Woods Hole Sea Grant

2016-2018 Program Guide

Supporting Coastal Science and Management in Massachusetts

The Woods Hole Sea Grant Program is part of a national network of Sea Grant programs located in states along the U.S. coastline and the Great Lakes, in addition to Puerto Rico and Guam. The program supports research, education, outreach, and extension projects that encourage environmental stewardship, long-term economic development, and responsible use of the nation's coastal and ocean resources. Our mission is to develop comprehensive understanding and application to coastal issues at local, regional, national, and international scales. To fulfill this mission, we seek input and advice from state and federal agencies, resource stakeholders, and the public, and recruit talent and expertise from public and private academic institutions throughout Massachusetts. Our outreach efforts are conducted in a cooperative partnership between the Woods Hole Oceanographic Institution and Cape Cod Cooperative Extension.

Woods Hole Sea Grant Fast Facts

291 acres of degraded ecosystems restored/enhanced as a result of WHSG efforts

363 jobs created/retained in fisheries and aquaculture with advice and guidance from WHSG

23 communities received climate adaptation training, consultation on coastal habitats and Community Rating System training

2,872 K-12 students reached through training of teachers on ocean science and policy topics

3,168 volunteer hours supporting WHSG projects

7,936 people engaged in WHSG supported informal education programs

$4.21 million (federal award plus cost share) invested by WHSG to support coastal issues

1.4 tons of plastic shrink-wrap recycled from recreational boats

Woods Hole Sea Grant Extension Program

The Woods Hole Sea Grant Extension Program (WHSGEP) is conducted through a partnership with Cape Cod Cooperative Extension. The extension program is primarily directed toward applied research, technology transfer, demonstration projects, and public outreach to those concerned with coastal and marine resources in Southeastern Massachusetts, including Plymouth, Barnstable, Bristol, Dukes and Nantucket Counties. This region encompasses a variety of coastal villages, cities, and natural areas, including salt marshes, barrier beach/sand dune systems, estuaries and open ocean habitats. This rich mixture of terrestrial and marine environments and their associated uses by humans presents a broad array of technical problems in need of solutions. The primary economic base for the region consists of housing, tourism, wild marine fisheries and aquaculture-related industries, light industry, and marine research and instrumentation associated businesses. Given these attributes, extension efforts focus on (1) fisheries and aquaculture and (2) coastal processes and hazards, and staff contribute to several statewide and regional efforts related to these topics.

Resilient Communities and Economies

Erosion and flooding are among the primary concerns of coastal residents and visitors. Technical assistance is provided to local boards, commissions, and regulatory staff in order to keep them informed and engaged on issues related to coastal hazards and the impacts of climate change. WHSG/CCCE consultation helps ensure that the natural and beneficial functions of coastal landforms are sustained. WHSG/CCCE helped to create the first regional Community Rating System (CRS) Coordinator in the country, making it possible for towns with limited resources to take advantage of flood insurance discounts offered by the CRS in exchange for pursuing resilience-building activities. The CRS, within FEMA's National Flood Insurance Program, offers discounts on flood insurance in a community that takes actions to reduce flood risk.

Healthy Coastal Ecosystems

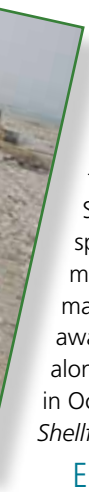
Woods Hole Sea Grant works closely with coastal communities to collect baseline data and assess the health of ecosystems. Data gathering programs are tailored to the needs of town natural resources managers, shellfish growers, others in the aquaculture industry, researchers, and volunteers interested in stewardship of marine habitats. In partnership with Barnstable County, Cape Cod Cooperative Extension, and the Southeastern MA Aquaculture Center, WHSG/CCCE conducts a water quality monitoring program that uses sensors at five locations in Southeastern Massachusetts to collect information on nine water quality parameters. These data have become increasingly important as research continues into shellfish growth and mortality issues, *Vibrio* contamination-related issues, and coastal eutrophication within the region. Through the Shellfish Habitat Assessment Program, WHSG/CCCE has been gathering oyster and quahog growth and survival baseline data since 2003 using standard methods at four locations. These data help managers learn about effects from short-term events such as harmful algal blooms and long-term conditions such as increasing water temperature and coastal acidification.

Sustainable Fisheries and Aquaculture

Woods Hole Sea Grant supports sustainable fisheries and aquaculture by responding to the needs of more than 20 town natural resources managers and 331 shellfish growers farming over 1,000 acres, in addition to others in the aquaculture industry and researchers interested in stewardship of marine habitats. The annual value of the Massachusetts' aquaculture industry in 2015 exceeded $23 million. Growing, harvesting, and eating shellfish are an important part of coastal life in Massachusetts. WHSG staff contributes to the sustainability and safety of local shellfish through a diverse set of efforts. The Shellfish Research Farm Network conducts applied research on topics such as gear performance, predator control, and handling of seed. A disease-monitoring network of 25 monitoring stations provides information on disease occurrence, intensity, and seasonality throughout Southeastern Massachusetts, which contributes to better-informed management decisions. Staff assists with shellfish propagation and enhancement programs for oysters and quahogs in all 15 towns on Cape Cod, and has helped inform

consumers about safe seafood harvesting and handling by producing and disseminating brochures on the topic. Finally, research on the effects of air exposure time and temperature relative to *Vibrio* levels in oysters, and monitoring the presence of more pathogenic strains of *Vibrio* have directly informed the *Massachusetts' Vibrio Control and Management Plan.*

Woods Hole Sea Grant Outreach & Education Program



Woods Hole Sea Grant's Outreach and Education Program works with its target audiences—educators, students, coastal decision makers, citizens, and research scientists and engineers—to provide them with the tools they need to make connections between ocean science information and ocean and coastal issues. Staff contributes to regional planning and outreach activities for the Northeast Sea Grant Consortium, the New England Ocean Science Education Collaborative (NEOSEC), Coastweek activities sponsored by the Massachusetts Office of Coastal Zone Management, and the annual Cape Coastal Conference. Programs include management of marine debris, messaging on coastal ecosystem awareness through signs at area beaches and interactive displays along bike paths, geocaching, teacher workshops through the Topics in Oceanography series, and an 8-week course on *Fundaments of Shellfish Farming.*

Environmental Literacy and Workforce Development

Woods Hole Sea Grant first began offering *Topics in Oceanography* teachers' workshops at Woods Hole Oceanographic Institution in 2001, as a way to bring teachers and scientists face-to-face to foster

2016 Knauss Fellows

Alec Bogdanoff, *Legislative Fellow*

Degree: PhD in Physical Oceanography, MIT-WHOI Joint Program
Placement: U.S. Senator Edward Markey, Massachusetts

Kyrstin Fornace, *Executive Fellow*

Degree: PhD in Chemical Oceanography, MIT-WHOI Joint Program
Placement: Integrated Water Coordinator with NOAA Research National Sea Grant Office

2017 Knauss Fellows

Emily Argo, *Executive Fellow*

Degree: Masters in Environmental Conservation, University of Massachusetts, Amherst
Placement: U.S. Geological Survey, National Climate Change & Wildlife Science Center

Eleanor Bors, *Executive Fellow*

Degree: Ph.D. in Biological Oceanography, MIT-WHOI Joint Program
Placement: NOAA Office of International Affairs

Max Kaplan, *Executive Fellow*

Degree: Ph.D. in Biological Oceanography, MIT-WHOI Joint Program
Placement: NOAA Research Ocean Acidification Program

Woods Hole Sea Grant Research 2016-2018 Research Projects

Nitrogen pollution and recovery from nitrogen pollution in a seagrass-dominated estuary

A whole ecosystem experiment, Robert W. Howarth and Roxanne Marino (Cornell University), Focus Area: Healthy Coastal Ecosystems

Hydraulic jumps at an ecological hotspot

Mechanisms of zooplankton accumulation, temporal variability, and ecological consequences, Jesus Pineda, Karl Helfrich, Victoria Starczak, and Annette Govindarajan (Woods Hole Oceanographic Institution), Focus Area: Healthy Coastal Ecosystems

Is the recent decreased atmospheric nitrogen deposition improving water and vegetation quality in Waquoit Bay estuaries?

Ivan Valiela (Marine Biological Laboratory, Ecosystems Center), Focus Area: Healthy Coastal Ecosystems

Evaluating the relationship between kelp forest ecosystems and water temperature in the Southern Gulf of Maine

Jarrett Byrnes, (University of Massachusetts- Boston), Focus Area: Healthy Coastal Ecosystems

Understanding the impact of floating oyster aquaculture on the carbon and nitrogen flux to the sediments using natural abundance isotopic surveys and metagenomic approaches

Daniel Rogers (Stonehill College) and Virginia Edgcomb (Woods Hole Oceanographic Institution), Focus Areas: Sustainable Fisheries and Aquaculture and Healthy Coastal Ecosystems

Enhanced monitoring and spatial mapping of toxic algal blooms

Field implementation of an acoustic cell concentrator coupled with imaging in-flow cytometry, Michael Brosnahan, Don Anderson, Heidi Sosik, Rob Olson (Woods Hole Oceanographic Institution), Focus Areas: Sustainable Fisheries and Aquaculture and Healthy Coastal Ecosystems

Creating a spatially defined tool for marine aquaculture siting and permitting

Diane Murphy (Cape Cod Cooperative Extension), Read Porter (Roger Williams University), Rebecca Kihslinger (Environmental Law Institute), and Michael Tlusty (New England Aquarium), Focus Area: Sustainable Fisheries and Aquaculture

Integrating mussel and kelp longline culture structures and management

Scott Lindell (Woods Hole Oceanographic Institution), Focus Area: Sustainable Fisheries and Aquaculture

Inverse modeling of prehistoric storm intensity based on grain size characteristics of hurricane-induced event

Jeff Donnelly (Woods Hole Oceanographic Institution), Focus Area: Resilient Communities and Economies

Modeling shoreline morphological evolution

Steve Elgar and Britt Raubenheimer (Woods Hole Oceanographic Institution) Focus Area: Resilient Communities and Economies

interaction and learning about ocean science. Since 2001 we have conducted 30 workshops with 62 scientist-presenters speaking about their current research, and covering 52 different ocean science-related topics. These workshops reached an estimated 400 teachers (because some teachers have attended multiple workshops). Using a standard impact-factor multiplier of 100 students per teacher, the *Topics in Oceanography* workshops have impacted an estimated 40,000 students during the past 15 years.

WHSG Extension Program staff organizes and helps teach an 8-week course on shellfish farming, *Fundamentals of Shellfish Farming: Practical Tools, Tips & Techniques*. This popular course includes several weekend field trips to local shellfish farms and covers basic concepts of shellfish aquaculture, including biology, hatchery & nursery techniques, and grow-out methods for both clams and oysters. Additional topics include best management practices for shellfish farming, business management, marketing, and permitting. Representatives from the aquaculture industry, state agencies, and research scientists are invited to present guest lectures during the course to provide students with broad perspectives of the aquaculture industry. Upon successful completion of a challenging final exam, students are awarded certificates providing evidence of their commitment to learning the fundamentals of shellfish farming.

Woods Hole Sea Grant is currently spearheading the springtime collection and recycling of plastic sheeting used to protectively shrink wrap recreational small boats during the winter, the only known organized collection effort of its type on Cape Cod. Plastic shrink-wrap is used to protectively cover private recreational vessels in the winter in Massachusetts and is entirely recyclable; but according to state environmental officials, approximately 87 percent is disposed of improperly. With 137,668 registered boats in Massachusetts, a large quantity of waste is generated and entering the disposal stream. This material could be diverted to the secondary market, primarily used in composite decking or timber. In 2015, approximately 2,880 pounds of plastic were recycled from 115 boats in Falmouth, MA.

2016–2018 Northeast Sea Grant Consortium Regional Projects in Ocean Acidification

Flexing mussels: Does *Mytilus edulis* have the capacity to overcome effects of ocean acidification? Dianna Padilla (SUNY-Stony Brook)

Probing molecular determinants of bivalve resilience to ocean acidification, Bassem Allam et al. (SUNY-Stony Brook)

Genetic and phenotypic response of larval American lobster to ocean warming and acidification across New England's steep thermal gradient, Richard Wahle (University of Maine)

Sensitivity of larval and juvenile sand lance *Ammodytes dubius* on Stellwagen Bank to predicted ocean warming, acidification, and deoxygenation, Hannes Baumann (University of Connecticut)

Staff

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