



Sea Grant
50
YEARS

THE STATE OF SEA GRANT 2016 BIENNIAL REPORT TO CONGRESS



Sea Grant

National Sea Grant Advisory Board
November 2016

In Memoriam

John A. Knauss

1925 - 2015



Dr. John A. Knauss (1925 – 2015) was instrumental in the formulation of the National Sea Grant College Program.
Credit: Michael Salerno

In 2015, the marine science and policy community lost one of its greatest leaders. Dr. John A. Knauss was nationally and internationally recognized as a leader in oceanography and marine policy who made lasting impacts on marine science, policy, and management in the United States. In partnership with Senator Claiborne Pell and Dr. Athelstan Spilhaus, Knauss was instrumental in the formulation and development of the National Sea Grant Program in 1966. He remained involved with Sea Grant for the rest of his career. Knauss' legacy, and the achievement that he is perhaps best known for, is as the founder of the Sea Grant internship program which was renamed the Dean John A. Knauss Marine Policy Fellowship (Knauss fellowship) in 1987 in honor of his leadership role.

Knauss was born in Detroit, Michigan, in 1925. Though he originally sought liberal arts training, his interests turned to meteorology, and he earned a Bachelor of Science from the Massachusetts Institute of Technology and a Master of Science from University of Michigan in physics. After working with the Navy Electronics Laboratory in San Diego, Knauss pursued a Ph.D. in oceanography from the Scripps Institution of Oceanography.

In 1962, he founded and became Dean of the Graduate School of Oceanography at the University of Rhode Island (URI), serving there until 1987. Knauss considered his involvement in Sea Grant at URI to be his biggest public contribution. He strongly believed that scientists have a role and a responsibility to be involved in public policy. While at URI, Knauss served on a commission that led to the creation of NOAA in 1970 and the Coastal Zone Management Act in 1972.

Knauss served on many government and scientific panels, including being President of the Association of Sea Grant Program Institutions and Fellow of the American Association for the Advancement of Science, the American Geophysical Union, and the Marine Technology Society. He was the Administrator of NOAA from 1989 to 1993. Knauss was inducted into the Rhode Island Heritage Hall of Fame in 1983 and was awarded an honorary Doctor of Science degree from URI in 1992.

2016 STATE OF SEA GRANT BIENNIAL REPORT TO CONGRESS

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National Sea Grant Advisory Board
A Federal Advisory Committee



Dear Members of the Congress of the United States of America,

On behalf of the National Sea Grant Advisory Board (the Board), I am proud to share this Biennial Report to Congress, The State of Sea Grant 2016, as directed by the 2008 Sea Grant Act (PL 110-394). The State of Sea Grant 2016 provides an update on the National Sea Grant College Program (Sea Grant) over the past two years. This report represents the fourth such report to Congress, and once again, the Board recognizes Sea Grant's impacts (economic, environmental, and cultural) on the coastal and Great Lakes communities the program serves.

In 2016, Sea Grant celebrates 50 years of using research, extension, and education to positively impact coastal communities. Sea Grant's work encompasses diverse issues relevant to local, regional, and national priorities. Sea Grant helps to ensure the coastal areas in which we live, work, and recreate are clean, safe, and sustainable.

The state and regional Sea Grant programs know their constituents well and are constantly looking for ways to meet their communities' needs. Throughout this report the Board has identified national, regional, and local highlights from the program chosen from approximately 3,000 impacts reported by Sea Grant. Sea Grant leverages federal dollars through matching funds and capacity building efforts; in 2015 the Sea Grant program was funded at \$67.3 million and delivered an economic return of \$575 million. This represents a 854% economic impact of federal funds.

Since the 2014 Biennial Report to Congress, there have been some changes at Sea Grant. Most significantly, the National Sea Grant Office (NSGO) has had a change in leadership. Dr. Leon Cammen stepped down as director of the Sea Grant after 25 years with the program. NOAA led a national search and in July 2016 Dr. Jonathan Pennock became the director. Dr. Pennock, an internationally known coastal scientist, previously served as the director of the New Hampshire Sea Grant program and the deputy director of the School of Marine Science and Ocean Engineering at the University of New Hampshire. The Board looks forward to working with Dr. Pennock as we usher in a new era of leadership for Sea Grant. The Board acknowledges with gratitude the service of Dr. Nikola Garber as interim Sea Grant director throughout much of 2015 and 2016. The NSGO also filled several assistant director positions to align with the major functions of the office, including an assistant director of partnerships to help identify and nurture high-value collaborations both nationally and across the network.

Sea Grant is an asset to the National Oceanic and Atmospheric Administration (NOAA). It provides a national network to share its research, information, products, and services with universities, industry, decision-makers, and coastal communities. Sea Grant has been responsive to the Board recommendations in previous reports. This year the Board has turned its attention to several new matters including diversity and inclusion in the Sea Grant network as well as expanding its extension and liaison programs across NOAA.

Sea Grant's legislation has not been reauthorized as of the printing of this report. The Board, along with Sea Grant and NOAA leadership, is eager to assist Congress in this endeavor and is also available to work with transition teams after the 2016 election. The Board looks forward to advising on and reporting Sea Grant's impacts for another 50 years.

Dale Baker
Chair, National Sea Grant Advisory Board

CONTENTS

2	In Memoriam: John A. Knauss	24	Sea Grant By the Numbers
3	Letter from the Chair	26	Sea Grant in Action
4	Executive Summary	32	Achieving Organizational Excellence
6	Sea Grant Model	36	2016 Recommendations
8	Celebrating Sea Grant	38	Emerging Opportunities
10	2014 Responses	40	Supplemental Information
12	Focus Areas		

EXECUTIVE SUMMARY

The State of Sea Grant 2016 is the Biennial Report to Congress from the National Sea Grant Advisory Board (the Board), as mandated by reauthorization of the National Sea Grant College Program (Sea Grant) in 2008 [PL 110-394]. This report celebrates the 50th Anniversary of Sea Grant, illuminates its contributions to the nation and the economy in the last two years, and offers recommendations and opportunities for continued advancement in science serving America's coasts. The report encapsulates what Sea Grant is able to accomplish with an 854% economic impact of federal investment.

Recommendations made in the 2014 Biennial Report have been met by Sea Grant:

- Sea Grant advanced national priorities while solving problems locally and regionally, emphasizing partnerships and meeting stakeholder needs.
- Sea Grant completed its four-year review of all state activities, and all programs have been found to meet standards of excellence.
- Budget equity among programs is being addressed and will continue as additional federal funds become available.
- Environmental literacy and workforce development, key requirements for environmental quality and next generation Sea Grant leadership, are receiving increased attention.

Focus Areas 2014-2017

Among the 33 state Sea Grant programs, the focus areas identified in the national Strategic Plan were addressed in creative and efficient ways, using a full catalog of science and communication skills. Examples in this report represent impacts in those focus areas, which include healthy coastal ecosystems, sustainable fisheries and aquaculture, resilient communities and economies, and environmental literacy and workforce development.

Sea Grant in Action

While the range of Sea Grant activities is as broad as its geographic reach, as deep as its science capability, and as diverse as its list of stakeholders, this report focuses on community resilience, ocean acidification, and aquaculture as highlights of program activities in the past two years.

- In the face of environmental change and coastal hazards, Sea Grant works with coastal communities and businesses to develop models for potential climate scenarios, assists with anticipating and overcoming hazard-driven challenges, and shares strategies for adaptation and mitigation.
- Aquaculture has been part of the Sea Grant portfolio for all of its 50 years. Current research and extension deal with pending regulatory decisions, new and emerging species for aquaculture, seafood safety, and product quality.
- Ocean acidification affects important ecosystem services as well as the seafood industry and ecotourism. Sea Grant research aids public understanding of the changes and development of strategies to mitigate consequences.

Achieving Organizational Excellence

Within the Sea Grant organization, 20 national office staff, 33 university-based state programs, 300 extension agents, 2,300 scientists, 1,100 university Sea Grant employees, and over 1,300 partners work together cooperatively to reach program goals. Since the last Biennial Report, all parts of the program have been evaluated by multiple processes. One program, Pennsylvania Sea Grant, was advanced to full College Program status.

Education in Sea Grant, now recognized as one of the focus areas, is getting expanded attention as a result of a 2014 Recommendation by the Advisory Board. The range of education efforts, from family awareness programs to federal fellowships and graduate training, and the diverse approaches to education in the 33 programs, present challenges that are being accepted as opportunities for building program strength.

Sea Grant undertakes critical law and policy research, translates science for policy makers, and assists communities with legal barriers to innovation. Sea Grant legal programs in four states, along with attorneys throughout the country, can address a variety of law and policy issues to serve coastal stakeholders.

A Sea Grant Liaison program, which embeds Sea Grant personnel in partner agencies, including five NOAA Sentinel Sites for climate change, expanded during this reporting period. The program leverages resources to facilitate the transfer of scientific information, tools, and technologies to coastal stakeholders. An evaluation of the program by the Board provided information on funding and administrative models for consideration as new appointments are considered.

2016 Recommendations

The Board recommends that the following be addressed in the coming two to three years:

- Sea Grant should seek partnerships with more programs in NOAA to build on the existing investments and reputation of the Sea Grant Program;
- The NSGO should support the expansion of the Sea Grant Liaison Program in NOAA line offices, labs and programs;
- Sea Grant should continue to enhance diversity and inclusion throughout the network so that its workforce, programming and materials are representative of the nation and audiences the program serves;
- Sea Grant should enable educators' collaboration through programmatic and travel support at state and national levels so the Education Network can work together on responsive programming and evaluation; and
- Sea Grant should enhance efforts toward gathering and sharing the wisdom and experience of experts through theme/focus teams relevant to Sea Grant's mission.



Students solve problems during a marine science quiz bowl organized by MIT Sea Grant. Credit: MIT Sea Grant

Emerging Opportunities

An analysis of existing program efforts identified some opportunities based on current research, perceived needs for science information as well as policy and management strategies, and mechanisms for expanding outreach. The Sea Grant network has formed a "Data Stewardship Committee" in advance of efforts that could bring together and integrate the scientific data collected by individual programs into large spatial and time-specific datasets.

Preparing for the next 50 years of Sea Grant is exciting and challenging, and Sea Grant is poised to meet new and ongoing challenges. The Board looks forward to the reauthorization of Sea Grant in coming Congressional sessions.



THE SEA GRANT MODEL

As Sea Grant celebrates its 50th anniversary, it is important to note that the Sea Grant model builds upon the longstanding tradition of American support for higher education. The Sea Grant model of research, extension, and education provides the scientific foundation and requisite citizen involvement to encourage and promote the wise use and conservation of our nation's natural resources.

Modeled after the land grant system, the National Sea Grant College and Program Act of 1966 authorized "the establishment and operation of Sea Grant colleges and programs by initiating and supporting programs of education and research in the various fields relating to the development of marine resources." Over its 50-year history, Sea Grant research, extension, and education have similarly led to dramatic improvements in the conservation and use of U.S. coastal and marine resources.

The Sea Grant model has withstood the test of time in large part because of its nimble ability to respond to emerging challenges through its partnership structure of the federal government, coastal states, universities, and the private sector. This partnership relies on a framework that includes leadership from the National Sea Grant Office (NSGO), Sea Grant Association (SGA), and the Board; management and support from NOAA; and the intellectual capabilities of more than 3,000 professionals from 200 participating academic institutions. By harnessing the enormous capacity within our nation's leading universities, Sea Grant has conducted research leading to new pharmaceutical, fisheries, aquaculture, and energy products from the sea as well as more resilient coastal communities.

Through its network of university-based extension professionals, Sea Grant has improved fisheries management and product development through applied research and training. It has promoted educational and informational processes that have led to greatly improved community-based planning processes in coastal communities. Through its core mission of building the next generation of scientists and community leaders, Sea Grant educational programs have informed tens of thousands of students annually and support roughly 1,000 undergraduate and graduate students per year who will become the next generation of scientists and coastal leaders in an increasingly global and competitive world. Sea Grant continues to support the renowned Knauss fellowship program that has engaged over 1,100 graduate students since its inception nearly 30 years ago. Many of these fellows currently serve as leaders in government, academia, and the private sector.

As we look forward to the next 50 years, the Sea Grant model will be needed more than at its birth 50 years ago. Researchers will need to continue the discovery of new information, and that information will need to be transferred to those who can apply it. A quote from Benjamin Franklin may best illustrate the continuing need for the Sea Grant model, "Tell me and I forget. Teach me and I remember. Involve me and I learn." Through its highly emulated citizen involvement process, the necessary model is in place for the coastal public to expand its learning.

Opposite page: A fisherman shows customers a crab during a "Shop the Dock" program offered by Oregon Sea Grant to encourage direct market sales of locally-caught seafood. Credit: Pat Kight/Oregon Sea Grant

Below: Extension specialists with Florida Sea Grant train citizen science residents how to test water quality in the Florida Keys. Credit: Florida Sea Grant



CELEBRATING SEA GRANT



Fifty Years: a strong Sea Grant heritage



The ocean, coast, and Great Lakes resources of the U.S. give us food, wealth, and wonder. They challenge us with their power while sustaining us with their bounty. The sea's role in Earth processes influences everyone.

In 2016, the National Sea Grant College Program (Sea Grant) marks its 50th birthday. Congress established the program through PL 89-688 to recognize the importance of the oceans, coasts, and Great Lakes to the world's environment, to the nation's economy, and to human well-being. Those 50 years have chronicled many changes as Sea Grant has worked to maintain relevance in the face of human actions and natural forces affecting the coastal environment. The program's consistent trajectory upward and outward in terms of impact and outreach speaks well for the founders' vision and those who strive to carry it forward.

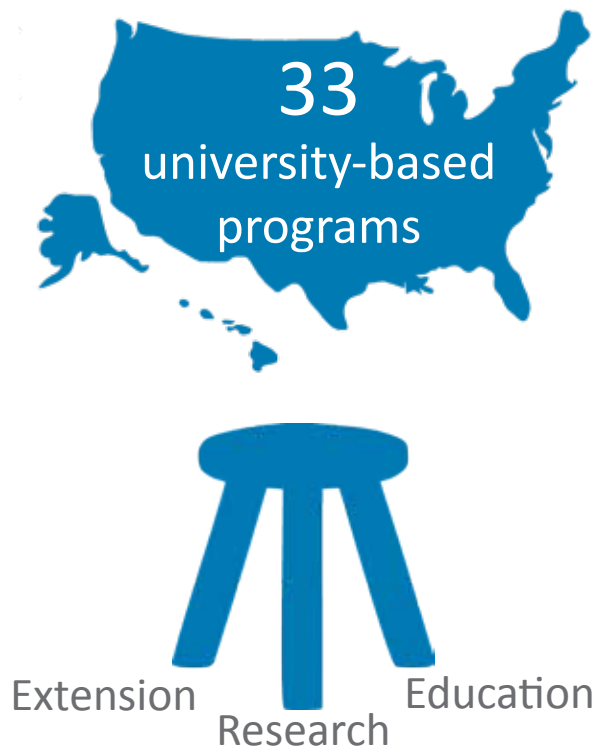
Sea Grant grew from a keynote presentation at the American Fisheries Society in 1963. Dr. Athelstan Spilhaus called for a sea grant college program to parallel the successes of the university land grant colleges program in bringing academia, government, and public interests together to solve land use issues. He then tirelessly advocated for the program with the help of two other champions, Senator Claiborne Pell of Rhode Island and Dean of the Graduate School of Oceanography of the University of Rhode Island, Dr. John A. Knauss, until it became a federally funded reality three years later. President Lyndon Johnson signed the Pell-Rogers Sea Grant College and Program Act into law in October 1966. The legislation had the support of nearly every coastal state's congressional delegation. The new program began its life in the National Science Foundation in February of 1967, and a year later Sea Grant awards were made to the Massachusetts Institute of Technology (MIT), California Institute of Technology (CalTech), and Louisiana's Nicholls State College.

Sea Grant was one of nine ocean and atmospheric programs from five departments that were consolidated into the newly legislated National Oceanic and Atmospheric Administration (NOAA) in 1970. The Secretary of Commerce designated the first Sea Grant Colleges in 1971—Oregon State University, University of Rhode Island, University of Washington, and Texas A&M University. By 1985, there were 31 programs in 29 coastal states and Puerto Rico, of which 21 were designated as Sea Grant Colleges. Fifty years from inception, there are 33 programs in the Sea Grant network.

The high economic impact of Sea Grant remains true 50 years after development of the program with continually increasing economic impact. The stakeholders continue to grow in number and encompass a broader slice of coastal and Great Lakes interests than 50 years ago. The ethos of Sea Grant remains the strength of the program—research, extension, and education that brings intellectual and physical resources to bear on the needs of marine and coastal communities.

When Sea Grant was reauthorized in 2008 (PL 110-394), Congress included a mandate for the Board to report to Congress on a biennial basis. The 15-member board provides advice to the Secretary of Commerce to address the national’s highest priorities regarding the understanding, assessment, development, management, utilization, and conservation of ocean, coastal, and Great Lakes resources. The State of Sea Grant 2016 thus reviews the past two years of program accomplishments and impacts, summarizes issues and challenges within the program, and offers recommendations for actions to maximize program effectiveness. The report also looks back in homage to Sea Grant’s beginnings and progress.

Sea Grant, a program within NOAA and the U.S. Department of Commerce, is proud of its mission of “Putting science to work for America’s coastal communities.” By harnessing the academic and research power of universities and partners, Sea Grant investigates important resource questions and develops methods for carrying that information to coastal communities. It honors the heritage of its past while looking at contributions that can enhance its future.



Opposite page: A recreational fishing vessel attempts to get the first catch of the day off the coast of Connecticut.
Credit: Connecticut Sea Grant

SEA GRANT RESPONSES

to 2014 Recommendations



A commercial fisherman retrieves a crab trap in Florida coastal waters. Credit: Florida Sea Grant

The following recommendations were made by the Board in The State of Sea Grant 2014. Responses under each recommendation note the ways in which each one was addressed by Sea Grant in the succeeding biennium.

Recommendation One

Sea Grant should continue to focus on advancing national priorities while solving problems on a local and regional basis. This national focus must continue to emphasize partnerships and collaborative efforts within the Sea Grant network and with other federal, regional, state, and local agencies and organizations, without loss of sensitivity to community stakeholders' needs.

Response

In accordance with its Federal mandate and widely accepted model, Sea Grant has actively addressed this recommendation. For example,

- Sea Grant Programs around the Gulf of Mexico addressed a need noted by Congress and the National Marine Fisheries Service. Sea Grant hosted a red snapper workshop for government and research scientists, the Gulf Fisheries Management Council and representatives from the fishing community. Plans were made to move forward on addressing the issue of stock assessment and modeling, and the first round of grants have been awarded.
- Partnerships are building through Sea Grant Liaisons in NOAA.
- Topical collaborations on oyster research, harmful algal blooms, aquatic non-native species, and other issues are expanding.
- Sea Grant is a leader in NOAA's coastal community resilience efforts through its Resilience Toolkit.

The Board concludes that activities in this category are numerous and expansive; this no longer needs to be a recommendation but a continuing expectation of Sea Grant operations.

Recommendation Two

Sea Grant should continue to support tracking and reporting of the cumulative, measurable impacts of Sea Grant activities toward the achievement of national goals.

Response

Sea Grant's legislative mandate for research, education, and outreach carries a responsibility for ongoing demonstrations of effectiveness, responsiveness to local, state, regional and national needs, and awareness of additional opportunity for growth. Metrics for impact have been developed and implemented in all aspects of Sea Grant programming (Appendix B). The Planning, Implementation, and Evaluation (PIE) process has achieved another four-year cycle of annual reports, site visits, and Program Review Panel, and all programs have been found to meet the Sea Grant Standards of Excellence. The Board concludes that this no longer needs to be a recommendation but a continuing expectation of Sea Grant operations.

Recommendation Three

The continued viability of Sea Grant relies on adjustment of budget equity among programs, while maintaining program review and merit considerations. The Sea Grant network should embrace steps toward balancing the federal funding among programs, with a goal of assuring all programs a minimum base of funding.

Response

Budget rebalancing began through the 2014 appropriation, with smaller programs being provided funds to raise their budget to at least \$1 million. When additional core federal funds are available, the rebalancing could continue for greater budget equity among the state programs.

Recommendation Four

Sea Grant should strengthen the focus area in Environmental Literacy and Workforce Development by demonstrating how Sea Grant K-12 and informal STEM education programs and targeted graduate fellowships are mission critical, respond to national priorities, and result in evidence-based accomplishments and impacts.

Response

Environmental literacy and workforce development continue to be a priority to the Sea Grant network, and there continues to be increased attention to these topics in the National Sea Grant Office. New hires have been charged with education responsibilities; the education network meets regularly online for sharing program information and ensuring its availability to the public.

Metrics for education have been strengthened, but more review is needed in this area. Further efforts to strengthen evaluation of program efforts are included in the 2016 recommendations. NOAA's Office of Education reaches out to Sea Grant with its research webinars to review successful practices and how success is measured.

Language in both House and Senate Sea Grant Reauthorization bills strengthens the Knauss fellowship by noting that it shall be implemented.

FOCUS AREA IMPACTS

The 2014-17 Sea Grant Strategic Plan identifies four focus areas—Healthy Coastal Ecosystems, Sustainable Fisheries and Aquaculture, Resilient Communities and Economies, and Environmental Literacy and Workforce Development. This section contains a sampling of some of the thousands of impacts and accomplishments in the four focus areas.

Healthy Coastal Ecosystems



California Sea Grant has studied the effects of Marine Protected Areas and shown that they are effective in restoring fish populations but the change does not happen quickly. Credit: California Sea Grant

Sustainable Fisheries and Aquaculture



Delaware Sea Grant developed artificial bait for eel and conch fisheries that reduces their reliance on valuable horseshoe crabs previously used as bait. Similar catch rates with new and traditional baits demonstrate the value of the new bait in wild harvest. Credit: Delaware Sea Grant

Resilient Communities and Economies

Georgia Sea Grant, using a participatory approach, assessed how coastal flooding risks exacerbated by sea level rise were impacting the City of Tybee Island, and explored adaptation actions to make the City more resilient over time. Tybee Island City Council voted unanimously to accept the plan, the first of its kind in Georgia.



Environmental Literacy and Workforce Development

New curriculum topics in this biennium include ocean acidification (Washington Sea Grant), mangroves and seagrass beds (Puerto Rico Sea Grant, in Spanish), and microplastics (Oregon Sea Grant). Credit: Oliver Bencosme/Puerto Rico Sea Grant



Healthy Coastal Ecosystems

Sea Grant is a leader in understanding, maintaining, and restoring healthy coastal ecosystems. Early Sea Grant projects included gathering scientific information on nutrient cycling, ecological relationships, and pollution sources, and translating it into forms useful to fishery managers. Using new technologies and tools, today's Sea Grant supports ecosystem based approaches to managing the coastal environment, including restoring the productivity of degraded ecosystems and promoting the stewardship of healthy ones through research, extension, and education.

Sea Grant provides valuable data for ecosystem management and restoration.

Impact

Woods Hole Sea Grant monitored *Vibrio* bacteria levels in oysters to inform decisions on re-submergence requirements. As a result, state regulators reduced the required re-submergence period from 14 days to 10 days for aquaculturists statewide, easing the burden on farmers. This study will continue in 2016 to potentially reduce the standard even further based on additional data.

Impact

MIT Sea Grant research on biometric sensors to understand changing ocean conditions is expected to grow into a significant business opportunity. The market for these sensors is expected to grow globally to a \$17.4 billion business by 2020.

Impact

In 2015, Texas Sea Grant-led volunteers protected, enhanced, or restored 1,161 acres of coastal prairie, dune, and wetland habitat including land in the Houston-Galveston metro area.

A researcher supported by Minnesota and Michigan Sea Grant programs developed the first ever vertebrate pheromone biopesticide for use in US waters. The pheromone attracts invasive lampreys to a location where they can be trapped. Credit: Minnesota Sea Grant



Impact

Alaska Sea Grant collaborated with Alaska native hunters to document traditional knowledge of historic habitat and subsistence hunting patterns for sea otters. The traditional knowledge collected was used to enhance GIS maps on current sea otter distributions. As a result of this effort, Bristol Bay regional tribes used this information to develop a marine mammal conservation plan.

Sea Grant works to prevent, monitor, and remove ecosystem contaminants.

Impact

Ohio Sea Grant's shrink wrap recycling program is saving marinas and taxpayers money while conserving landfill space and providing a useful product. Over two million pounds of shrink wrap used for boat storage has been recycled since 2006. Marinas save about \$300 per year in reduced waste disposal costs while keeping the material out of landfills. The recycled plastic has been made into nearly 332,000 highway guardrail spacer blocks, protecting over 414 miles of highway.



Illinois-Indiana Sea Grant helped eight new pharmaceutical collection centers get started in 2015. There are now 49 in the two states. They have collected 28,577 pounds of pharmaceuticals in 2015, keeping them out of the states' waterways. Credit: Illinois-Indiana Sea Grant



Efforts by New Hampshire Sea Grant researchers to re-evaluate water sample analysis after sewage system leaks allowed the state of Connecticut to re-open shellfish growing areas quickly after viral contamination, minimizing negative economic impact. Credit: New Hampshire Sea Grant

Impact

In 2015 North Carolina Sea Grant led an effort by agencies and volunteers to survey nearly 170 miles of waterways that have growing issues with invasive *Hydrilla*. Sea Grant convened local, state, and federal agencies resulting in a new multi-agency technical advisory group to address the issue.

Sustainable Fisheries and Aquaculture

The original Sea Grant legislation in 1966 emphasized aquaculture, which “can substantially benefit the U.S., and ultimately the people of the world, by providing greater economic opportunities, including expanded employment and commerce; the enjoyment and use of our marine resources; new sources of food; and new means for the development of marine resources” (Sea Grant, The First Ten Years). Seafood safety and sustainability, along with public education about seafood selection and benefits, are the goals of this Focus Area. Programs for aquaculture, new markets for seafood, and fishing fleet sustainability are important means of meeting stakeholder needs.



Several Sea Grant programs have worked with fishing communities and municipalities to facilitate direct purchase programs for local seafood. Credit: Louisiana Sea Grant

Impact

An aquaculture training program led by Maine Sea Grant created several new businesses and generated new interest in aquaculture. The program has trained more than 50 individuals to date, and has created a set of instructional materials and a network of professionals to help eight new producers start and grow their businesses.

Impact

Georgia Sea Grant’s research on black gill disease in shrimp yielded a diagnostic tool for monitoring and launched a collaborative project with South Carolina Sea Grant. Investigators leveraged new funding, and newly developed curriculum introduces the issue to students.

Impact

Maryland Sea Grant has provided business training and assistance to help oyster aquaculture entrepreneurs apply for low-interest loans. The seven applicants in 2014 received more than \$400,000 in loan commitments.

Impact

Mississippi-Alabama Sea Grant research and extension has led to development of a commercial off-bottom oyster farming industry that approaches \$1 million/year.

Impact

For the first time, commercial production of marketable size littleneck clams and blue mussels were achieved thanks to research-industry partnerships led by Alaska Sea Grant.

Sea Grant research and development enhances aquaculture outcomes.

Impact

Florida Sea Grant research informed a new 2015 state law allowing use of mechanical harvesters for clams. Research showed only minor short-lived effects on water quality and sediment disturbance.

Impact

A Texas Sea Grant-funded research project developed and pioneered a super-intensive indoor shrimp aquaculture technique, the bio-floc system, which was implemented by three commercial shrimp operations, sustaining three businesses and 112 jobs and creating 20 additional jobs for a combined economic impact of \$10.2 million.

South Carolina Sea Grant Consortium combines ecotours and aquaculture tours for a unique and profitable experience. The program is informed by research conducted by S.C. Sea Grant and helps both industries diversify income while educating the public about the growing field of aquaculture. Credit: Maryland Sea Grant





Wisconsin Sea Grant, with the Urban Farm Project which raises yellow perch for local markets, reports research indicating fish can thrive in waters with elevated ammonia, nitrogen, and nitrate levels. Credit: Wisconsin Sea Grant

Impact

Maryland Sea Grant and its partners completed the development of a research-based public-education campaign, which will reduce the introduction of aquatic invasive species via the marine bloodworm live bait trade. By engaging bait shop owners and anglers in the program’s design, this effort is now set to succeed.

Impact

University of Southern California Sea Grant and a scientist from California State University at Long Beach worked with students to increase the scale and effectiveness of barotrauma outreach to recreational anglers. More than 600 local anglers were reached, and behavioral changes, i.e. using descending devices, were observed onboard fishing vessels.

Impact

Shellfish and seaweed growers can now get loss protection for natural hazard damage to their crops just like farmers do on land. Connecticut Sea Grant, state and federal agencies, the aquaculture industry, and Connecticut’s congressional delegation worked with the USDA to broaden the Noninsured Crop Disaster Assistance Program to include farmed shellfish as commodities. The change to the program adds shellfish grown directly on the ocean bottom and crops grown on ropes underwater, such as mussels and seaweed.

RED SNAPPER

The red snapper is popular with sport and commercial fishers across the Gulf of Mexico. Historical overharvesting resulted in a depleted population, but under current management measures the population is recovering, with full recovery expected by 2032. Some controversy surrounds the current stock assessment, particularly the accuracy of population estimates on artificial reefs and other structures difficult to sample using trawl surveys. After regional consultations with state, academic, and user communities, a two-phase competitive grant process was instituted. The recently awarded Phase I grant includes the development of an experimental design. Phase II will use this design to implement a U.S. Gulf of Mexico study to obtain a one-time estimate of absolute abundance to compare with the current red snapper stock assessment. Sea Grant and NOAA National Marine Fisheries Service are working together to take full advantage of the \$12.5 million research competition appropriated in fiscal year 2016.



Red snapper Credit: Florida Sea Grant

Sea Grant and NOAA Fisheries are working together to take full advantage of the \$12.5 million research competition appropriated in fiscal year 2016.



A Florida Sea Grant Extension Specialist holds a red snapper during an education and research cruise. Credit: Florida Sea Grant

Resilient Communities and Economies

Sea Grant uses research and its extension infrastructure expertise with communities to inform them of risks of living in the coastal regions. In its early days, the focus was on coastal erosion. Today, Sea Grant helps communities respond to multiple environmental issues and hazardous events and ensure a strong coastal economy.



Louisiana Sea Grant developed a free smartphone app that will improve emergency preparedness for those who navigate Louisiana coastal waters. Credit: Louisiana Sea Grant

Impact

Rhode Island Sea Grant facilitated the revision of the Rhode Island Ocean Special Area Management Plan with new science that aided in the federal approval of lease blocks for the nation's first offshore wind farm.

Impact

Lake Champlain Sea Grant's research shows bioretention study ponds effectively remove sediments and nutrients from rainwater as well as water volume and slow runoff. In addition, Lake Champlain Sea Grant educates stormwater professionals and community leaders on the success of the study ponds and ongoing research.

Impact

A Great Lakes Water Safety Consortium was created as a direct result of Michigan Sea Grant's involvement in the Dangerous Currents Coastal Storms Project. Michigan Sea Grant distributed safety equipment, helped improve safety signage, and helped develop warning systems in coastal communities. As a result of these combined efforts, people are heeding beach safety warnings. Drowning deaths have declined each year from 102 in 2012 to 40 in 2015.

Impact

Hawai'i Sea Grant has educated more than 75,000 homeowners with the Homeowners Handbook to Prepare for Natural Disasters. The publication is now available as a free download. The fourth edition will be published in 2016 with hurricane and tsunami risk added. The publication has also been adapted by 13 other Sea Grant programs for local use.

Sentinel Site Liaisons

NOAA’s Sentinel Site Program measures the ecological impacts of sea level rise and applies science-based solutions. The program is running more efficiently as a result of efforts by five Sea Grant Programs, with the support of the NSGO and NOAA National Ocean Service, to hire regional coordinators for the five Sentinel Site Cooperatives. The Coordinators bring researchers, managers, and other stakeholders together throughout their assigned Sentinel Site regions.

A \$50,000 project funded by Virginia Sea Grant led to an additional \$120 million in grant funding from U.S. HUD to implement resiliency designs in a Norfolk community. The area had experienced a 14-inch rise in local sea level since the 1930s. The photo shows an area of Norfolk, VA that experienced flooding during a heavy rain event in 2015. Credit: NOAA



Impact

A Florida Sea Grant extension specialist partnered with local businesses to develop a mobile application that markets local ecotourism opportunities in Florida’s Panhandle region. The application was showcased at the Pensacola Airport in 2015 and was viewed by over 200,000 visitors. Interviews with ecotourism businesses showed that their businesses improved because of the app.

Sea Grant assists in earthquake and tsunami resilience.

Impact

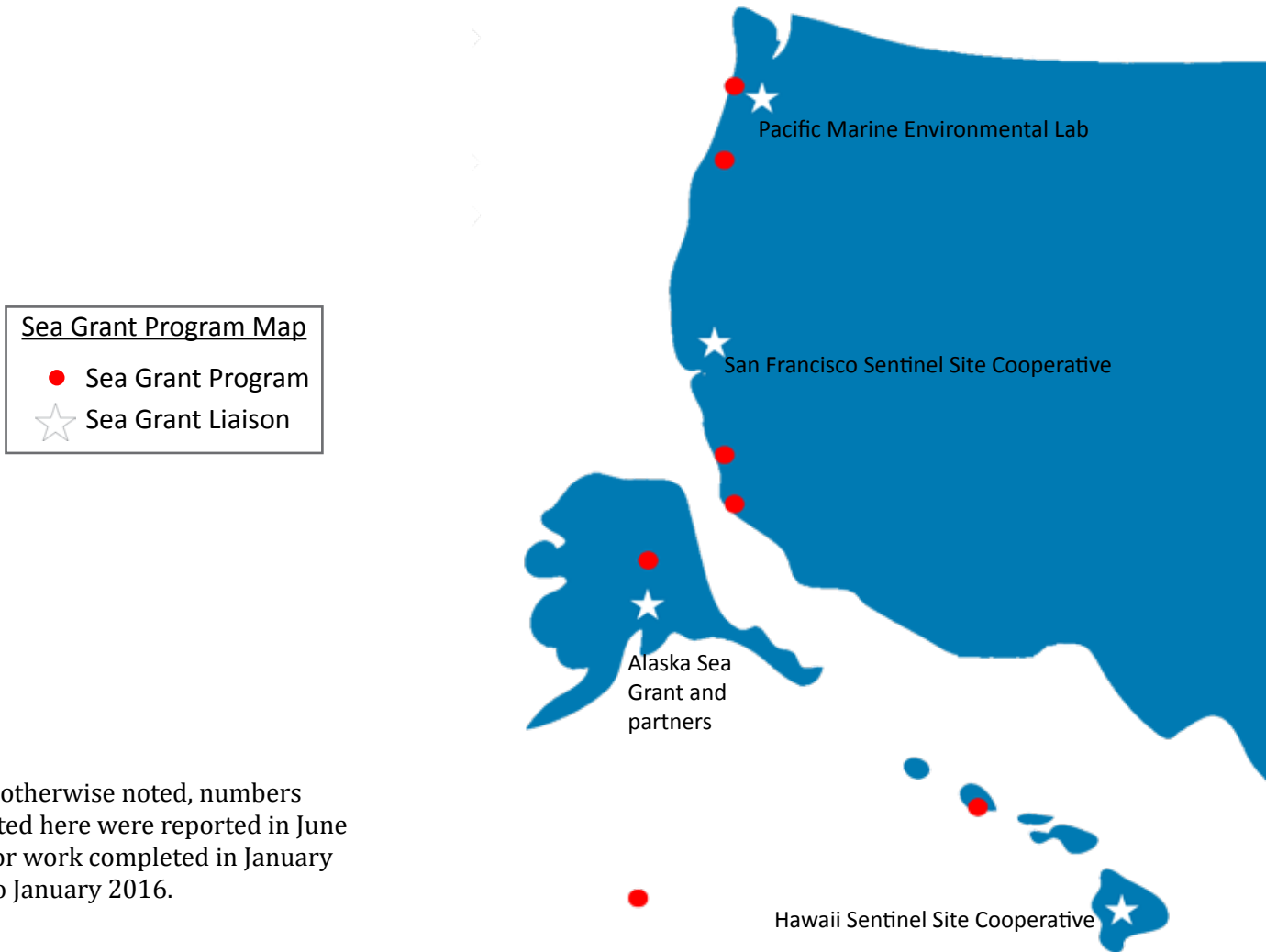
Washington Sea Grant educates ship pilots and Coast Guard personnel on how to escape Port Angeles in the event of a tsunami, an area known as one of the worst exposed areas on the west coast.

Impact

Oregon Sea Grant, working with the Seismic Rehabilitation Grant Program (SRGP), created an earthquake preparedness app that was viewed a quarter of a million times in the first six months. Because of the effort, the SRGP was awarded \$300 million from the Oregon Legislature for public renovations in seismically sensitive areas. Oregon Sea Grant also works with communities on the desirability of relocating schools and emergency services out of tsunami hazard zones, setting up neighborhood supply caches on high ground, and holding regular community-wide disaster drills.

SEA GRANT BY THE NUMBERS

For 50 years, Sea Grant has been putting science to work for America's coastal communities.



Unless otherwise noted, numbers presented here were reported in June 2016 for work completed in January 2015 to January 2016.



Scientists affiliated with Sea Grant in 2015



Industry and local, state, and regional partners in 2015



University Sea Grant employees (supported by a team of <10 federal employees in 2015)

265,602
Volunteer hours

\$575M
Economic Impact

1,105
graduate students supported



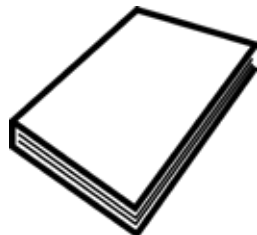
534
Communities implement sustainable development practices as a result of Sea Grant's efforts

20,770
Jobs created or sustained with assistance from Sea Grant

1,956
Hazard analysis & critical control points (HACCP) certifications issued by Sea Grant



860
undergraduate students supported



489
Peer-reviewed articles published documenting Sea Grant research



127,348
Acres of degraded habitats restored

Environmental Literacy and Workforce Development

“Adequate training and education of manpower” was one of the three pillars supporting the original design of the National Sea Grant Program in 1966. Today’s Sea Grant seeks to build an environmentally literate public through a continuum of lifelong formal and informal engagement opportunities. Sea Grant builds a future workforce with knowledge and skills critical to local, regional, and national needs.

Sea Grant educators are national and global leaders who contribute to national STEM culture.

Impact

With funding from the NOAA Marine Debris Division, Florida Sea Grant is engaging citizens to raise awareness about microplastics in Florida waters. After completing the volunteer-led awareness program, 85% of participants said they now check the labels on their personal care products, 67% said they changed the types of personal care items they use, and more than 99% said they shared information about microplastics with others.

In Guam, Sea Grant’s Builders of a Better Bay (BBB) students collect turbidity and water level data at rivers within the Pago watershed. BBB can help assess the extent to which upland activities affect the bay. The BBB’s Kids curriculum for Palau now spans four elementary grades. Students in the curriculum have met with local, state, and national legislators about resource management. Credit: Guam Sea Grant



Impact

New York and Connecticut Sea Grant programs lead the Long Island Sound Mentor Teacher Program. Over both states, 40 mentor teachers have teamed up to offer 40 workshops for 540 formal and informal K-12 educators. Workshop participants report teaching more than 33,800 students annually in 74 Connecticut and 73 New York city, town, or regional school districts about the Long Island Sound estuary.

Impact

The Pennsylvania Sea Grant Great Lakes-Great Stewards project was adopted as a model for EPA's Center for Great Lakes Literacy efforts. The model program provides training for teachers and resources for students to develop and share stewardship projects with their peers and communities and provides hands-on learning opportunities in students' local watersheds.

Impact

North Carolina Sea Grant researchers conducted an environmental education (EE) evaluation and distributed a new model for assessing EE effectiveness. Publications and media reports led to an increase in focus on EE evaluation across North Carolina and the Southeast.

Innovative media and methods illustrate Sea Grant educators' skills in pedagogy and science for bringing timely topics to learners.

Impact

Maryland Sea Grant educators train teachers in aquaponics, in which fish and plants are raised in recirculating closed systems. In turn, the teachers help students to use science and engineering to solve practical problems, important STEM goals. Sea Grant's data on students and process were published in the European Journal of Health & Biology Education in 2015.

Impact

Louisiana Sea Grant developed an award winning oral history film, *The Telling Tide*, with interviews conducted by high school students in four coastal communities. Students became more aware of coastal issues, reported being more confident talking to their elders, and noted the value of communication skills.

Impact

Ohio Sea Grant developed the first Sea Grant iTunesU course on the topic of climate impacts in the Great Lakes. Launched in November of 2014, it was featured by Apple, Inc. and was the top downloaded Ohio State University course in December 2014 with 69,587 viewers and 7,587 subscribers. This is one of several eLearning opportunities developed by Ohio Sea Grant to bring current research to the public and stakeholders.

SEA GRANT IN ACTION

In addition to the ongoing efforts within each of Sea Grant's four focus areas, some efforts stand out as addressing new and growing challenges and opportunities. In this section, we highlight the ways in which Sea Grant is currently "in action" to address issues related to resilience, aquaculture, and ocean acidification.

Resilience



University of Southern California Sea Grant is building resilience in coastal communities with a new citizen science program called the Urban Tides Community Science Initiative. Credit: Astrid Hsu /USC Sea Grant

BY THE NUMBERS

Each year, Sea Grant programs dedicate approximately \$16 million to resilience efforts. A portion of this amount comes from the annual mini-grants the NSGO provides to the 33 Sea Grant programs to support program development in the area of resilience. These mini-grants have led to ongoing research, extension, and education efforts on resiliency and have resulted in Sea Grant programs leveraging tens of millions in additional grant funds.

In 2015, Sea Grant provided 730 resilience-focused trainings. In addition, 570 communities worked with Sea Grant in 2015 to implement sustainable development practices. Currently, there are over 100 tools available in the Sea Grant Resilience Toolkit (which links to the broader U.S. Climate Resilience Toolkit).

Each coastal community deals with a unique set of challenges, and Sea Grant programs across the country adapt the Sea Grant Model to work locally, involving stakeholders and decision-makers, to identify resilience options that best fit the community.

Through an inclusive collaborative planning process facilitated by Alaska Sea Grant and others, the village of Shaktoolik, AK, decided to "defend in place" against anticipated climate threats. Facing imminent flooding and erosion due to climate change, the team prepared an adaptation plan that was approved by the community. It emphasizes public safety, property protection, cost-effectiveness, and fundable options using local talent, labor, and materials. As a result, residents and leaders of Shaktoolik prioritized response measures and have completed a protective berm, the first adaptation measure.

The Planning Board of Chelsea, MA has new climate change adaptation guidance thanks to a group of students from Worcester Polytechnic Institute (WPI) and MIT Sea Grant.

The Hawai'i Sea Grant project, "Building Resilience to Coastal Hazards and Climate Change in Hawai'i," helps communities reduce their vulnerability to natural hazards and climate change. The project is supported by a grant of \$850,000 from NOAA's Regional Coastal Resilience grant program.

Supported by Lake Champlain Sea Grant and partners, communities are implementing storm water plans to improve flood resilience via rain gardens, pervious paving materials, and gravel.

Rhode Island Sea Grant is helping to bring the FORTIFIED Home™ program to the state in order to construct resilient buildings. FORTIFIED Home™ is a set of engineering and building standards designed to help strengthen new and existing homes through upgrades to minimum building code requirements that will reduce damage from specific natural hazards.

HURRICANE SANDY RESPONSE

Sea Grant helps communities and businesses develop long-term solutions for climate change adaptation. The 2013 Disaster Relief Appropriations provided a \$1.8 million grant to Sea Grant programs in Connecticut, New Jersey, and New York to support the Coastal Storm Awareness Program (CSAP). Overseen by local and state emergency managers, the National Weather Service, and state coastal zone managers, CSAP identifies which sources of storm warnings are most trusted, what factors influence decisions by residents, and what changes might make storm warnings more impactful.



A man walks through a flooded street in Delaware after Hurricane Sandy. Credit: Delaware Sea Grant



Beach houses in New Jersey were destroyed by Hurricane Sandy. Credit: New Jersey Sea Grant

New Jersey Sea Grant integrated CSAP results into a series of community workshops and a hands-on lesson plan to teach students about storm surge. Connecticut Sea Grant established the Climate Adaptation Academy to identify climate issues and share solutions on topics such as flooding, living shorelines, and legal issues. At the request of the Governor's New York State Resilience Institute for Storms and Emergencies, New York Sea Grant helped evaluate evacuation plans and community response capabilities, identify local emergency responders, and analyze critical information gaps needed to improve evacuation plans and save lives.

Aquaculture



A team led by University of New Hampshire Sea Grant designed an aquaculture raft that allows for a four-season fish and shellfish source and improves water quality by removing nitrogen. Testing is underway with steelhead trout, blue mussels, and sugar kelp, potentially valued at \$70,000 annually. Credit: New Hampshire Sea Grant

BY THE NUMBERS

In the past two years, Sea Grant has received over \$13 million in Federal funding to support both national and state programs for aquaculture research, extension, and technology transfer projects, as well as workshop and training support. These funds are supplemented with a corresponding state match of over \$6.5 million. Topical research priorities have included:

- a) research to inform pending regulatory decisions regarding aquaculture on the local, state, or federal level leading to an information product—such as tool, technology, template, or model—needed to make final decisions on a specific question;
- b) research to support the introduction and/or increase in production of new and emerging species;
- c) research that supports continued seafood safety and product quality; and
- d) social and/or economic research to understand aquaculture issues in a broader context.

Detailed information, including past award recipients and projects, can be found on the Sea Grant website. The 2017 President's budget includes a budget line for \$7 million to continue work done in Sea Grant's national aquaculture portfolio.

The U.S. imports more than 90% of the seafood we consume; over half of that is produced via aquaculture. Current estimates of U.S. aquaculture production, freshwater and marine, are valued at \$1.2 billion; 6% of domestic seafood landings by weight and 20% by value. Since its beginning, Sea Grant has been involved in research to support sustainable aquaculture, leveraging federal, academic, and industry partners to support increased efficiency and yield, investing in high-priority research, and engaging communities through extension programs that bring together the collective expertise of extension agents, educators, and communicators. Sea Grant recently completed a 10-year national aquaculture vision to guide future investment and assure impacts in national areas of need.

Rhode Island Sea Grant research is investigating reasons for support or opposition to help understand the “social carrying capacity” of aquaculture-grown shellfish in the state. Washington Sea Grant assessed stakeholder perceptions of geoduck aquaculture in South Puget Sound and analyzed challenges to permits. Results revealed a level of conflict unsuitable for a collaborative process, but led to a case study for use in college courses.

Procedures developed by North Carolina Sea Grant for spawning striped bass without hormone manipulation have been adopted by the National Program for Genetic Improvement and Selective Breeding. The processes produced millions of fry in 2015 and efforts are ongoing.

A Mississippi-Alabama Sea Grant project found that recirculating aquaculture systems can be a nutrient source for common marsh plants when solids are removed.

Workers harvest oysters at a Maryland oyster farm. Credit: Maryland Sea Grant



Ocean Acidification



Hawai'i Sea Grant maintains and has expanded the Ocean Acidification Network, begun in 2005, the longest continuous time series of carbon dioxide data in coastal coral reef environments worldwide. Near real-time data is available at several websites maintained by their collaborators at NOAA's Pacific Marine Environmental Laboratory (PMEL). Credit: Hawaii Sea Grant

Ocean chemistry is rapidly changing. Since the start of the Industrial Revolution, the global ocean has absorbed approximately 41% of the CO₂ released to the atmosphere, resulting in a decline in ocean pH on a scale not seen in at least one million years. A lower, more acidic, pH reduces the ability of many organisms to create hard calcium carbonate shells and skeletons. The effects reach from zooplankton to oysters, mussels, and corals. This additional stressor, combined with warming oceans and rising sea levels, is causing some economically important organisms to struggle and could lead to the potential collapse of certain aquaculture industries, shellfisheries, and coral reefs. Sea Grant supports research to improve community understanding of ocean acidification and other climate change-related effects on coastal communities, economies, fisheries, and ecosystems.

Understanding the role that eelgrass ecosystems play in preparing for and mitigating the effects of climate change provides an opportunity to secure protection and restoration resources. MIT Sea Grant worked with several partners in Massachusetts to quantify the carbon storage of eelgrass beds, which could serve as refuges for marine bivalves. Washington Sea Grant was instrumental in obtaining a \$1.5 million grant from the Paul Allen Family Foundation to pilot a novel ocean acidification mitigation strategy in Puget Sound using algae.

Washington, Oregon, and Maine Sea Grant programs are conducting research to increase the viability of aquaculture-grown bivalves in more acidic waters, seeking to develop/identify oysters and mussels that are more tolerant of lower pH.

In 2015, New Hampshire Sea Grant-funded researchers determined more acidic seawater reduces lobsters' responses to bait, indicating that ocean acidification may impact lobster populations and the commercial lobster fishery.



An ecologist with MIT Sea Grant samples sediment taken from an eelgrass bed. The research is part of an ongoing effort to determine how much carbon is stored in eelgrass beds. Credit: MIT Sea Grant

BY THE NUMBERS

In 2015 grant funds were announced to address the impacts of ocean acidification on key resource species in the northeast (New York Bight to the Gulf of Maine). This effort is supported by dedication of existing funds from the Northeast Sea Grant Consortium (consisting of the Sea Grant programs including New York, Connecticut, Rhode Island, MIT, Woods Hole, New Hampshire, and Maine) in partnership with the NOAA Ocean Acidification Program. The grant funds are meant to assist coastal communities in adapting to current and future ocean acidification conditions in the region. The competition provided \$800,000 in federal funds with an additional \$400,000 non-federal match. Projects will provide new information on bivalves, lobsters, and finfish.



One of the recently awarded grants will study how young lobster respond to ocean warming and acidification across New England. Credit: J. Waller

ACHIEVING ORGANIZATIONAL EXCELLENCE

The Sea Grant organization continually works towards excellence, and many of the recent achievements and efforts are highlighted in this section. Sea Grant deserves to be proud of its legal network, the highly successful Knauss fellowship program, and the completion of another quadrennial review of all program aspects. Concerns still arise with the lack of program reauthorization by Congress and the ways in which Sea Grant's role in environmental education lacks sufficient understanding and support in the states.



Knauss fellows visit the White House in 2015. Credit: National Sea Grant Office

John A. Knauss Marine Policy Fellowship

The Knauss fellowship has been launching illustrious careers by offering direct experience working on the latest issues in ocean and coastal management, fisheries, and research. As a key component of Sea Grant's workforce development, the Fellowship has provided opportunities for promising students for 37 years. Through these fellowships, nearly 750 fellows have been placed in federal departments and agencies, and over 360 have been placed in the U.S. Congress. Many are impacting current Sea Grant focus areas and Congressional priorities. In recognition of Sea Grant's 50th Anniversary, the programs collected profiles of many of the more than 1,100 Knauss fellowship alumni in a new "Where are they now?" feature on the national Sea Grant website.

Sea Grant Law and Policy Expertise

Promising solutions to some of our most pressing environmental problems are often derailed for lack of knowledge or by misinformation about existing legal authorities and the opportunities these authorities provide for innovation. Sea Grant is uniquely positioned around the country to undertake critical law and policy research, translate scientific information for policy makers, and reduce legal barriers to the adoption of innovative management strategies to address emerging community needs.

The National Sea Grant Law Center is a nationally recognized and respected resource on ocean, coastal, and Great Lakes law. The Law Center's work with the Western Regional Panel on Aquatic Nuisance Species is helping Western states and several Canadian provinces align their invasive species laws and regulations to improve interstate cooperation and reduce the risk of introduction from recreational watercraft.

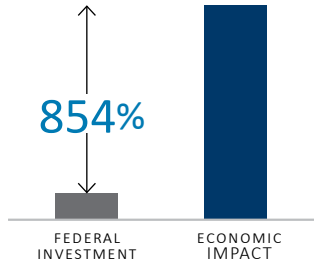
The Sea Grant Legal Network also includes legal programs in five states (LA, MS-AL, NC, and RI), and attorneys working with Sea Grant throughout the country. The Legal Network provides technical assistance, develops model ordinances, and facilitates community-planning initiatives. These initiatives help local governments improve floodplain management, adapt to sea level rise, and increase their participation in the National Flood Insurance Program Community Rating System. Sea Grant legal programs and attorneys are responsive to stakeholder needs and can address a variety of law and policy issues arising locally and nationally.

Performance Review Panels and Site Review Teams

Sea Grant is committed to careful planning and rigorous evaluation at both the state and national level to ensure that the program has local, state, and national impacts. The network is currently developing new strategic plans, both on the national and state level, and also has completed evaluations of programs' success in meeting the goals of their 2014-2017 strategic plans. The quadrennial Site Visits were completed in September 2015 and assessed state Sea Grant program operations. Programs are evaluated, on-site, in three general areas: 1) their approach to management; 2) the scope and success of their engagement with stakeholders; and 3) the degree of collaboration with other Sea Grant and NOAA programs, and other relevant partners. The quadrennial Performance Review Panels were held in October 2015 to conduct retrospective evaluations of each program's overall impact on society from both environmental and socioeconomic perspectives and were evaluated against the state program's 2014-2017 strategic plan. The results of the Site Review are used by the NSGO to determine whether the Sea Grant program is: 1) recertified, and 2) eligible for merit funding. Performance Reviews determine the amount of merit funding a program may receive.

Economic Impact

Because of Sea Grant’s matching requirement, there is at least one dollar of state and local funds for every two federal dollars spent. The work Sea Grant does earns an 854% economic impact of federal investment, creating jobs, and ensuring Americans can live near, vacation at, and earn a living from our oceans and Great Lakes for generations to come.



\$575 million in economic impact, a leveraging of 854 percent on the federal investment of \$67.3 million in 2015



Researchers and students with California Sea Grant work to study and restore seagrass beds. Credit: Tenney Rizzo/ Cal Poly

Sea Grant Reauthorization

Since the passage of the National Sea Grant College and Program Act in 1966, Sea Grant has continuously received strong bipartisan support from the Senate and House of Representatives in the U.S. Congress. This is evidenced by repeated reauthorization every five years until 2014. In the 114th Congress, there have been multiple bills introduced in both the House and Senate to reauthorize Sea Grant. At the time of printing, the Senate has passed S. 3282.

The NSGO is the one of the only NOAA programs that has operated under an administrative funding cap. To improve management of the Program, the reauthorization bills recommend an increase for the NSGO from the current 5.0% to 5.5% of the authorized appropriation for the whole program or the amount specifically appropriated for administration, whichever is less. This will help the NSGO replace numerous vacancies and increase productivity for the Sea Grant Programs that they serve. The bills also authorize the NSGO to use the Inter-governmental Personnel Act to take on short-term appointees from the Sea Grant Colleges. Both of these measures will facilitate the greater range of support services needed at the national level.



**Volunteers work with Illinois-Indiana Sea Grant to restore Lincoln Park.
Credit: Illinois-Indiana Sea Grant**

Further, the reauthorization legislation seeks to solidify the popular Knauss fellowship program by making it mandatory, subject to available appropriations. Over 1,100 graduate students have served as Knauss Fellows. There is language recommending the placement of Fellows in the legislative branch each year, and authorization for direct hire authority into any federal agency for which the candidate meets qualification standards (subject to availability of appropriations). Finally, reauthorization would change the frequency of this State of Sea Grant report from the Board, to every three years rather than biennially.

Introduced legislation recommends authorization of appropriations at the same amount in 2015-2020 as in the 2008 Sea Grant reauthorization. Congress also authorizes additional funding for aquatic non-native species, oyster disease, harmful algal blooms, coastal resilience, sustainable aquaculture, and fishery extension activities to enhance existing core programs.

The National Sea Grant Advisory Board and Sea Grant Association continue to support current reauthorization legislation and encourage early passage.

SEA GRANT RECOMMENDATIONS

2016



A child enjoys swimming in Lake Michigan. Credit: Todd Marsee/Michigan Sea Grant

Recommendation One

Sea Grant should seek partnerships with more programs in NOAA to build on the existing investments and reputation of the Sea Grant Program.

Justification

Sea Grant, primarily through its extension program, is consistently recognized for engaging stakeholders with reliable products, services, and information that address local needs, while also transferring research priorities back to universities. Some partnerships with NOAA offices currently exist and Sea Grant should engage other NOAA offices and programs to raise awareness of Sea Grant capabilities. Finding opportunities that build on Sea Grant expertise and experience can increase the impacts of NOAA investments and NOAA's service to society.

Recommendation Two

The NSGO should support the expansion of the Sea Grant Liaison Program in NOAA offices, laboratories, and programs, based on the recommendations of the Board in their 2016 Liaison Subcommittee Report.

Justification

The NSGO has successfully provided Sea Grant Liaisons to requesting NOAA offices and laboratories. The program is a partnership between Sea Grant college programs, Sea Grant extension, and the receiving NOAA line office and/or laboratory, and is especially beneficial when there is need for stakeholder engagement.

Recommendation Three

Sea Grant should continue to enhance diversity and inclusion throughout the network so that its workforce, programming and materials are more representative of the nation as well as the audiences the program serves.

Justification

Census projections estimate that minority groups will collectively make up over half the U.S. population by 2044. To meet the needs of a changing society, Sea Grant must make sure its workforce is representative of, and meeting the needs of, local communities.

Recommendation Four

Sea Grant needs to demonstrate how its K-12 and informal education programs collectively respond to national priorities and result in evidence-based accomplishments and impacts. To accomplish this, Sea Grant should enable collaboration through consistent programmatic and travel support at state and national levels so the Education Network can work together.

Justification

Sea Grant can leverage its extensive program and products to be on the forefront of environmental literacy and STEM nationally and globally. With additional program funds and opportunities to work as a group, Sea Grant educators could develop collective projects and wider scale research and evaluation programs to demonstrate the impact of education efforts in classrooms and informal education.

Recommendation Five

Sea Grant should enhance efforts toward gathering and sharing the wisdom and experience of experts in subject matter relevant to Sea Grant's mission. Previous theme/focus teams began this productive process and offer a mechanism moving forward.

Justification

Sea Grant's highly praised nimbleness to address important and emerging coastal issues depends on awareness of emerging issues and cutting edge science. It is important for Sea Grant to maintain and enable this forward-looking function, and the NSGO should organize and support a new mechanism towards that goal. Revisiting the concept of theme/focus teams is warranted.



Students solve problems during a marine science competition. Credit: MIT Sea Grant

EMERGING OPPORTUNITIES

The Board highlights several emerging opportunities in this section including prospects within the four strategic focus areas, additional possibilities in data sharing, and results from a recent Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis.

Healthy Coastal Ecosystems

This Focus Area might benefit from increased coordination within the Sea Grant network, with NOAA, and with external partners. Building up Sea Grant's social science portfolio in this area could support development of ecosystem-based management strategies. Innovation and outreach on ocean acidification, climate impacts, and blue carbon, as well as in more established topic areas, would effectively show linkage with other Focus Areas such as Resilient Communities and Economies.



Volunteers with New Hampshire Sea Grant plant dune grass during a coastal restoration project. Credit: New Hampshire Sea Grant

Sustainable Fisheries and Aquaculture

New seafood markets and techniques developed through Sea Grant could help meet the growing demand for sustainably caught and produced seafood. Integrated plant and seafood aquaculture systems already being explored by some Sea Grant research can reduce nutrient levels and perhaps mitigate ocean acidification effects. The regulatory environment for aquaculture is complex, and Sea Grant expertise is already proving valuable to the industry.



Dungeness crab caught off the coast of Oregon Credit: Oregon Sea Grant

Resilient Communities and Economies

Sea Grant can build on the progress achieved through the COP21 Climate Agreement, including fostering cooperation, identifying knowledge and legal gaps and needs, and promoting the development and dissemination of tools and methodologies. Portfolio opportunities related to climate change could include integrated approaches to water issues and climate adaptation, and natural infrastructures for mitigation.

Environmental Literacy and Workforce Development

Sea Grant can leverage its extensive education network and products to be on the forefront of environmental literacy and workforce development in Science, Technology, Engineering, and Mathematics (STEM) nationally and globally. Expanding audiences for Sea Grant education will be important as a means of expanding the diversity of the STEM workforce and implementing new technologies for instruction to serve “digital natives.”

Data Stewardship

The Sea Grant network has formed a “Sea Grant Data Stewardship Subcommittee” to develop a consistent set of principles that guide how Sea Grant uses and shares data. Sea Grant-funded research projects often generate data that is local or regional in scope. Nationally, Sea Grant programs produce substantial quantities of spatiotemporal data that can be aggregated, analyzed, and evaluated to advance Sea Grant focus areas and create additional education and research opportunities as well as opportunities to connect coastal “big data” to Sea Grant’s 2018-2021 national and state-level strategic planning. Key opportunities for Sea Grant may be in the dissemination of data or novel and applied uses of coastal “big data.”

National Program Opportunities

Sea Grant leaders, including representatives from the NSGO, SGA and the Board, have also identified themes that offer opportunities for Sea Grant program leadership and management. In addition to opportunities already identified, the following themes present new opportunities:

- Future funding opportunities to support the Sea Grant mission,
- Additional and stronger strategic partnerships, and
- Regionalizing the Sea Grant model.

In its 50 productive years of putting science to work for America’s coastal communities, Sea Grant has looked back to honor those whose vision propelled the program in early years. Over the years, it has listened to scientists, managers, and citizens to learn what the program could do in support of changing needs, and it has implemented research and outreach to impact those needs. Sea Grant looks now toward its next 50 years with determination to use the best of its heritage and its current advice, apply its research rigor, legal, and outreach expertise, and teach the next generations of learners and workers so that future scenarios are approached with confidence. The National Sea Grant Advisory Board is proud of its charge to tell the Sea Grant story.

Sea Grant Programs

Sea Grant Program	Program Status
Alaska Sea Grant	College
California Sea Grant	College
Connecticut Sea Grant	College
Delaware Sea Grant	College
Florida Sea Grant	College
Georgia Sea Grant	College
Guam Sea Grant	Coherent Area Program
Hawai'i Sea Grant	College
Illinois-Indiana Sea Grant	College
Louisiana Sea Grant	College
Lake Champlain Sea Grant	Coherent Area Program
Maryland Sea Grant	College
Maine Sea Grant	College
Michigan Sea Grant	College
Massachusetts Institute of Technology (MIT) Sea Grant	College
Minnesota Sea Grant	College
Mississippi-Alabama Sea Grant	College
National Sea Grant Law Center	Project
National Sea Grant Library	Project
North Carolina Sea Grant	College
New Hampshire Sea Grant	College
New Jersey Sea Grant	College
New York Sea Grant	College
Ohio Sea Grant	College
Oregon Sea Grant	College
Pennsylvania Sea Grant	College
Puerto Rico Sea Grant	College
Rhode island Sea Grant	College
South Carolina Sea Grant Consortium	College
Texas Sea Grant	College
University of Southern California (USC) Sea Grant	Institutional
Virginia Sea Grant	College
Washington Sea Grant	College
Woods Hole Sea Grant	Institutional
Wisconsin Sea Grant	College

Quick Glance: Sea Grant Metrics

2015 Performance Measures and Metrics

These numbers reflect accomplishments from February 1, 2015 - January 31 2016

Economic Impacts

\$575M
In economic impact

2,903
Businesses created or sustained

20,770
Jobs created or sustained

2
Patents

Healthy Coastal Ecosystems

582
Ecosystem-based management (EBM) tools, technologies, and information services developed

649
EBM tools used by Sea Grant customers

4,033
Resource managers use EBM

127,348
Acres of degraded ecosystems restored

Safe and Sustainable Seafood Supply

40,243
Fishers adopt responsible harvesting techniques

1,956
Hazard analysis & critical control points (HACCP) certifications

Resilient Communities and Economies

896
Trainings to improve resilience

255
Communities improved resilience

534
Communities implemented sustainable development practices/policies

Education, Outreach and Extension

265,602
Volunteer hours

860
Undergraduate students supported

1,105
Graduate students supported
Research

489
Peer-reviewed publications

Reports, Links, More Information

Reports Mentioned

National Sea Grant College Program, 1979. The First Ten Years. Washington DC: U.S. Department of Commerce, NOAA

Sea Grant Association. 2016. NOAA Sea Grant 10-Year Aquaculture Vision. MASGP-16-015.

National Sea Grant Advisory Board. 2016. NOAA Sea Grant Liaison sub-committee report.

Links for more information

Sea Grant 50th Anniversary (2016) <http://seagrant.noaa.gov/50thAnniversary.aspx>

Sea Grant Knauss Alumni: Where Are They Now? (2016) <http://seagrant.noaa.gov/50thAnniversary/KnaussAlumniWhereAreTheyNow.aspx>

Search Sea Grant Impacts and Accomplishments (2016) <http://seagrant.noaa.gov/WhatWeDo/SearchImpactsandAccomplishments.aspx>

Sea Grant assures the quality of its programs by following concurrent cycles of PIE: Planning, Implementation, and Evaluation:

Sea Grant National and State Strategic Plans (2016) <http://seagrant.noaa.gov/NetworkResources/Planning.aspx>

Sea Grant guidance on program implementation (2016) <http://seagrant.noaa.gov/NetworkResources/Implementation.aspx>

Sea Grant guidance on reporting and evaluation (2016) <http://seagrant.noaa.gov/NetworkResources/EvaluationandReporting.aspx>

Sea Grant Legislation (2016) <http://seagrant.noaa.gov/WhoWeAre/Laws,RegulationsandPolicies.aspx>

Sea Grant Resilience Toolkit (2016) <http://seagrant.noaa.gov/WhatWeDo/ResilienceToolkit.aspx>

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Putting science to work for America's
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