in 22 states have been trained to use the WSG.
- More than 1,000 local leaders have participated in WSG education programs in Minnesota.
- The WSG for local leaders comes in three versions — Lake, Stream, and River.
- The WSG classroom version for late elementary through high school students was created in 2015.
- Minnesota Sea Grant NEMO/WSG activities helped nine St. Croix watershed communities adopt new stormwater management ordinances called Minimal Impact Design Standards.
- The policy actions taken by NEMO/WSG participants is estimated to have created \$6.6M in economic benefit due to improved water quality in the St. Croix watershed.
- WSG participants at the West Metro Twin Cities NEMO Workshop-on-the-water program reported a 90% improvement in understanding of best management practices for shorelines and stream banks.
- 39 people participated in the WSG at the Sea Grant and NOAA Central Region Collaboration Team workshop on tools for reducing nutrient runoff.



The Watershed Game, River version



The four versions of the Watershed Game — River, Stream, Lake, and Classroom — are interactive, educational tools that help individuals understand the connection between land use and water quality. Participants learn how various land uses impact water and natural resources, increase their knowledge of best management practices, and learn how their choices can prevent adverse impacts.

Economic Benefits of Controlling Aquatic Invasive Species (HCE)

Our outreach helped decrease the rate of non-native species invasion in Minnesota lakes from 12% to 6% per year.

More than 92% of boaters and anglers surveyed by Minnesota Sea Grant in 2015 indicated that they would take actions to help stop aquatic hitchhikers.

Our roles on federal and state task forces, the *Stop Aquatic Hitchhikers* and *Habitattitude* campaigns, and the *Great Lakes Ballast Water Collaborative*, have positioned us as national leaders in the battle to stop the spread of aquatic invasive species (AIS). Our work averted multiple costly environmental lawsuits and has helped unify messages, research, and policies across the Great Lakes.

We calculate an annual ~\$6 million in economic benefit resulting from our aquatic invasive species work with respect to Minnesota's inland lakes.

Lakeshore Property Protection

Our work is valuable because it helps protect Minnesota's \$74B in shoreline property

At any time, about \$2.7B of shoreline property is for sale.

When aquatic invasive species are present, property values can decrease by 19%

Our work results in land sale profits and sustained realtor jobs

We estimate our aquatic invasive species work is worth about \$3.08M in realtor revenue from land sales

690 Minnesota lakes are kept free from aquatic invasive species each year. We estimate that we helped protect 10% or 69 of those lakes for an economic benefit of about \$6M.

Sport Fishing Industry Protection

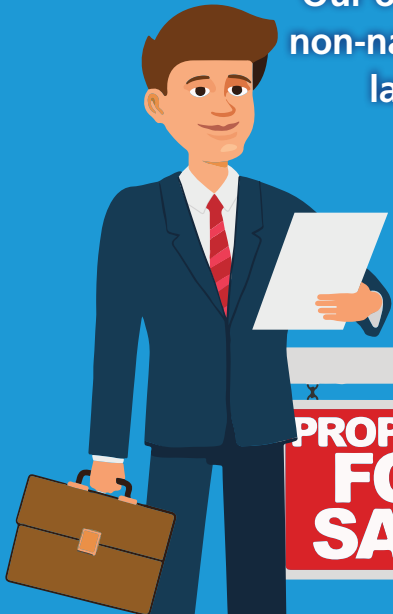
Our work is valuable because it helps protect Minnesota's \$4.8B sport fish industry.

When aquatic invasive species are present, angler catch rates can decrease by up to 50%

When catch rates decrease like this anglers are 8-16% less willing to pay to go fishing

Our work results in better fishing thereby sustaining jobs and revenue generated by anglers

We estimate our aquatic invasive species work is worth about \$3.05M to Minnesota's sport fishing industry



Major partners in Minnesota:

Minnesota Department of Natural Resources
UMN Minnesota Aquatic Invasive Species Research Center
UMN Extension

Collaborative Network and NOAA Activities



Activities and Projects Conducted in Collaboration with Other Sea Grant, NOAA, and Agency Partners

Minnesota Sea Grant's support of a Sea Grant Coastal Storms Outreach Coordinator position in the Great Lakes expands projects (RCE)

This position was created to assist with coordinating NOAA Great Lakes restoration efforts and NOAA Coastal Storms program activities in the Great Lakes in partnership with Wisconsin Sea Grant. Outcomes include standardized Great Lakes beach safety messaging, organization of four Great Lakes water safety conferences, formation of the Great Lakes Water Safety Consortium, publishing two climate funding opportunities documents, and funding for 10 small projects through NOAA Coastal Storms Program. From 2013-2016, the position was co-funded by the NOAA Coastal Storms Program and Office for Coastal Management and Minnesota Sea Grant. It was located in the National Weather Service Office in Chanhassen, Minnesota. Collaborators included all Great Lakes Sea Grant programs, Illinois Department of Natural Resources, Indiana Department of Natural Resources, Great Lakes Environmental Research Laboratory, Minnesota's Lake Superior Coastal Program, Great Lakes Commission, National Weather Service, Michigan Department of Natural Resources, and others.

Minnesota Sea Grant fosters multiple collaborations with the Mid-Continent Ecology Division Laboratory (MED) of the Environmental Protection Agency (RCE, HCE, SFA, ELWD)

We collaborated on research using paleolimnology to guide restoration efforts, dredge recycling-reuse initiatives, and green infrastructure projects. A project on the effects of endocrine disrupting chemicals on smallmouth bass included a Sea Grant graduate scholar who worked at the MED lab during her entire thesis project. Outreach and education collaborations include taking K-12 teachers on research cruises and creating community-science opportunities.

Minnesota Sea Grant's work with the Great Lakes Sea Grant Network advances the understanding of how crude oil travels throughout the Great Lakes region (RCE)

Our program helped facilitate, communicate, plan, and inform efforts to educate decision-makers about the risks and benefits of crude oil transport in the region. The collaboration included the Great Lakes Sea Grant Network, Gulf of Mexico Research Institute, International Joint Commission, Great Lakes Commission, Joyce Foundation, and partners and stakeholders who attended the 2017 Crude Move Symposium: Oil Transportation Infrastructure, Economics, Risk, Hazards and Lessons Learned in Ohio. Lake Champlain Sea Grant maintains the website of the network's work in this arena. <http://glslcrudeoiltransport.org>

Additional Examples of Grant-Funded Projects with External Primary Partners Include:

A Workshop to Prioritize Strategies for Food Fish Aquaculture in Minnesota (2016-17) with UMN Extension (SFA)

Aquatic invasive species Prevention Aid Program (2015-17) with St. Louis County, Minnesota, 1854 Treaty Authority, UMD Natural Resources Research Institute (HCE)

Aquatic invasive species Management Internship (2016-17) with National Park Service, 1854 Treaty Authority, UMD Natural Resources Research Institute (HCE)

Ecological Limits of Hydrologic Alteration Stakeholder Engagement (2016) with Minnesota Department of Natural Resources, Minnesota's Lake Superior Coastal Program, The Nature Conservancy, UMD Natural Resources Research Institute, UMN St. Anthony Falls Laboratory, NOAA Office for Coastal Management (HCE)

The Value of Drinking Water Quantity Versus Quality (2017-18) with Center for Agriculture and Rural Development, Iowa State University (RCE)

Strengthening the Educator-Scientist Community of Practice Through Dynamic

Shipboard and Shoreline Professional Development and Stewardship (2015-17) with Great Lakes Sea Grant Education Network, U.S. EPA, UMD, National Marine Sanctuary Foundation, Discovery World, Great Lakes Aquarium, Fond du Lac Tribal and Community College, Wolf Ridge Environmental Learning Center, Lake Superior National Estuarine Research Reserve, and other partners (ELWD)

Using a Teacher Mentor Model to Expand the Impact of the Center for Great Lakes Literacy (2017) with the Great Lakes Sea Grant Education Network, U.S. EPA, Wisconsin Sea Grant, Discovery World (WI), City of Port Washington (WI), City of Sheboygan (WI), Wisconsin Department of Natural Resources, Sheboygan County (WI) YMCA, Ozaukee County Planning and Parks (WI), City of Two Rivers (WI), and Wisconsin Historical Society (ELWD)

Number and Types of Regional/Multi-Program Projects

Between 2014 and 2017, we participated in eight projects that included the entire Great Lakes Sea Grant Network. Projects ranged from understanding how crude oil is moved around the Great Lakes region and the associated risks; community assessments of climate change readiness; and evaluating the Impact-based Warning Tool for the National Weather Service. We partnered with two to four Great Lakes Sea Grant programs on six additional projects that included rip current safety, the Coastal Hazard and Resilience Program, and organization of the Great Lakes Water Safety Consortium. We collaborate most often with Wisconsin Sea Grant, in part because we share Lake Superior and the St. Louis River Estuary. Wisconsin Sea Grant was our partner on the eight projects mentioned above and an additional nine projects. The projects include research, education, and outreach on the St. Louis River Estuary and area of concern, the Port of Duluth-Superior, shipboard science for teachers, climate resiliency, and promoting the consumption of Lake Superior fish.

Outside of the Great Lakes, we collaborated with the NOAA Central Regional Collaboration Team, Louisiana and Mississippi-Alabama Sea Grant, and the NOAA National Water Center to organize Nutrient Runoff Risk Reduction: A Workshop to Explore Decision Support Tools at the University of Alabama. We also partnered with Woods Hole Oceanographic Institute, Massachusetts Institute of Technology, Lake Champlain, and Florida Sea Grant to co-lead the Community Response to Flooding visioning effort and the National Sea Grant Law Center on the Law and Policy Symposium.



Success in Sea Grant National Competitions

Minnesota Sea Grant successfully competed for four National Sea Grant Office projects during this reporting period.

A Workshop to Prioritize Strategies for Food-Fish Aquaculture in Minnesota (2016-17) \$19,000. (SFA)

Great Lakes Coastal Weather, Water and Beach Safety Forecasts and Stormwater Products for Coastal Residents and Communities (2015-17) \$114,500. (RCE)

Regional Collaboration Project to Address Nutrient Runoff (2017-18) \$50,000. (HCE)

Minnesota Sea Grant Supports National Visioning Efforts (2017-18) \$30,000 (Co-lead Community Response to Flooding Visioning and participated in all 10 visioning efforts) (SFA, HCE, RCE, ELWD)

Performance

Leadership by Staff on Boards and Committees

Aquatic Nuisance Species Task Force, Communication, Education and Outreach Committee, Co-chair – **Doug Jensen** (HCE)

Canadian Lake Pulse Network, Scientific Committee, Chair – **John Downing** (HCE, RCE, SFA, ELWD)

City Nature Challenge, Co-lead – **Marte Kitson** (ELWD)

Clean Water Summit: Green Infrastructure for Clean Water Conference, Co-chair – **John Bilotta** (RCE)

Council of Great Lakes Region, Science Advisory Board member – **Dale Bergeron** (HCE, RCE)

Council of Scientific Society Presidents, Meetings and Data and Publications Committees, Chair – **John Downing** (HCE, RCE, SFA, ELWD)

Dredge Research Collaborative, Advisory Board member – **Dale Bergeron** (RCE)

Duluth Bikes, Advisory Board, Chair – **Tom Beery** (RCE)

Duluth Urban Watershed Advisory Committee, Founder – **Jesse Schomberg** (RCE)

Duluth-Superior Metropolitan Interstate Council, Port Land Use Plan, Advisory Committee member – **Dale Bergeron** (RCE)

Governor's Council on Minnesota Lake Superior Coastal Program, Vice-chair – **Don Schreiner** (HCE, RCE)

Great Lakes Panel on Aquatic Nuisance Species, Information and Education Committee, Chair – **Doug Jensen** (HCE)

Great Lakes Sea Grant Network Program Leaders, Network Chair – **Jesse Schomberg** (HCE, RCE, SFA, ELWD)

Great Lakes Water Safety Consortium, Board of Directors – **Jesse Schomberg** (RCE)

Greater Lake Superior Foundation, Board of Directors member – **Sharon Moen** (SFA)

Green Marine, Great Lakes Environment Committee and Advisory Board member – **Dale Bergeron** (RCE)

Harbor Technical Advisory Committee, Chair – **Dale Bergeron** (HCE)

Hwy H2O, Science Advisory Board member – **Dale Bergeron** (HCE, RCE)

University of Minnesota – Institute on the Environment, Elected Fellow – **John Downing** (HCE, RCE, SFA, ELWD)

Itasca Waters, Founder – **John Downing** (HCE, RCE, SFA, ELWD)

Lake Superior Lakewide Action Management Plan: Superior Working Group, Sustainability Committee, Chair – **Brent Schleck** (HCE)

Lake Superior National Estuary Research Reserve, Advisory Board member – **Jeff Gunderson, John Downing** (HCE)

Network Advisory Council to the Sea Grant Association, Vice-chair –

Sharon Moen (HCE, RCE, SFA, ELWD)

Northern Bedrock Historic Preservation Corps, Vice-chair – **Jesse Schomberg** (RCE)

Puerto Rico ASLO meeting (2019), Co-chair – **John Downing** (HCE, RCE, SFA, ELWD))

Sea Grant Extension Assembly, Elected Secretary-Treasurer – **Jesse Schomberg** (HCE, RCE, SFA, ELWD)

St. Louis River Quest, Board of Directors – **Doug Jensen** (ELWD)

Twin Ports Rip Current Working Group, Co-founder – **Jesse Schomberg** (RCE)

UMD Natural Resources Research Institute, Community Impact Advisory Board member – **John Downing** (HCE, RCE, SFA, ELWD)

UMD Shared Campus Governance, Research, Scholarship and Creative Activities Subcommittee, Chair – **Valerie Brady** (HCE, RCE, SFA, ELWD)

UMN Minnesota Aquatic Invasive Species Research Center, Advisory Board member – **Jeff Gunderson, John Downing** (HCE)

Upper Midwest Invasive Species Conferences, Co-chair – **Doug Jensen**; Committee Chair (2016) – **Marte Kitson** (HCE)

Wildwoods Animal Rehab, Advisory Board, Chair – **Cindy Hagley** (HCE)

“Let’s be clear: Our precious land, air and water are a big part of the reason we all live in northern Minnesota, and I am absolutely committed to protecting them. ... Last year, I led a bipartisan push to fully fund the Great Lakes Restoration Initiative and the Sea Grant Program.”

U.S. Rep. Rick Nolan,
Duluth News Tribune,
Dec. 31, 2017.

How Program Achieved Recognition as an Intellectual and Practical Leader in Marine Science, Engineering, Education, and Advisory Service in the State and Region.

Minnesota Sea Grant Environmental Quality Extension Educator, **Cynthia Hagley**, has been regularly sought by state, university, and other organizations for her facilitation skills to guide critical decision-making processes. Examples include the University of Minnesota Department of Soil, Water, and Climate and the Minnesota Legislature Environment Committee, the Minnesota Department of Natural Resources, and the Consortium for Ocean Science Exploration and Engagement.

At a 2016 United States Senate Committee on Commerce, Science, and Transportation briefing on the necessity of economic resilience in coastal communities, the Director of Port Planning and Resiliency, Duluth Seaway Port Authority, **Jim Sharrow**, spoke about how Minnesota Sea Grant’s expertise and advice on sustainable practices relating to corrosion, dredge material and ballast water management led to millions of dollars in savings. (RCE)

Minnesota Sea Grant Program Leader, **Jesse Schomberg**, was sought for his expertise in stormwater management and community decision-making facilitation skills by the Minnesota Pollution Control Agency in 2015 to create and facilitate the Duluth Urban

Watershed Advisory Committee. The group has developed a framework for cooperative watershed management for the Duluth metropolitan area. (HCE, RCE)

Minnesota Sea Grant Director **John A. Downing** was sought as an intellectual limnology leader by national and international media after receiving the John H. Martin Award in 2017 by the Association for the Sciences of Limnology and Oceanography for a landmark paper on global oceans, human activities, and nitrogen.

The Center for Great Lakes Literacy website (www.CGLL.org) is the intellectual and practical hub for the Great Lakes education community of practice. It is a platform for social networking, and Great Lakes resources such as curricula, webinars, and professional development. (ELWD)

Awards

Sea Grant Association 2014 Research to Application Award to the Minnesota and Wisconsin Sea Grant programs for a decade of working with port managers, U.S. Army Corps of Engineers, U.S. Navy, university researchers, and partners to identify causes and mitigation of accelerated rates of infrastructure corrosion in the Port of Duluth-Superior. 2014 (RCE)

Stop Aquatic Hitchhiker! Achievement Award from Wildlife Forever to Minnesota Sea Grant Extension Educator Doug Jensen for invaluable commitment to preventing the spread of aquatic invasive species. 2014 (HCE)

Elsevier (International) Research Scholarship to Sea Grant graduate scholar Brittany Krugar for her research on Lake Superior's food web. 2014 (HCE)

Outstanding Programming Award from the Great Lakes Sea Grant Network to the Minnesota and Wisconsin Sea Grant programs for the Stories and Science of the St. Louis River Estuary website. 2015 (HCE) stlouisriverestuary.org

Best Student Presentation Award from the Minnesota Chapter of the American Fisheries Society to Sea Grant graduate scholar Trevor Keyler for his research presentation on the sensitivity of deep-water Lake Superior fishes to various light spectra. 2015 (SFA)

Sander Award from the North Central Division of the American Fisheries Society to Sea Grant graduate scholar Trevor Keyler. 2015 (SFA)

Outstanding Service Award from the University of Minnesota Duluth to Minnesota Sea Grant Program Analyst Dee Angradi. 2016 (RCE, HCE, SFA, ELWD)

First Place Social Sciences and Management Category, North Carolina State University 12th Annual Graduate Student Research Symposium, to Allie McCreary for her Minnesota Sea Grant-influenced research on the impacts of climate change on nature-based tourism. (RCE)

Early Career Award from the Great Lakes Sea Grant Network to Minnesota Sea Grant Extension Educator Marte Kitson. 2017 (ELWD)

Association for the Sciences of Limnology and Oceanography Ramon Margalef Award for Excellence in Teaching and Mentoring in the Fields of Limnology and Oceanography to Minnesota Sea Grant Extension Educator Cynthia Hagley. 2017 (ELWD)

Association for the Sciences of Limnology and Oceanography John H. Martin Award to Minnesota Sea Grant Director John A. Downing and co-authors for a landmark 1996 study that has had long-lasting relevance. 2017 (HCE)

National Science Foundation Graduate Research Fellowship to Sea Grant graduate scholar Amber White for methylmercury cycling work in the St. Louis River Estuary. 2017 (RCE)



**US Army Corps
of Engineers®**



**STOP AQUATIC
HITCHHIKERS!**



ELSEVIER



**UNIVERSITY OF MINNESOTA
DULUTH**



ASLO
ASSOCIATION FOR THE SCIENCES OF
LIMNOLOGY AND OCEANOGRAPHY

We are recognized by leaders in the field.

Productivity

Summary of Progress Toward National Performance Measures and Metrics

From 2014-2017, the National Sea Grant Office provided an annual average of \$1,245,662 to Minnesota Sea Grant. This funding was matched with an annual average of \$642,070 in University of Minnesota (UMN) funds. UMN funds are a combination of cash and unrecovered facilities and administration (F&A) costs. UMN-negotiated F&A rates are 33% for outreach and 52% for research.

We are a small program. We receive 2.09% of the \$47.8M in total annual base funding for all 33 programs, but our contribution to annual targets is typically much greater. With this base funding and additional external and leveraged grants, Minnesota Sea Grant made the following progress toward national performance metrics and measures.

With respect to metrics, our ability to reach more than 55,000 P12 students in four years is notable. Similarly, our dedication to transferring science to stakeholders is shown by the 34,000 attendees at our events and presentations. We do not offer HACCP training and our Clean Marina Certification metrics reflects the work of the Minnesota Clean Marina organization of which we were a founding member.

With respect to program-specific measures, we exceeded all of our four-year targets. Minnesota Sea Grant's contribution to the National Sea Grant Office's targets are shown in the table below.

National Performance Measures	Annual Average	NSGO Annual Target	Contribution To National Target
# SG products used to advance environmental literacy and development workforce	14	406	3.3%
# communities implemented hazard resiliency practices to mitigate coastal hazardous events	5	205	2.4%
Businesses created	1	40	3.1%
Businesses sustained	52	620	8.3%
Economic benefits 1	\$13,247,964	\$81,590,500	16.2%
Jobs created 2	63	259	24.3%
Jobs sustained	229	3,080	7.4%
# SG tools, technologies, information services used to improve ecosystem-based management	18	250	7.2%
# fishermen, seafood processors and aquaculture industry personnel who modify practices 3 & 4	20	6,295	0.3%
# communities implemented sustainable economic and environmental development practices and policies 5	41	335	12.1%
# acres of coastal habitat protected, enhanced or restored	4,818	497,445	1.0%
# resource managers who use ecosystem-based approaches in the management of resources	555	N/A	N/A
# people engaged in SG-supported informal education	41,431	1,160,959	3.6%
# SG-supported graduates employed in a career related to their degree within two years of graduation	5	177	2.8%

With regard to the measures ➤

1. Economic benefit values, to a large extent, reflect the value of managing aquatic invasive species in the Great Lakes and in Minnesota.
2. The jobs created as a result of Minnesota Sea Grant's activities reflect a portion of the state's seasonal aquatic invasive species watercraft inspector jobs.
3. Minnesota's food-fish aquaculture is small. Minnesota's commercial fishing industry is small.
4. Based on our AIS-HACCP plan (2013), the U.S. Fish and Wildlife Service and Ontario Ministry of Natural Resources have led regional efforts. The North Central Regional Aquaculture Center and UMN Veterinary Diagnostic Laboratory have also extended our fisheries and aquaculture contributions well beyond our state and we do not count this work.
5. The number of communities that implemented sustainable economic and environmental development practices and policies reflects work with community leaders to control stormwater and work with communities and natural resource managers to control the spread of aquatic invasive species.

Selected Impact and Accomplishment Statements Linked to 2014-2017 Strategic Plan Goals and Objectives

From 2014 to 2017, Minnesota Sea Grant entered 207 impacts and accomplishments into PIER. All are connected to the mission, objectives, and goals of our program and 80 were selected for the site review team briefing package. Below are examples showing how impact and accomplishment statements are linked to the four objectives and 12 goals described in our program's 2014-2017 Strategic Plan.

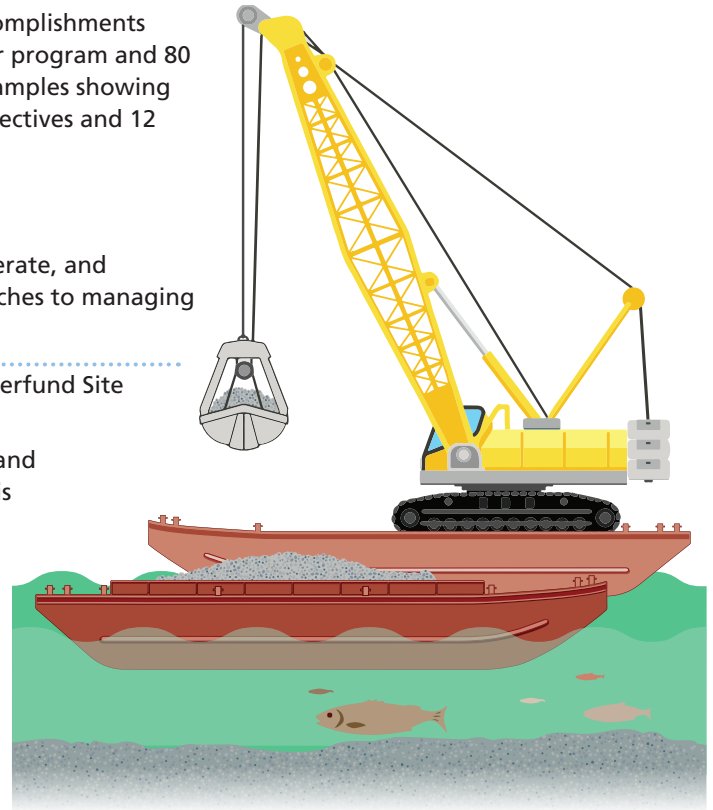
1 Healthy Coastal Ecosystems (HCE)

The following three statements meet the HCE objective to create, generate, and disseminate scientific information supporting ecosystem-based approaches to managing the coastal environment in Minnesota.

Impact: Recycling and Reusing Dredge Material Contributes to Superfund Site Remediation.

Recap: Innovation and cooperation on dredging creates revenue and opportunities within a Great Lakes community. Because it is permissible to reuse materials dredged from the shipping channels in the Port of Duluth-Superior harbor, maritime activity can continue, dredge disposal costs have been dramatically reduced, and an Area of Concern is being restored.

Goal 1: The work improved the ecosystem services of the St. Louis River Estuary by providing a way to cap polluted areas and create habitat for wildlife and plants.



Impact: Working with Tribes to Standardize Wild Rice Monitoring Methods Becomes Benchmark.

Recap: Minnesota Sea Grant worked with researchers and tribal resource managers to publish and distribute a field guide and handbook that are being adopted as the benchmark methods and rationale for monitoring wild rice stands in the Upper Midwest.

Goal 2: The work improves the ability of tribes and the Minnesota Pollution Control Agency to use ecosystem-based approaches to manage land, water, and living resources.

Impact: Boaters and Anglers Take Actions to Prevent the Spread of Aquatic Invasive Species.

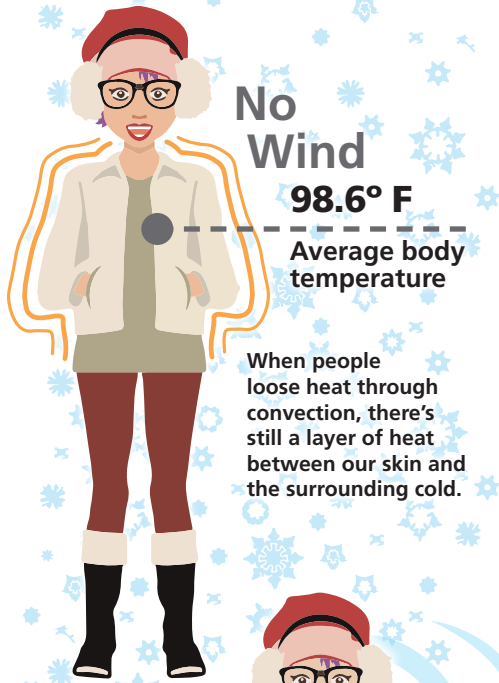
Recap: For more than two decades Minnesota Sea Grant has brought hundreds of partners together to reduce the economic, social, and environmental impacts associated with aquatic invasive species. Efforts such as the Stop Aquatic Hitchhikers campaign have demonstrated significant increases in public awareness and public willingness to adopt behaviors that prevent the spread of aquatic invasive species.

Goal 3: The work helps to protect aquatic ecosystems from the spread of non-native plants, animals, bacteria and viruses.



**STOP AQUATIC
HITCHHIKERS!**

The Science of Wind Chill

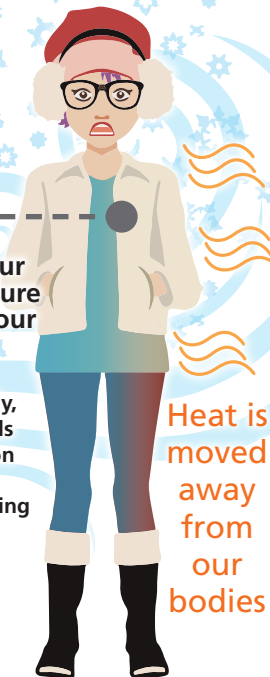


When people lose heat through convection, there's still a layer of heat between our skin and the surrounding cold.

Windy

95° F
Hypothermia begins when our body temperature drops two to four degrees.

But when it's windy, the moving air pulls apart this insulation layer. It speeds up heat loss by whisking away the warmth from our skin.



Our program is a NOAA Weather-Ready Nation Ambassador. We are committed to serving as an example and engaging our stakeholders to make this country ready, responsive, and resilient.

2 Sustainable Fisheries and Aquaculture (SFA)

The following two statements meet the SFA objective to assist in generating a sustainable supply of safe foods and other products from wild and domestic aquatic environments for commercial harvest, aquaculture, and recreational fisheries.

Impact: Advancing Food-Fish Aquaculture in Cold Climates.

Recap: Minnesota Sea Grant held a two-day workshop to explore the potential for developing food-fish aquaculture industries in cold climates like Minnesota. The resulting synthesis is serving as a reference document for advancing aquaculture in Minnesota.

Goals 4 and 6: The workshop was geared toward identifying how to create an economically viable and environmentally safe food-fish aquaculture industry in Minnesota, and supporting a safe, secure, and sustainable supply of seafood to meet public demand.

Impact: Sold Out: Taste of Lake Superior Fish Classic Educates Participants about Sustainable Fisheries.

Recap: Tickets sold out for the fourth Taste of Lake Superior Fish Classic, which showcased eight regional chefs presenting versions of cisco and lake whitefish, which are sustainably and commercially harvested from Lake Superior.

Goal 5: The work sought to inform consumers about the health benefits of seafood consumption and how to evaluate sustainability of the fish they buy.

3 Resilient Communities and Economies (RCE)

The following four statements meet the RCE objective to foster sustainable, resilient, and thriving coastal communities that successfully balance economic development and environmental protection while preparing for threats and hazards.

Accomplishment: Surveys Indicate Residents of Lake Superior Tourism-dependent Communities Think Climate is Changing, But Need More Information to Decide How to Respond.

Recap: Surveys by Minnesota Sea Grant-sponsored researchers show that residents of tourism-dependent communities along the north shore of Lake Superior believe that the climate is changing and that local communities should be responding, but only 35% feel they have enough information to know what to do. This information will help Sea Grant and community leaders determine what communities need in order to move forward with climate preparedness planning.

Goal 7: The work provides information to aid development of a vibrant, resilient, and sustainable tourism economy on Minnesota's North Shore.

Impact: Using the Watershed Game Changes Communities.

Recap: Sixty percent of the facilitators who responded to a survey indicated the Watershed Game resulted in a positive impact or change within their communities. The classroom and local leader versions of the game helped students and community leaders understand interactions among land use, water quality, and policy.

Goal 8: The work improved the ability of communities to make informed strategic decisions that move systems toward resiliency from stormwater trends.

Impact: Helping Communities Review Ordinances to Promote Use of Green Infrastructure.

Recap: The Minnesota and Wisconsin Sea Grant programs hosted a workshop on tackling barriers to green infrastructure in local codes and ordinances.

RCE goal 9: The work seeks to improve coastal water resources to sustain human health and ecosystem services.

Accomplishment: Alert! Weather Hazards Ahead!

Recap: Minnesota Sea Grant joined partners in evaluating the efficacy of National Weather Service warnings and in plans to produce outreach materials about how climate change and development could affect Lake Superior streams in Minnesota.

RCE goal 10: The work provides an avenue through which resilient coastal communities can adapt to the impacts of hazards and climate change.

4 Environmental Literacy and Workforce (ELWD)

The statement below meets the ELWD objective to increase ocean and Great Lakes literacy among Minnesota students and teachers, and increase the ability and capacity for citizens to understand and use scientific evidence to make informed decisions regarding environmental issues. It also meets the two focus-area goals.

Impact: Shipboard Training of Educators Improves Capacity to Teach Great Lakes Science.

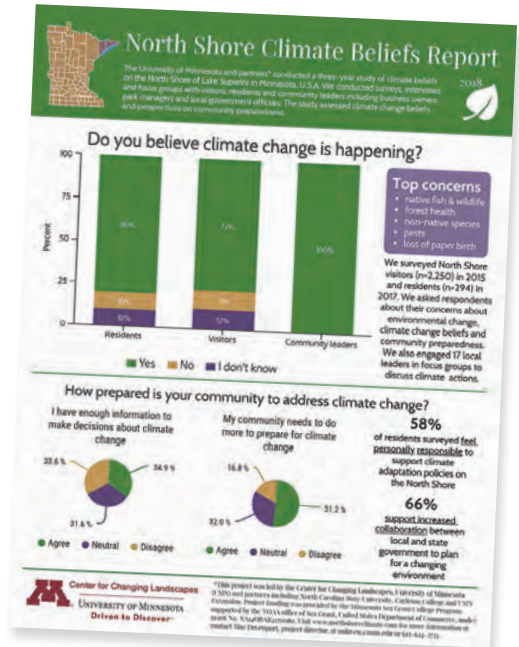
Recap: The Minnesota and Wisconsin Sea Grant programs completed a two-year pilot project that united educators with scientists and graduate students for week-long shipboard experiences on a tall sailing ship. The project is informing a new Great Lakes-wide program pairing educators who are not yet using Great Lakes materials with shipboard-trained educators.

Goals 4 and 6: The work seeks to produce an environmentally literate public supported by a continuum of lifelong formal and informal engagement opportunities, and to produce a workforce skilled in science, technology, engineering, mathematics and other disciplines critical to local, regional, and national needs.



Minnesota Sea Grant Extension Educator Cynthia Hagley leads a group of educators aboard the S/V Denis Sullivan as part of a 2017 shipboard science workshop.

The S/V Denis Sullivan is the world's only re-creation of a 19th century three-masted, traditionally rigged, Great Lakes schooner.



Minnesota Sea Grant supported a three-year study that assessed climate change beliefs and perspectives on community preparedness of people on the North Shore of Lake Superior in Minnesota.

Program Objectives and Associated Comments

This document highlights what we do. Equally important to our program is who we are. As we work toward the next 50 years of Sea Grant, our program strives to demonstrate:

- Principles of environmental stewardship
- Workplace health and well-being
- Accountability
- Diversity and inclusion
- Scientific integrity and innovation
- Financial and social sustainability

The principal objective of the Minnesota Sea Grant Program is to provide the best water-related science to the broadest range of stakeholders possible while covering the needs of Great Lakes coastal communities and Minnesota's rich inland water resources.

The program takes a team approach where staff seek stakeholder feedback on information needs. Staff then prioritizes information needs and translates them into research, outreach, and education goals, which are fulfilled by extension and communication staff.

The water science Minnesota Sea Grant provides comes from Sea Grant-funded research and sound, peer-reviewed science sources that are crafted into curricula, workshops, programs, and materials for delivery to target audiences across the state and the Great Lakes. Our program's vision encompasses and leverages the regional-to-international science enterprise. This means that Minnesota Sea Grant's science, outreach, and education find relevance beyond the Great Lakes.

Minnesota Sea Grant projects noted throughout this briefing book find national audiences. For example, collaborations with Louisiana Sea Grant on nutrient runoff and the Mississippi River are as relevant and important to our country's water resources as our Great Lakes Sea Grant Network projects. Minnesota Sea Grant crafts innovative projects that target key issues, clarify desired objectives, clearly articulate changes sought, adhere to strategic objectives, define metrics of success, and assess program metrics with modern assessment tools.

Program Changes Resulting from Previous Site Review and Performance Review

Knauss Fellowships

The 2015 site review team recommended that Minnesota Sea Grant increase emphasis on the recruitment of potential Knauss fellow applicants. We expanded announcements to include neighboring states without Sea Grant programs. Staff made concerted efforts to talk with potentially eligible graduate students about the fellowship. We updated our Knauss Fellowship web page to include profiles of former Knauss fellows and participated in NSGO Knauss Fellowship communication efforts. Our 2017 applicant was successful.

Partnerships

The 2015 site review team suggested that Minnesota Sea Grant consider investigating opportunities to partner with University of Minnesota (UMN) water programs on issues of mutual interest. We invigorated partnerships with the University of Minnesota Duluth (UMD) Large Lakes Observatory (LLO), UMD Natural Resources Research Institute (NRRI), UMD Swenson College of Science and Engineering, and the UMN Water Resources Center which resulted in:

- Collaboration on a National Science Foundation proposal led by LLO.
- Regular meetings of the directors of water-related research programs including Sea Grant, LLO, and NRRI.
- Co-hosting of a virtual town hall with NRRI and LLO in support of the Minnesota governor's water quality initiative.
- Program Director John Downing serves on the UMN Water Council leadership team founded by the Office of the Vice President for Research.

Guiding Principles

- We strive to reflect best management practices in our activities and products.
- We strive to be conscientious about how our activities contribute to the collective human carbon footprint.
- We strive to be a positive example of global responsibility and practice what we seek to instill in others.
- We strive to be welcoming to and serve the most diverse cross section of society.
- We strive to foster a mentally and physically healthy workplace.
- We strive to be accountable to and treat each other and our stakeholders with respect.
- We strive to engage diverse groups because they are best at solving problems.
- We strive to be known for timely responses and respect for deadlines.
- We seek collaborative relationships among staff and our stakeholders that leverage our strengths.
- We strive to make decisions and offer services based on the best and most sound information available.
- We strive to be politically neutral non-advocates who deliver scientifically sound information.
- We strive to manage our program to be resilient against unforeseen negative financial events.
- We strive to be honorable public servants by making the best and most sustainable use of public funds.
- We strive for, promote, and value efficiency and sustainability in problem solving.
- We strive for long-term sustainability over short-term fixes.

Notes



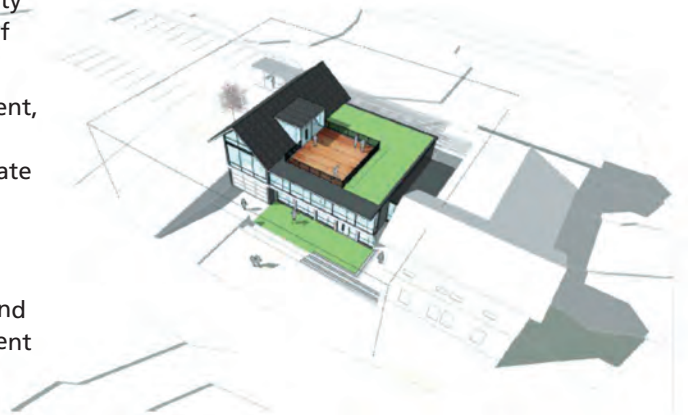
Future Home of University of Minnesota Sea Grant College Program



The University of Minnesota Duluth's historic Limnology Facility property at 6008 London Road in Duluth is the future home of the University of Minnesota Sea Grant College Program.

As a leader in science-based understanding of shore and coastal development, we envision the property and facility to be a demonstration site for green infrastructure and stormwater management. We will model and demonstrate the technologies we train and encourage others to use.

We envision addressing the eroding beaches and soils, habitat destruction, and poor stormwater handling—especially during storms and wind events—by installing green roofs, rain barrels and gardens, bioretention areas, and riparian buffers. We will address current issues with stormwater management by installing permeable pavements, eliminating curbs and gutters, and adding organic and sand filters.



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