

Maryland Sea Grant

ANNUAL REPORT 2017



Science Serving Maryland's Coasts

MESSAGE FROM THE DIRECTOR



Each year, Maryland Sea Grant reflects on our many accomplishments in research, education, and outreach, and our valuable partnerships.

This year, we highlight our Sea Grant Extension agents and their partners for their critical and impressive efforts to increase sustainability in the Chesapeake and coastal bays. Our Sea Grant Extension watershed specialists implement practices to reduce runoff and help communities create and maintain stormwater management infrastructure. Our aquaculture extension agents help the industry continue to grow and thrive. Our seafood specialist advises industry to make sure the

fish and shellfish we eat are safe. Our fisheries economist advises local and regional policy makers on fisheries management. Our Chesapeake Bay Sentinel Site Cooperative coordinator translates scientific data into products that increase communities' resilience to coastal storms, erosion, and flooding.

Our extension agents' work is possible in part by Maryland Sea Grant-supported research. Maryland scientists advance understanding in our region and inform policy decisions. Research highlights include guiding restoration of the Chesapeake Bay's submerged grasses and exploring coastal flooding patterns to assist climate change adaptation decisions.

Maryland Sea Grant's education leader brings together scientists and high school students to investigate biofilms and showcase aquatic biodiversity in city harbors in the U.S. and Europe. Maryland Sea Grant fellowships have a diverse cohort of undergraduate and graduate marine scientists. Our Knauss fellows spend a year in Washington, D.C. learning about the integration of science and policy. Our Centro TORTUGA undergraduate students in Puerto Rico — even after the devastation of Hurricane Maria — remain committed to studying the island's coastal ecosystems.

I hope you will agree that Maryland Sea Grant's efforts form a coherent whole that starts with research and then disseminates and implements knowledge learned through our outreach efforts. Thank you for your continued support of Maryland Sea Grant.

A handwritten signature in blue ink that reads "Fredrika C. Moser". The signature is written in a cursive style and is underlined with a single horizontal line.

Fredrika C. Moser, Ph.D.

About Maryland Sea Grant

We support research, education, extension, and public outreach efforts designed to help restore and preserve the Chesapeake Bay and Maryland's coastal natural resources. Working with leaders from across our state, we help communities respond to our state's coastal environmental challenges and promote a sustainable coastal economy.

Maryland Sea Grant, part of the University System of Maryland, is a partnership between the State of Maryland and the National Oceanic and Atmospheric Administration. Maryland Sea Grant is administered by the University of Maryland Center for Environmental Science (UMCES).

If you would like to support our work, please visit us at: www.mdsg.umd.edu/donate

2017 PROGRAM HIGHLIGHTS

Extension

Landscape certification program

Maryland Sea Grant Extension watershed specialists helped develop a training manual and certification program to reduce pollutants by emphasizing stormwater best management practices (BMP) for conservation landscaping. Since 2016, this Chesapeake Bay Landscape Professional Certification Program has helped reduce nitrogen inputs to the Chesapeake Bay by 775 pounds, phosphorus by 370 pounds, and sediment by 509,929 pounds.

“Maryland Sea Grant has played a pivotal role in supporting this new landscaper certification initiative. We are deeply grateful for this collaboration and the benefits it brings to the environment.”

— Beth Ginter, Chesapeake Bay Landscape Professional Certification Program

Stormwater management

In 2017, five Watershed Stewards Academies graduated 60 new stewards and led 51 new projects that treated over 54,500 square feet of impervious surface. In all, stewards planted 9,305 native plants, educated 3,334 individuals, and engaged 177 volunteers. These efforts will help reduce nutrient and sediment pollution from stormwater.



CECIL COUNTY WATERSHED STEWARDS ACADEMY participants take a break after completing the hard part of excavating a rain garden at the Rising Sun Public Library. PHOTO BY ERIC BUEHL

BY THE NUMBERS

In 2017, Maryland Sea Grant’s Extension agents helped secure:

\$300,000+

in aquaculture business loan commitments

\$400,000+

in stormwater management grants

Oyster aquaculture training

Maryland Sea Grant Extension’s aquaculture business specialist advises Maryland oyster farmers on comprehensive financial practices to help build their operations. Extension agents also conducted training programs and workshops for more than 200 participants, which provided information on recent innovations and successful techniques for improving oyster aquaculture production.

Seafood safety

Maryland Sea Grant Extension’s seafood specialist provides training in mandatory federal food safety procedures to small businesses. As a result, 53 people received Hazard Analysis and Critical Control Points (HACCP) certification. The specialist also supervises the Maryland Crabmeat Quality Assurance and Inspection Program and helps the industry remain current with all safety regulations.

Marine education

Maryland Sea Grant is the headquarters for the National Marine Educators Association (NMEA), an organization of about 800 classroom teachers, informal educators, university professors, scientists, and more from around the world who work together to advance the understanding and protection of our freshwater and marine ecosystems. Our program helps coordinate national office activities including membership management and NMEA annual conferences.

Research

Conowingo and grass beds

Scientists are investigating one of the largest submerged grass bed recoveries in the northern Chesapeake Bay area near the Conowingo Dam. The study is among the first to consider sediment transport from the Susquehanna River into the upper Chesapeake Bay. They discovered the important role grasses play in controlling sediments flowing over the dam and provided key data to managers of the dam and its reservoir.

Mosquito control and stormwater

Scientists and our extension agent studied mosquito infestation in household stormwater management systems (e.g., rain barrels, downspout extenders) and found these systems harbored fewer human-biting mosquitoes than other water-holding garden features (e.g., birdbaths, buckets). The research team shared this important information with households and homeowners' associations to dispel the myth that stormwater management systems produce more mosquitoes and encouraged residents to use these systems in their homes.

Oxygen change and water quality

Researchers studied how an oxygen aeration system installed in Rock Creek, a Patapsco River tributary, affects the stream's ecology. Without the aeration system this heavily polluted river has little oxygen and many aquatic plants and animals cannot live in it. The scientists found that when aerators were turned off, oxygen disappeared almost entirely in 24 hours and the low oxygen area expanded far beyond the aerated location. This research is informing local managers who are seeking restoration funding to improve the creek's water quality.



AERATORS IN ROCK CREEK create a swirl of bubbles at the surface. When fully operational, the aerators pump over 15,000 liters of air per minute into the water. PHOTO BY NICOLE LEHMING

Understanding and responding to risk

Scientists are building new computer models to investigate how future sea level rise might affect coastal areas in Maryland. They found that there were lower levels of regional flooding if low-lying areas were kept natural and allowed to flood than if the Chesapeake Bay shoreline was converted to hard structures. For example, the models showed that during a Category 2 hurricane, if low-lying areas can no longer flood, hardened shorelines could increase storm surge by 50–80 centimeters in Baltimore, Annapolis, and Washington, D.C. The scientists have created digital images to illustrate their findings to help city and town managers improve flood risk management that addresses rising sea levels and extreme storm events.



MODELED INUNDATION of downtown Baltimore during Hurricane Isabel in 2003 (top) projected to 2100 (bottom) under the IPCC RCP 8.0 climate scenario. GRAPHIC COURTESY OF MING LI, GERONIMO.HPL.UMCES.EDU/MINGLI

Public Outreach and Education

Aquaculture in Action

Maryland Sea Grant led teacher professional development workshops and school consultations to improve their teaching skills and knowledge through Aquaculture in Action, our highly successful, student-driven, project-based learning science program. In 2017, Maryland Sea Grant taught 20 teachers who supported 14 aquaculture projects, including five new schools in Maryland, involving 900 students who raised and released more than 2,500 native fish. Teachers constructed and installed 14 micro-computing water-quality monitoring systems.

Aquaculture workshops to promote growth

Maryland Sea Grant held two workshops to determine ways to address problems facing Maryland aquaculture industry's growth in the Chesapeake and coastal bays. These workshops brought aquaculture entrepreneurs together with researchers, extension agents, state government officials, and federal partners and resulted in improved collaboration among participants and new aquaculture grant applications.

Fellowships

Maryland Sea Grant supported dozens of undergraduate and graduate students in 2017. Support for undergraduate environmental

BY THE NUMBERS

1,662 P-12 students reached with our education programs

88 Undergraduate students supported

50 Graduate students supported

research included our Research Experiences for Undergraduates (REU) internships and the University of Maryland's Gemstone Honors program. Multiple graduate fellowships supported research in diverse areas including Chesapeake and coastal bay ecology, green infrastructure, water quality, and fisheries. The Knauss Fellowship sent four graduate students to federal agencies to sharpen their policy skills. Students shared many of their experiences in these programs on our Fellowship Experiences blog.

Communications and the Quarterly

Maryland Sea Grant celebrated its 40th anniversary with a special issue of our award-winning magazine, *Chesapeake Quarterly*, highlighting Chesapeake Bay research over the decades. We continue to expand our social media presence through Facebook, Instagram, and Twitter to share relevant news and science with our stakeholders.

Diversity and inclusion

Maryland Sea Grant and our partners developed undergraduate research programs in Maryland and Puerto Rico and provided funding to support students at scientific meetings. From 2014 to 2017, more than 180 students from diverse backgrounds participated in marine science research, developed professional networks, and presented their research at meetings and symposia, thus increasing opportunities to succeed in scientific careers. Despite the devastation caused by Hurricane Maria, our Centro TORTUGA (Tropical Oceanography Research Training for Undergraduate Academics) program in Puerto Rico continues to thrive and successfully teach beginning undergraduate Hispanic students about marine science.



CENTRO TORTUGA STUDENTS receive geosciences training during Centro TORTUGA's summer workshop. PHOTO COURTESY OF CARLOS OLIVO-DELGADO

Research Projects Funded in 2017

Controlling Fouling and Pests Associated with Water Column Oyster Aquaculture

R. Tjaden • *University of Maryland Extension*

Developing a Technology to Induce Sterility in an Emerging Marine Aquaculture Species, Sablefish, by Disrupting Primordial Germ Cell Development

T. Wong • *University of Maryland, Baltimore County*

Managing for Biodiversity and Blue Carbon in the Face of Sea Level Rise and Barrier Island Migration

K. Gedam • *The George Washington University*

Exploring the Connectivity of Sediment Transport in Upper Chesapeake Bay

C. Palinkas, E. Russ*
University of Maryland Center for Environmental Science (UMCES), Horn Point Laboratory (HPL)

Understanding Decisions to Participate in Oyster Aquaculture in Maryland-Implications of Livelihood Diversification on Resilience

L.J. Shaffer, A. Michaelis*
University of Maryland, College Park

Linking Stormwater BMP Implementation and Mosquito Infestation to Resident Socioeconomic Status, Knowledge, and Attitudes in Two Suburban Watersheds

P. Leisnham, K. Maeda*
University of Maryland, College Park

Potential Pollution Trade-Offs for Sustainable Coastal Agricultural Management

E. Davidson, J. Hagedorn*
UMCES, Appalachian Laboratory (AL)

Using an Individual-Based Model to Predict the Genetic Impacts of Hatchery Based Restoration of the Eastern Oyster (*Crassostrea virginica*) in Chesapeake Bay

L. Plough, K. Hornick*
UMCES, HPL

Salt Water Intrusion and Legacy Nutrient Release Across Coastal Farmland

K. Tully, D. Weissman*
University of Maryland, College Park

New Measures of Aquatic Habitat for Assessing Restoration Resilience

M. Baker, H. Oakland*
University of Maryland, Baltimore County

Continuous Mapping of Channel Features for Monitoring Aquatic Habitat and Sediment Flux in Coastal Systems

M. Baker, A. Rittle*
University of Maryland, Baltimore County

Analysis of the Spatial and Temporal Structure and Dynamics of the Northern Atlantic Black Sea Bass (*Centropristis striata*) Stock

T. Miller, R. Brodник*
UMCES, Chesapeake Biological Laboratory (CBL)

Quantifying Changes to Nutrient Cycling and Nitrogen Removal in an Estuary as a Consequence of Aeration

L. Harris, Z. Gotthardt*
UMCES, CBL

Understanding Atlantic Menhaden Population Dynamics Through Use of Data from a Large-Scale Historical Tagging Study

M. Wilberg, E. Liljestrand*
UMCES, CBL

Determining the Resiliency of Juvenile Oysters to Estuarine Stressors and Climate Change: Implications for Restoration and Aquaculture Programs

D. Breitburg • *Smithsonian Environmental Research Center*

Development of a Bayesian Approach for Estimating Ecosystem-Based Reference Points for Atlantic Menhaden

G. Nessler • *UMCES, CBL*

Improving Prediction and Visualization of Coastal Inundation on the Eastern Shore of Maryland

M. Li, F. Zhang* • *UMCES, HPL*

Integrated Geospatial, Cultural, and Social Assessment of Coastal Resilience to Climate Change

M. Paolisso, E. Van Dolah*
University of Maryland, College Park

Resilience of *Vallisneria americana* in the Chesapeake Bay

K. Engelhardt, C. Perkins*
UMCES, AL

Tracking Septic System Performance by Using Innovative Mass Spectrometric Approaches and Traditional Nutrient Measurements

M. Gonsior, K. Martin*
UMCES, CBL

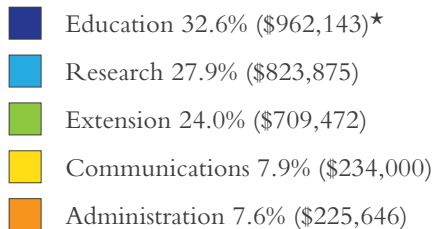
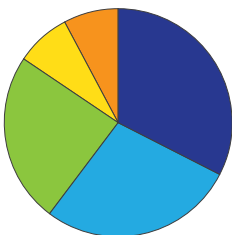
Variation in Retention and Export of Atmospheric Nitrate as a Function of Land Use Across the Chesapeake Bay Watershed

D. Nelson, J. Bostic*
UMCES, AL

* Fellows funded by Maryland Sea Grant

Budget Overview

Grant Funding 2017 (Total: \$2,955,136)

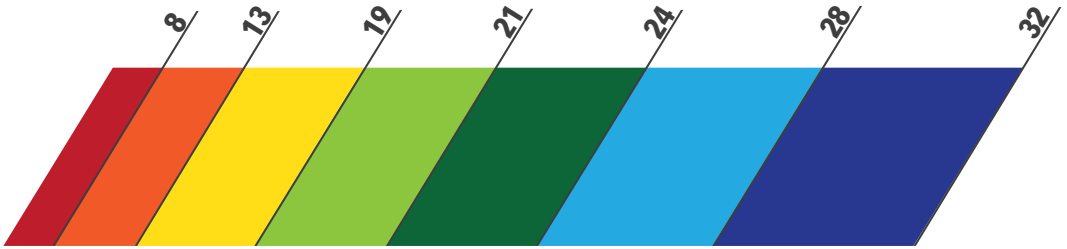


Total funding in 2017, including state funding: \$5,039,300

* Includes funding for research fellows

Partners

In 2017, Maryland Sea Grant worked with **145** partners from a diversity of programs. For a complete list of partners, visit our website at www.mdsg.umd.edu/partners.



- Public schools K-12
- Local businesses
- Non-governmental organizations
- Academic institutions
- Sea Grant programs
- Federal agencies
- County, state, and regional governments

Program Governance*

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Chesapeake Bay Foundation

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UMCES, Chesapeake Biological Laboratory

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U.S. Geological Survey at Chesapeake Bay Program Office

* As of July 1, 2018

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* Staff as of July 1, 2018

* Maryland Sea Grant hosts the
national office for the National
Marine Educators Association

Visit www.mdsg.umd.edu/our-office for full addresses and contact information for our staff.



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www.mdsg.umd.edu

Cover photograph: One of our Research Experiences for
Undergraduates (REU) students aboard the R/V Rachel Carson.

PHOTO BY NICOLE LEHMING

Publication Number UM-SG-PI-2018-01