

Virginia Sea Grant

Program Introduction

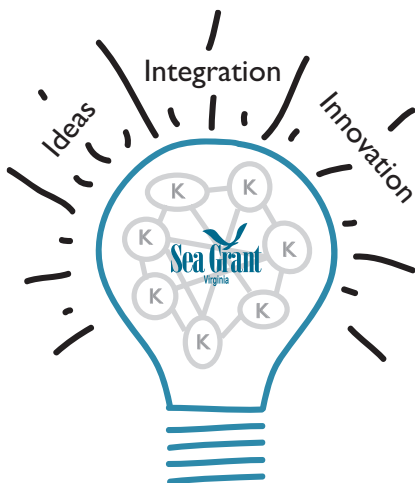
2008-2012 has been a period of exciting changes for Virginia Sea Grant (VASG). In five years, we have moved our headquarters to Virginia Institute for Marine Science (VIMS), hired a new director and assistant director for research, established and staffed a communication center, and launched a forward-looking strategic plan. We are a renewed and growing program, adapting and innovating to fit Virginia's changing coastal and marine resource landscape.

VASG Basics

- * Based at VIMS with five additional partner academic institutions: University of Virginia (UVA), Virginia Tech, Old Dominion University (ODU), George Mason University (GMU), Virginia Commonwealth University (VCU).
- * Mid-sized Sea Grant Program: \$1.3 million annual base budget plus block grants for Coastal Community Development and the Bridge national online teacher resource.
- * Highly leveraged: in 2011, total program spending was \$3.5 million (when total federal funding and match were added to the \$1.3 million base)
- * Respected and well-established extension program accounts for 43% of budget, while research accounts for 31%, but VASG integration with the extraordinary marine research capacity in Virginia adds up to research impacts well beyond this budget.
- * Nationally recognized program in safe and sustainable seafood, longstanding national leader in marine literacy, growing programs in coastal community development, and emerging innovative projects to address climate change and coastal community resilience.

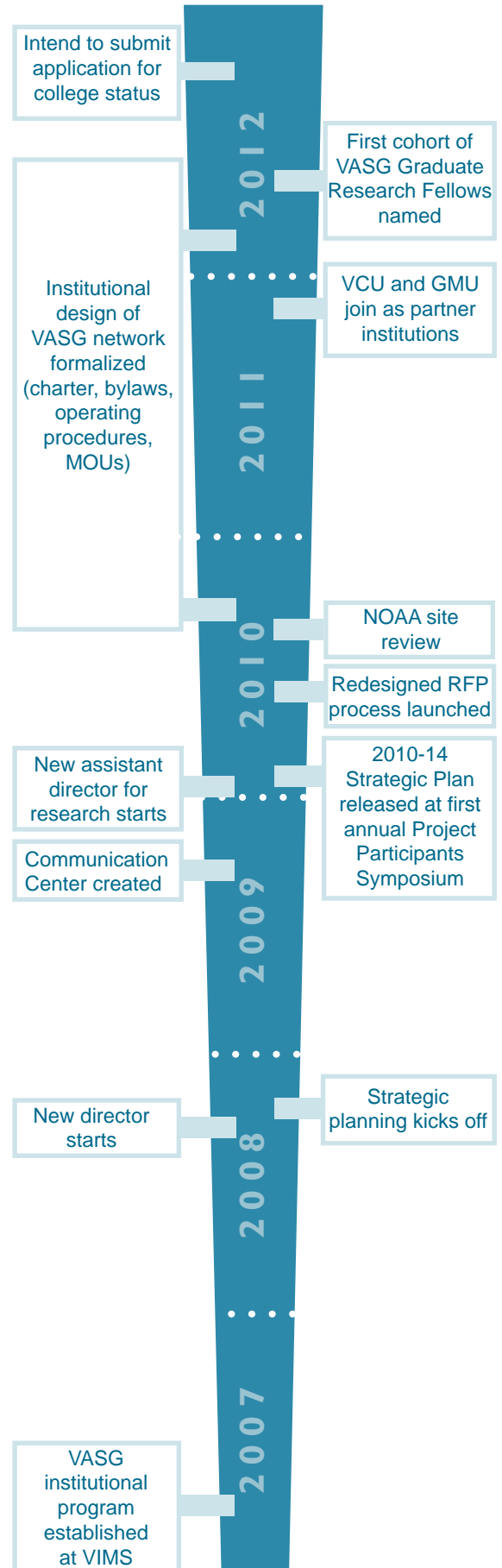
How The VASG Network Works

We're designing a new kind of Sea Grant that functions as a continually interacting network of partners and players. Institutions, end users, and Sea Grant staff work together in an organizational structure that facilitates new linkages to adapt to emerging challenges. Each integrative project creates unique knowledge (k), and Sea Grant helps Virginia coastal communities make new connections to advance innovation.



"Pockets of knowledge and insight exist everywhere, particularly in highly integrated Sea Grant projects and programs. VASG's job is more than building the integrated teams to conduct research, extension, and education; we need to proactively enable the connection and catalyze a reaction between pockets of knowledge. That is where tomorrow's solutions will come from." —VASG Director Troy Hartley, 2012 VASG Annual Report

Rebuilding VASG



Virginia Sea Grant

Safe & Sustainable Seafood Supply

VASG has historical strengths in seafood-related issues—from sustainable fisheries and aquaculture to seafood safety and culinary education.

Progress Toward Goals

The VASG 2010-14 Strategic Plan contains four goals for safe and sustainable seafood supply, and we have made excellent progress toward fulfilling each of them. Here are some highlights from 2010-2011:

Goal	Progress Highlights
<i>Advance science and support businesses in sustainable fisheries and aquaculture.</i>	<ul style="list-style-type: none"> * Conducted research direct application to making fisheries and aquaculture ecologically and economically sustainable. ✓ * Instituted sustainable aquaculture practices, developed rearing protocols for new aquaculture species, and provided the only annual assessment of economic trends in the Virginia shellfish aquaculture industry. * Initiated student-driven research into the market for a community supported fishery in Williamsburg.
<i>Improve understanding and use of best practices in seafood safety, product development, and processing.</i>	<ul style="list-style-type: none"> ✓ * Developed and tested new processing and packaging equipment, procedures, and materials for crab and oysters. * Expanded the market for aquacultured shrimp and cobia.
<i>Provide science to stakeholders and facilitate their involvement in decision making.</i>	<ul style="list-style-type: none"> * Improved stock assessment tools and techniques through better estimates of fish growth and mortality. ✓ * Improved understanding of blue crab reproduction, juvenile habitat use, and responses to management actions to help managers better regulate the fishery. * Studied the health risks of shellfish grown near wastewater treatment plants and developed methods to decontaminate those shellfish. * Conducted network analysis that contributed to improvements in ecosystem-based fisheries management for Chesapeake Bay.
<i>Provide support and guidance to industry to improve food safety and quality.</i>	<ul style="list-style-type: none"> ✓ * Tested Virginia shellfish processors for Listeria and helped institute safety procedures to prevent contamination. * Provided HACCP certification for hundreds of seafood processing industry employees and bilingual Spanish and English seafood safety training to over 500.

VASG Organizational Design Highlights 2008-2011

Inclusive, stakeholder-driven strategic planning. Planning is an ongoing, adaptive effort. Stakeholders contribute to plan adjustments at annual Project Participants' Meetings.

Centralized communication capacity in communication center. Launched rebranding initiative through visual identity guidelines, events to increase visibility among stakeholders and state government, and research to better understand target audiences.

Instituted new RFP procedures to address perceived conflicts of interest and engage stakeholder representatives in relevancy reviews (after consultation with VASG, relevancy reviews have been adopted by two NOAA NMFS offices).

Engaged partner institutions through increased advisory input, campus visits, internship programs, and a 50% growth in dues paying university membership.

Increased integration into William & Mary through law externships, joint seminar series, and involvement of undergraduates.

Redefined VASG as an organizational network through a six-university charter, bylaws, and operating procedures, and an agreement with the host institution (VIMS).

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Safe & Sustainable Seafood Supply

2008-2009 was a period of reorganization and renewal for VASG, but we built upon historical strengths in the program. 2010 saw the launch of a renewed VASG under a new strategic plan.

Selected 2008-2009 Impacts

- * Developed new, better performing oyster lines that were adopted by commercial oyster growers.
- * Improved methods for determining summer flounder quotas that was subsequently used by the Virginia Marine Resource Commission (VMRC).
- * Estimated natural mortality rates from striped bass tagging data to inform management efforts by the Atlantic States Marine Fisheries Commission.
- * Developed new fish mortality estimation methods that were put in place by the National Marine Fisheries Service for stock assessment of monkfish, five species of skates, and sea scallops.
- * Improved understanding of cownose ray biology to help address ray interactions with oyster aquaculture.
- * Collaborative research to determine the best gillnet mesh sizes for avoiding bycatch of American shad, Atlantic sturgeon, and large reproductive striped bass in the striped bass fishery, leading to changes in mesh size regulations by the VMRC.
- * Demonstrated a genetically unique, naturally reproducing Atlantic sturgeon stock in the James River, contributing to the 2012 decision to list the species as endangered.
- * Organized the second biennial meeting for the Virginia aquaculture industry to inform industry members of relevant science and encouraged networking and sharing of best practices.
- * Tested new packaging for pasteurized crab that improved shelf life and led to adoption by a local crab processor.

2010-2011 Impacts Recap (from PIER)

- * PIER output includes impacts in renewable energy for aquaculture, crab pot bycatch reduction, assistance to the oyster hatchery industry, crab fishery management, shellfish regulations near wastewater treatment plants, and prevention of shellfish contamination.

Selected Performance Measures (2008-2011)



563 culinary students and chefs received marine science programming



298 seafood processing employees HACCP trained

Catalyzing Connections

Building on the organizational growth of the last five years, VASG is continuing to innovate. We are redefining integration—forging new links across institutions, functional areas, and topical focus areas.

Convening researchers, students, industry, managers, and state government to explore ideas and network at Annual Project Participants' Symposium and Seafood Reception.

Connecting science grad students with end-user mentors through Graduate Research Fellowships to ensure application of research to real-world decisions.

Connecting across disciplines to involve students and researchers from marine science, social science, law schools, business schools, and communication schools in projects on community supported fisheries, ecosystem-based management, adaptation to sea-level rise, and more.

Involving courses and students in research by structuring RFPs, internships, and research projects to use student capacity to solve coastal and ocean resource problems (e.g. pairing students and faculty with coastal community planners to address climate change adaptation).

New programs train students in science communication, including partnerships with VIMS to train marine science students in teaching, with George Mason University to host a graduate intern in communication research, and with Thomas Nelson Community College for photography interns.

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Safe & Sustainable Seafood Supply

Ideas, Innovation, Integration

New Fellowship in Collaborative Fisheries Research

Together with the Southeast Fishery Science Center (SEFSC), Northeast Consortium, University of New Hampshire, Virginia Institute of Marine Science, and University of Massachusetts (Dartmouth), VASG launched the Collaborative Fisheries Research Fellowship pilot from 2009-2011.

- * Fellows conduct gear technology and conservation engineering research in collaboration with the fishing industry.
- * Fellows took an innovative, distance-learning course on the Theory & Practice of Collaborative Fisheries Research.
- * VASG created e-networking tools for students to share experiences and lessons learned while doing collaborative fisheries research.
- * Fellowship is continuing with a VASG-SEFSC partnership to support fellows.



Investigating a Community Supported Fishery for Williamsburg

VASG is leading a multidisciplinary team from William & Mary's schools of business, law, and marine science that is doing research to lay the groundwork for a community supported fishery (CSF) in the Williamsburg, VA, area.

- * Nation's first systematic research into who is interested in CSFs and why.
- * Half of all business start-ups fail in the first five years. This research aims to take lessons from the organizational design of established CSFs, to help future CSFs succeed.
- * Undergraduate and graduate students, interns, law students, VASG staff, and the National Sea Grant Law Center have teamed up to do local market research, a national survey and guide to the legal aspects of CSFs.



Educating Chefs about Fisheries, Marine Science, and Sustainability

The VASG education program has a longstanding strength in culinary education—including organizing the annual Chefs' Seafood Symposium for culinary professionals and students.

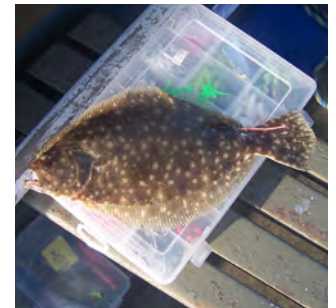
- * Collaboration between VASG Marine Extension Program and the American Culinary Federation's Virginia Chefs Association.
- * Bridges ocean literacy and fisheries—marine scientists and chefs provide the latest information on seafood science, fisheries issues, and cooking techniques.
- * Annual program held its 20th symposium in 2011.
- * Hosted 563 culinary students and professionals from 2008-2011.



Volunteer Taggers Provide Valuable Fisheries Data

The VASG recreational fishing specialist manages the Virginia Game Fish Tagging Program (VGFTP), which trains recreational anglers to tag and release fish and record recapture data.

- * Connects volunteers and extension staff to researchers and students who use the data.
- * Virginia's NMFS Sea Grant Population Dynamics Fellow Mark Henderson is using 10 years (over 47,500 data points) of VGFTP data on summer flounder for his dissertation research estimating mortality in this species.
- * 16 years of cobia tagging data from the VGFTP will be used in NOAA stock assessment efforts.
- * Program provides data for fisheries management while improving understanding of fisheries science in the angling community.



Virginia Sea Grant

Safe & Sustainable Seafood Supply

Lasting Impacts

Establishing and Ensuring a Sustainable Oyster Aquaculture Industry for Virginia

VASG-supported research and extension has been central to a resurgence in the Virginia oyster industry as cultured oysters take the place of depleted wild stocks, and has also established Virginia as the East Coast's largest hard clam producer.

- * Prior to 2008, VASG-funded researchers at VIMS's Aquaculture Genetics and Breeding Technology Center (ABC) developed disease-resistant oyster lines now used by industry.
- * VASG shellfish aquaculture specialists Mike Oesterling and Karen Hudson have worked with industry to ensure best practices, provide access to science, and document economic trends.
- * VASG's Shellfish Aquaculture Situation and Outlook Report shows cultured oyster sales have steadily grown since 2005, reaching a value of \$23.3 million in 2011. The Report also shows rapid growth in oyster hatcheries.
- * Current research and extension efforts focus on larval optimization and on facilitating collaboration among hatcheries to address water quality issues.
- * Current funding to ABC is supporting continued optimization of oyster stocks to ensure competitiveness and sustainability of Virginia's industry.



A Career of Contributions to Understanding Oyster Disease

In 2011, VASG, Maryland Sea Grant, and the Chesapeake Research Consortium awarded the prestigious Mathias Medal to Gene Burreson for his career studying shellfish pathology, monitoring oyster diseases, and providing information critical for developing oyster-management strategies. Burreson's research benefitted from Sea Grant support throughout his 30-plus year career.

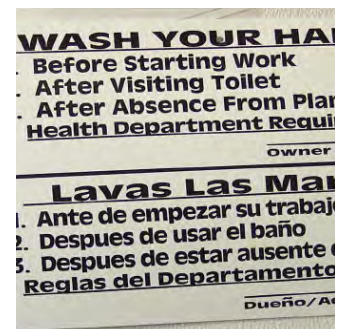
- * As a graduate student in the 1970s, Burreson worked with Oregon Sea Grant on fish parasites.
- * As a faculty member at VIMS in the late 90s and through the 00s, Burreson's research on shellfish disease was supported by VASG and MDSG.
- * Burreson's landmark work includes identifying the oyster parasite MSG and pinpointing its source, as well as pioneering important methods for detecting shellfish pathogens.
- * Throughout his career, Burreson encouraged and facilitated the use of his research results by industry and management to ensure sustainable shellfish harvesting in the Bay.

"Success with oyster management comes in very small steps, but at least during my career [Burreson was] involved right along the way in every step, and the success that we're seeing here today has a lot to do with science [he] developed and the input that [he] had to the management process." —Jack Travelstead, Commissioner, VMRC

Ensuring Safety for Seafood Consumers and Seafood Industry Workers

VASG extension staff provide seafood safety training to hundreds of industry workers a year.

- * From 2009-2011, 298 industry members received HACCP training.
- * Much of Virginia's seafood processing workforce consists of Hispanic workers on work visas. In 2011, 463 workers received safety training in Spanish and English.
- * VASG extension staff also certify and inspect seafood processing facilities and equipment to ensure safety and adherence to regulations.
- * In 2011, staff provided microbial analysis to 16 seafood processors.



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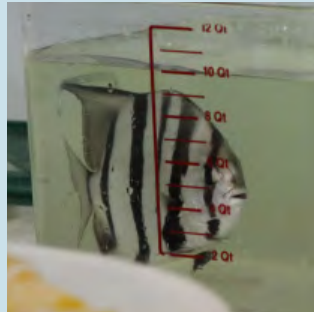
Safe & Sustainable Seafood Supply

Lasting Impacts

Leading the way in Finfish Aquaculture Research and Extension

VASG extension staff at both VIMS and Virginia Tech have made major contributions to finfish aquaculture from research and development on new aquaculture species to marketing to global leadership and training.

- * Developed rearing protocols and designed seawater systems for aquaculture of cobia and spadefish. Cobia protocols are now in use in a growing cobia aquaculture industry.
- * Developed innovative marketing strategies for aquacultured fish and prawns.
- * Provided technical assistance to help aquaculture facilities in Virginia use renewable energy sources—one model project has involved installation of an anemometer to evaluate the prospects for wind energy and a solar water heating system that saves thousands in propane costs.



Bycatch Reduction, from Sturgeon to Turtles

VASG has a longstanding strength in supporting research and extension to address fisheries bycatch and fisheries interactions with endangered and threatened species.

- * In 2008, VASG's staff conducted gear tests and bycatch studies on the gill- and pound-net fisheries that informed regulators.
- * In 2009, VASG staff contributed to research that documented a distinct population of Atlantic sturgeon in the James River and developed gillnet configurations for the striped bass fishery to reduce sturgeon bycatch.
- * Five collaborative research projects were funded from 2008-2011 by the Virginia Fisheries Resource Grant program for fishermen working with VASG extension staff on bycatch reduction in gill-net fisheries.
- * 2010 research projects included addressing terrapin bycatch in the blue crab fishery by mapping and modeling areas of overlap between terrapin habitat and crab fishing.
- * All five Collaborative Fisheries Research Graduate Fellows in the pilot program (2009-2011) conducted bycatch reduction research, from turtle exclusion devices on shrimp trawls to shark bycatch on longlines to bycatch reduction in trawl fisheries for groundfish.

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Sustainable Coastal Development

VASG has strong ongoing programming in coastal community economic development, as well as emerging programs assisting coastal communities in planning for climate change adaptation.

Progress Toward Goals

The VASG 2010-14 Strategic Plan contains four goals for Sustainable & Resilient Coastal Communities, our focus area that combines Sustainable Coastal Development and Hazard Resilient Coastal Communities. Three of those goals align most closely with Sustainable Coastal Development, and we have made excellent progress toward fulfilling each of them. Here are some highlights:

Goal	Progress Highlights
<i>Advance sustainable coastal economies.</i>	<ul style="list-style-type: none"> ✓ * Initiated national working waterfront conference that led to legislation. * Assisted marinas in obtaining Department of Interior funding for infrastructure.
<i>Encourage citizens, leaders, and industry to recognize trade-offs and work for sustainability and balance.</i>	<ul style="list-style-type: none"> * Economic analyses of boating industry helped communities evaluate trade-offs. * Sponsored York River Use Conflict Committee that led to recommendations for local planners. ✓ * Governance network analysis suggested actions to take for better ecosystem-based fisheries management. * Engaged communities in facilitated listening sessions on climate adaptation planning.
<i>Promote sustainable use and protection of land, energy, and water resources.</i>	<ul style="list-style-type: none"> ✓ * Technical assistance allowed fish farm to adopt renewable energy technology to heat water. * Student-faculty team made recommendations on sea-level rise adaptation strategies to Virginia Beach city government.

VASG Organizational Design Highlights 2008-2011

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Centralized communication capacity in communication center. Launched rebranding initiative through visual identity guidelines, events to increase visibility among stakeholders and state government, and research to better understand target audiences.

Instituted new RFP procedures to address perceived conflicts of interest and engage stakeholder representatives in relevancy reviews (after consultation with VASG, relevancy reviews have been adopted by two NOAA NMFS offices).

Engaged partner institutions through increased advisory input, campus visits, internship programs, and a 50% growth in dues paying university membership.

Increased integration into William & Mary through law externships, joint seminar series, and involvement of undergraduates.

Redefined VASG as an organizational network through a six-university charter, bylaws, and operating procedures, and an agreement with the host institution (VIMS).

"[VASG offers] good insights to adaptive management of network activities into the future and represent fresh thinking by Virginia Sea Grant management that the rest of the Sea Grant Network could benefit from."

NOAA August 10, 2010, Site Review
Team Final Report, July 9-10, 2012
Review of Virginia Sea Grant Program.

Virginia Sea Grant

Sustainable Coastal Development

2008-2009 was a period of reorganization and renewal for VASG, but we built upon historical strengths in the program. 2010 saw the launch of a renewed VASG under a new strategic plan.

Selected 2008-2009 Impacts

- * Convened a national meeting of working waterfront stakeholders that led to national collaboration and the introduction of a working waterfront preservation amendment to the reauthorization of the Coastal Management Act.
- * Researched the impact of personal property taxes on boat owners in Hampton to inform City Council tax policy decisions.
- * Provided grant preparation assistance that generated \$1.43 million in economic impact in 2009 through Department of Interior Boating Infrastructure Grants to Virginia Marinas.
- * Funded the creation of the York River Use Conflict Committee, which made recommendations to planners in Mathews and Gloucester County and has led to exploration of developing an offshore aquaculture business park.

2010-11 Impacts Recap (from PIER)

- * PIER output includes impacts from economic assessments, Boating Infrastructure Grant assistance (\$5.2 million in economic impact), ecosystem based fisheries management, climate change adaptation, and renewable energy technology in the aquaculture industry.

Selected Performance Measures (2009-2011)

Over \$38 million in economic benefits to communities.



86 jobs created.

294 jobs retained.

Catalyzing Connections

Building on the organizational growth of the last five years, VASG is continuing to innovate. We are redefining integration—forging new links across institutions, functional areas, and topical focus areas.

Convening researchers, students, industry, managers, and state government to explore ideas and network at Annual Project Participants' Symposium and Seafood Reception.

Connecting science grad students with end-user mentors through Graduate Research Fellowships to ensure application of research to real-world decisions.

Connecting across disciplines to involve students and researchers from marine science, social science, law schools, business schools, and communication schools in projects on community supported fisheries, ecosystem-based management, adaptation to sea-level rise, and more.

Involving courses and students in research by structuring RFPs, internships, and research projects to use student capacity to solve coastal and ocean resource problems (e.g. pairing students and faculty with coastal community planners to address climate change adaptation).

New programs train students in science communication, including partnerships with VIMS to train marine science students in teaching, with George Mason University to host a graduate intern in communication research, and with Thomas Nelson Community College for photography interns.

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Sustainable Coastal Development

Ideas, Innovation, Integration

Developing New Market Niches for Aquacultured Oysters

VASG extension staff at Virginia Tech and VIMS are working with the state's oyster aquaculture industry to develop a differentiated market for Virginia's half-shell oysters.

- * Cosponsored new annual oyster tasting event (2010 and 2011) to showcase local growers and encourage customers to explore taste profiles and differentiate between oysters from different locations.
- * Partnered with Virginia Marine Products Board to conduct oyster taste profile training to teach board staff, industry members, extension staff, culinary industry representatives how to better differentiate flavors of half-shell oysters.
- * Organized a workshop for oyster growers that exposed them to national leaders in the high-end oyster market to help them consider new markets.



Committee Addresses Use Conflicts, Encourages Innovation

In 2007, VASG, Virginia CZM Program, and Middle Peninsula Planning District Commission (MPPDC) supported the formation of the York River Use Conflict Committee to help county government deal with conflicting pressures on their waterfronts.

- * Local marine spatial planning effort seen as testing ground for innovative planning at the local scale
- * Committee's recommendations in 2008 included supporting working waterfront infrastructure and defining a Coastal Living Policy. All recommendations have been adopted by Gloucester County
- * As a result of the report, Mathews County began considering the development of an underwater aquaculture business park in county waters.

Lasting Impacts

National and Local Leadership on Working Waterfront Issues

VASG convened working waterfront stakeholders for a meaningful dialog that has led to continued enhanced collaboration between those interested in tourism, coastal access, coastal and marine jobs, waterfront infrastructure and more.

- * VASG Marine Extension Program leader led the effort to bring together a wide range of stakeholders to exchange ideas—resulting in Water Access 2007: National Symposium on Working Waterways and Waterfronts in Norfolk.
- * That meeting sparked a national initiative on water access that culminated in the introduction of the Keep America's Waterfronts Working Act (HR3223), which would amend the Coastal Zone Management Act to help retain working waterways.
- * VASG was again instrumental in initiating a follow-up symposium in Maine in 2010 and is helping plan for a 2013 meeting in Tacoma, Washington.



Economic Analyses Lead to Smarter Decision Making

The VASG Marine Extension Program at VIMS provides technical assistance to coastal communities throughout the state on economic development, workforce issues, and recreational boating infrastructure.

- * Over \$2 million in Boating Infrastructure Grants to Virginia marinas between 2009 and 2011, obtained with assistance from the VASG marina specialist.
- * In 2009, the VASG extension staff conducted a study of the impact of boat taxes on boat owners in Hampton, VA, which helped the city evaluate its options regarding tax policy.
- * In 2011, VASG research documented the economic value of recreational boating in Middlesex County to help the county assess whether to proceed with a dredging project to preserve boater access. As a result, the county was able to secure \$105,000 for the dredging project, which will result in an estimated \$225,000 in economic impact.

Virginia Sea Grant


Hazard Resilient Coastal Communities

VASG's program in hazard resiliency is relatively new, but we have introduced innovative models for helping coastal communities deal with storm surges and sea-level rise and plan for climate change adaptation.

Progress Toward Goals

The VASG 2010-14 Strategic Plan contains four goals for Sustainable and Resilient Coastal Communities, our focus area that combines Sustainable Coastal Development and Hazard Resilient Coastal Communities. One of those goals aligns most closely with Hazard Resilient Coastal Communities, and we have made excellent progress toward fulfilling this goal in multiple Virginia coastal communities:



Goal	Progress Highlights
<i>Build coastal community capacity to prepare, adapt, and respond to climate change impacts and other natural and human hazards</i>	 * VASG initiated projects that are beginning to see positive impacts. The Coastal Community Adaptation Initiative has led to four successful collaborations between student-faculty teams and community planners, ranging from storm-tide forecasting to citizen focus groups.

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Hazard Resilient Coastal Communities

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2008-2009 Impacts

- * Hazard Resilient Coastal Communities was a new area of focus in our 2010-2014 strategic plan. Thus there are no 2008-2009 impacts to report.

2010-11 Impacts Recap (from PIER)

- * PIER output includes impacts and accomplishments in developing a real-time tide monitoring system, creating a database of climate change impacts, and initiating public listening sessions about climate adaptation planning.

Catalyzing Connections

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Hazard Resilient Coastal Communities

Ideas, Innovation, Integration

Students and Faculty Serve Coastal Community Clients in Planning for Sea-Level Rise

Launched in 2010, VASG's Coastal Community Adaptation Initiative pairs student-faculty teams with community planners to help address adaptation to sea-level rise. VA coastal communities are among the most threatened by sea-level rise in the nation.

- * 2010 projects included student-faculty teams from UVA, Virginia Tech, and VIMS conducting listening sessions in Virginia Beach, researching adaptation planning options for rural and urban communities, and incorporating water level monitoring into emergency response management in Poquoson, VA.
- * Students and faculty helped coastal communities do case studies, evaluate planning options, engage the public in discussions of sea-level impacts, and assess citizens' attitudes toward different planning approaches.
- * Follow-up work in 2011 has generated considerable attention for focus group discussions in Virginia Beach, the Middle Peninsula, and the Eastern Shore.
- * The 2011 Mid-Atlantic Sea Level Rise and Inundation RFP, managed by VASG, supported a complementary effort in Anne Arundel County, MD, by an interdisciplinary team led by George Mason University to generate a sea-level rise visualization tool and evaluate the effects of that tool and other education offerings on citizens' attitudes toward policy options. The visualization tool and methods this project developed are being made available online and will be translatable to other communities.

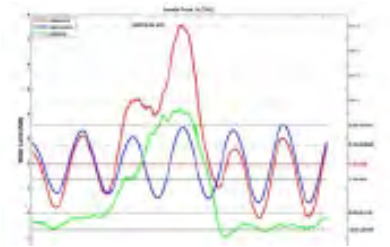


UVA Masters Student Melissa Keywood received NOAA's Jones Award for Excellence in Coastal Management for her work leading sea-level rise listening sessions in Virginia Beach.

Real-Time Tide Monitoring System Works for Local Businesses, Citizens, Governments

VASG-funded researchers have developed TideWatch, a website where Virginians can get up-to-date information about tide levels at six monitoring stations.

- * Researchers and VASG have conducted outreach with marina owners, emergency managers, and local governments.
- * Marina owners have benefitted from real-time tide monitoring data during storms since 2009. Marinas and their customers were better able to protect property during 2011's Hurricane Irene.
- * National Weather Service and emergency managers used an experimental flood forecasting system, also developed by VASG-funded researchers to make evacuation decisions during Hurricane Irene.



"We are very fortunate to have a - this tool to assist us in our decision making process" —Michael Bryant, Hampton, VA, Deputy Fire Chief and Emergency Manager.

Virginia Sea Grant

Healthy Coastal Ecosystems

VASG has a strong history of research and education efforts in healthy ecosystems, with an emphasis on fisheries-ecosystem interactions.

Progress Toward Goals

The VASG 2010-14 Strategic Plan contains two goals for Healthy Coastal & Ocean Ecosystems, and we have made excellent progress toward fulfilling each of them. Here are some highlights:

Goal	Progress Highlights
<i>Develop and provide sound science to support ecosystem-based approaches.</i>	<ul style="list-style-type: none"> ✳ Conducted joint funding and joint staff efforts with other states in the region to support research leading to ecosystem-based approaches on a regional scale. ✓ ✳ Improved blue crab management by providing stock assessment data and verifying the effectiveness of gear modifications and management strategies. ✳ VASG staff selected to sit on National Research Council committee to assess fisheries stock rebuilding efforts.
<i>Support use of integrated, ecosystem based approaches to managing resources and enhancing ecosystem resilience.</i>	<ul style="list-style-type: none"> ✳ Mapped terrapin habitat and studied its overlap with the blue crab fishery in order to reduce bycatch. ✓ ✳ Mapped governance networks for Chesapeake Bay management and provided analysis to improve the effectiveness of ecosystem-based approaches. ✳ Modeled the requirements for oyster restoration success, demonstrating the importance of shell budget and the effectiveness of rotational harvesting currently in effect in the Rappahannock River.

VASG Organizational Design Highlights 2008-2011

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Centralized communication capacity in communication center. Launched rebranding initiative through visual identity guidelines, events to increase visibility among stakeholders and state government, and research to better understand target audiences.

Instituted new RFP procedures to address perceived conflicts of interest and engage stakeholder representatives in relevancy reviews (after consultation with VASG, relevancy reviews have been adopted by two NOAA NMFS offices).

Engaged partner institutions through increased advisory input, campus visits, internship programs, and a 50% growth in dues paying university membership.

Increased integration into William & Mary through law externships, joint seminar series, and involvement of undergraduates.

Redefined VASG as an organizational network through a six-university charter, bylaws, and operating procedures, and an agreement with the host institution (VIMS).

"[VASG offers] good insights to adaptive management of network activities into the future and represent fresh thinking by Virginia Sea Grant management that the rest of the Sea Grant Network could benefit from."

NOAA August 10, 2010, Site Review
Team Final Report, July 9-10, 2012
Review of Virginia Sea Grant Program.

Virginia Sea Grant

Healthy Coastal Ecosystems

2008-2009 was a period of reorganization and renewal for VASG, but we built upon historical strengths in the program. 2010 saw the launch of a renewed VASG under a new strategic plan.

Selected 2008-2009 Impacts

- * Enhanced wastewater treatment plants compliance with new regulations on effluents by determining how much and what forms of nitrogen in effluent are available for uptake by organisms. Research demonstrated that organic nitrogen should be included in release limits from wastewater treatment plants and in overall nutrient budgeting for Chesapeake Bay.
- * Research projects on juvenile fish habitats, dispersal, and growth produced new knowledge and understanding of fish population dynamics in the Chesapeake Bay and support improvements in management and habitat protection.
- * Improved understanding of cownose ray biology and reproduction in order to evaluate and manage cownose ray interactions with shellfish aquaculture and prevent cownose ray predation on shellfish through aquaculture cage design.

2010-11 Impacts Recap (from PIER)

- * PIER output includes impacts and accomplishments in regional ecosystem research, understanding blue crab biology and management, network analysis of fisheries management efforts, research on seagrass restoration requirements, and more.

Catalyzing Connections

Building on the organizational growth of the last five years, VASG is continuing to innovate. We are redefining integration—forging new links across institutions, functional areas, and topical focus areas.

Convening researchers, students, industry, managers, and state government to explore ideas and network at Annual Project Participants' Symposium and Seafood Reception.

Connecting science grad students with end-user mentors through Graduate Research Fellowships to ensure application of research to real-world decisions.

Connecting across disciplines to involve students and researchers from marine science, social science, law schools, business schools, and communication schools in projects on community supported fisheries, ecosystem-based management, adaptation to sea-level rise, and more.

Involving courses and students in research by structuring RFPs, internships, and research projects to use student capacity to solve coastal and ocean resource problems (e.g. pairing students and faculty with coastal community planners to address climate change adaptation).

New programs train students in science communication, including partnerships with VIMS to train marine science students in teaching, with George Mason University to host a graduate intern in communication research, and with Thomas Nelson Community College for photography interns.

Virginia Sea Grant

Healthy Coastal Ecosystems

Ideas, Innovation, Integration

Regional RFPs Provide Forum for Collaboration

Virginia, Maryland, and Delaware Sea Grant programs have combined forces to support a regional RFP for research that is relevant to all three states.

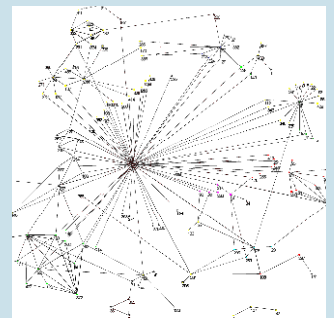
- * Regional RFP has supported research on larval fish dispersal in Chesapeake and Delaware Bays and on the connection between land use and water quality in coastal bays of the Delmarva Peninsula.
- * RFP forges relationships between researchers in neighboring states and allows PIs to benefit from facilities and resources in neighboring states.
- * The success of regional research has led to additional Mid-Atlantic regional efforts, including invasive species research and outreach, research on the socioeconomic aspects of fisheries management, and a priority-setting exercise for Mid-Atlantic Coastal Zone Management Programs that resulted in an RFP to support regional work on policy approaches to sea-level rise and inundation.



Bringing Social Science to Ecosystem Based Fisheries Management

VASG staff is bringing expertise in network analysis to bear on improving fisheries management in Chesapeake Bay.

- * Worked with VASG Coastal Law and Policy Interns to analyze the governance network for ecosystem-based fisheries management in the Bay.
- * VASG's analysis illustrated a lack of connectivity between local, state, and regional governance and pinpointed areas for improvement.
- * VASG staff member has been selected to serve on a National Research Council committee to assess the effectiveness of fisheries stock rebuilding plans at the request of the U.S Congress.



Lasting Impacts

Blue Crab Biology and Management

Blue crabs are the most valuable fishery in the Chesapeake Bay, an iconic symbol of the Bay, and an important predator in Bay ecosystems. In the past decade, reductions in crab numbers have led to management decisions that have had a large impact on the crab industry. VASG has a track record of supporting important research that is informing managers as they restore and preserve the fishery and the ecosystem that depends on healthy crab populations.

- * Studies funded in the last three RFP cycles have examined blue crab mating behavior and juvenile habitat use and have produced results that have direct implications for managers. These results have informed the Virginia Marine Resources Commission and been incorporated into stock assessments.
- * VASG-funded researchers demonstrated that blue crab populations have recovered since a Virginia banned the winter dredge fishery for female blue crabs in 2008. This result validated managers' swift response to the population decline.
- * VASG-funded researchers have shown that bycatch-reduction devices (BRD) are effective in reducing terrapin bycatch in the blue crab fishery while retaining blue crab catches. Another team of VASG-funded researchers are now mapping terrapin habitat to help determine how best to target the use of BRDs where terrapins and crab fishing overlap.



Virginia Sea Grant

Healthy Coastal Ecosystems

Lasting Impacts

Studying the Coupled Human-Ecological System of Aquacultured Clam Beds

It is often assumed that aquacultured clams clean the water and thus have a positive impact on coastal bay ecosystems, but clam aquaculture has become so intensive in some of Virginia's coastal bays that more study is needed to ensure that the industry and the ecosystem remain sustainable.

- * VASG-funded researchers, including a VASG Graduate Research Fellow, are investigating the impact of clam beds on nutrient levels in a coastal bay.
- * Clam growers in this bay are collaborating with researchers in the hopes that understanding any negative impacts of clam aquaculture will help them adapt their practices to keep their business sustainable and the bay healthy.
- * Past VASG-funded research in 1999-2000 and 2003-2004 set the stage for this study with investigations of the carrying capacity for hard clams and of the interactions of aquacultured hard clams with submerged aquatic vegetation.



The Science Behind Restoring Seagrass Ecosystems

Seagrass ecosystems dominated Virginia's coastal bays until the 1930s, but were almost completely destroyed by disease and storms. As a result, species such as bay scallops, which depended on seagrass for habitat, underwent a collapse and have yet to recover. Seagrass restoration has begun to gain a foothold on Virginia's Eastern Shore.

- * A team of VASG-funded researchers, including a VASG Graduate Research Fellow, are evaluating models that use physical variables to explain and predict where seagrass can grow and translating these models for managers.
- * Another VASG Graduate Research Fellow is comparing seagrass growth at different sites and evaluate differences in nutrients and other variables between these sites.
- * A third group of VASG-funded researchers are evaluating the effects of predation on juvenile bay scallops so that they can be restored as seagrass ecosystems return.
- * In 2008, seagrass researchers worked with VASG educators to offer a workshop on seagrass for classroom teachers.

Restoring Oysters to Virginia's Creeks

The success or failure of oyster restoration efforts in the Chesapeake Bay have been a source of some controversy in the past several years, but the historic importance of oysters to Bay ecosystems is indisputable.

- * In 2009, the Army Corps of Engineers and the states of Virginia and Maryland jointly decided not to allow use of the non-native oyster *Crassostrea ariakensis* in oyster restoration or aquaculture efforts. Between 1999 and 2006, VASG funded extensive research into the risks, benefits, and basic biology of *C. ariakensis* to inform managers on the best science in order to make this difficult decision
- * VASG-funded researchers have also been studying the parameters necessary for successful restoration of native oysters, including water and bottom conditions, diseases, and population dynamics.
- * VASG has a decade-long track record of supporting research on oyster breeding and disease, including work by Gene Burreson (winner of the 2011 Mathias Medal for lifetime achievement in science-to-management impacts) on identifying and screening for oyster diseases, and by the VIMS's Aquaculture Genetics and Breeding Technology Center (ABC) to develop disease-resistant oysters. In addition to making the recent impressive growth in Virginia's oyster aquaculture industry possible, this research set the stage for better outcomes in oyster restoration.







Virginia Sea Grant

Coastal & Ocean Literacy

VASG has a history of very strong programming and national leadership in coastal and ocean literacy, including online teacher resources, teacher training, and culinary education programs.

Progress Toward Goals

The VASG 2010-14 Strategic Plan contains four goals for Coastal & Ocean Literacy, and we have made excellent progress toward fulfilling each of them. Here are some highlights:

Goal	Progress Highlights
<i>Elevate awareness and understanding of coastal and ocean science to support better decision making.</i>	<ul style="list-style-type: none"> ✓  * Annual Blue Crab Bowl engages high school students in marine science and inspires them to pursue marine science careers. * Communication center created in 2010 has increased the reach of VASG stories and products and is designing comprehensive strategies for reaching target audiences.
<i>Enhance scientists' and extension staffs' ability to communicate about their work.</i>	<ul style="list-style-type: none"> ✓  * Provided several new science communication training offerings to VIMS graduate students, project PIs, and staff. * Worked with researchers to create classroom activities that use their data. * Launched undergraduate and graduate internship programs in science communication.
<i>Improve educators' ability to teach coastal and ocean science.</i>	<ul style="list-style-type: none"> ✓  * Provided professional development workshops for teachers. * Trained graduate students in teaching methods and placed them in local classrooms to work with teachers through the GK-12 PERFECT program. * Maintained and added valuable content to the Bridge, an online marine science resource for teachers nationwide.
<i>Increase awareness and understanding of health, safety, and sustainability among the culinary community and consumers.</i>	<ul style="list-style-type: none"> ✓  * Organized educational programs for culinary professionals and students that expose them to marine science information related to seafood sustainability and safety. * Established a database of information about mercury levels in lower Chesapeake Bay finfish.

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Virginia Sea Grant

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Selected 2008-2009 Impacts

- * The Bridge online resource (average of 50,000 hits per month) and Scuttlebutt listserv (average of 29 emails per day) gave teachers access to resources, data, and networking opportunities to improve their students' classroom experiences.
- * NSF-funded GK-12 PERFECT program (led by VASG education staff) trained 12 science graduate students in science communication and teaching methods and placed them with teacher mentor in local classrooms for the 2009-2010 academic year.

2010-11 Impacts Recap (from PIER)

- * PIER output includes impacts and accomplishments from the Chefs' Seafood Symposium, Blue Crab Bowl, communication center strategy and internships, GK-12 program, the Bridge, teacher workshops, and more.

Selected Performance Measures (2009-2011)



376 culinary students and chefs received marine science programming

Catalyzing Connections

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www.marine-ed.org/bridge

50,000 hits per month (average)
at the Bridge online teacher
resource



146 grad students, staff,
and interns trained in
communicating science



397 teachers trained

Virginia Sea Grant

Coastal & Ocean Literacy

Ideas, Innovation, Integration

Internships Train Students in Science Communication

The VASG communication center has initiated three programs for science communication interns.

- * An undergraduate summer communication internship. We have had four undergraduate summer interns that have focused on video production, writing, design, and communication research.
- * A partnership with George Mason University to host graduate communications research interns. This partnership was initiated late in 2011 and 2012 was the first summer that we hosted a GMU intern, who conducted focus groups to characterize our audiences and their communication needs.
- * A partnership with Thomas Nelson Community College, beginning in summer 2011 to host photography interns. We have hosted four photography interns during summer, fall, and spring semesters and plan to expand this internship to design students from TNCC.



Creating Social Networks and Providing Resources for VASG Fellows

Since 2009, VASG has created two new graduate fellowship programs and continued its excellent track record in securing Knauss and other national Sea Grant, NMFS, and NOAA fellowships for Virginia students.

- * Collaborative Fisheries Research Fellows benefit from an innovative, distance-learning course on the Theory & Practice of Collaborative Fisheries Research and e-networking tools for students to share experiences and lessons learned while doing collaborative fisheries research.
- * VASG is developing similar networking and training programs for Graduate Research Fellows, Virginia's Knauss Fellows and other fellows.
- * 2012 VASG Project Participants' Symposium offered students, fellows, and other attendees a session on communicating science.



Scientists Learn Teaching, Communication Techniques

In 2009, VASG educators initiated two projects that are providing communication and teaching training for science graduate students and staff at Virginia Institute of Marine Science (VIMS)

- * NSF-funded GK-12 program places VIMS grad students in local middle and high school classrooms with teacher mentors. GK-12 fellows also get extensive training in communication and teaching methods. Since starting in 2009, the program has trained 23 GK-12 fellows.
- * VASG educators have worked with COSEE and Lawrence Hall of Science in California to develop a series of seminars in Communicating Ocean Science that are offered to VIMS staff and students on a yearly basis.



Virginia Sea Grant

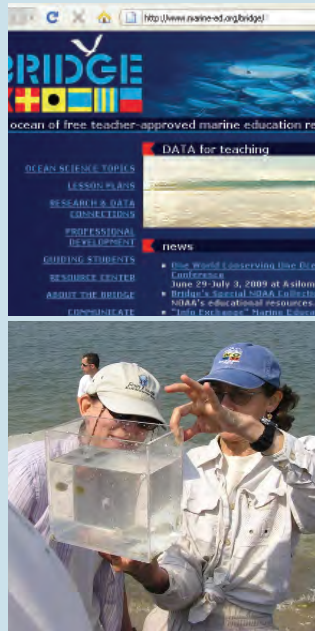
Coastal & Ocean Literacy

Lasting Impacts

Pioneering Online Resources Have National and International Reach

The Bridge, an online clearinghouse of ocean science resources for teachers, provides vetted and reviewed web pages and activities that are easy for teachers to use in the classroom.

- * Launched in 1998, just two years after Google, the Bridge anticipated teachers' need for help navigating ocean science resources online and was there to fill that need.
- * The Bridge celebrated its 10th birthday with a redesign in 2008 and has continued to grow, with an average of 50,000 hits a month over the past four years..
- * Scuttlebutt listerv for teachers, also maintained by VASG educators, allows teachers and informal educators from around the world to exchange ideas and get questions answered.
- * DATA activities on the Bridge make real research data available in a format that can be used in the classroom, and provides activities and ideas for using that data.
- * Visitors to the Bridge's 556,854 pages of resources come from 195 countries (85% are from the U.S.).



Staff Lead the Marine Education Community

In addition to the programs they provide in teacher training, communicating science, providing online ocean science resources, and more, VASG's education staff takes on important leadership roles in the education community, both inside and outside Sea Grant.

- * VASG educator has served as network chair and member of safe and sustainable seafood national focus group.
- * Multiple VASG education staff have served the Mid-Atlantic Marine Education Association as President and Committee Chair.
- * VASG educators have also served the National Marine Educators Association as President, Board Member, Webmaster, Committee Chair, Newsletter Editor.
- * Educators served the Consortium for Ocean Leadership National Ocean Sciences Bowl as Technical Advisory Panel Member, Chief Rules Judge, and Virginia Regional Competition (Blue Crab Bowl) Organizer.
- * Educators serve on journal editorial boards and review panels.

Educating Chefs about Fisheries, Marine Science, and Sustainability

The VASG education program has a longstanding strength in culinary education—including organizing the annual Chefs' Seafood Symposium for culinary professionals and students.

- * A collaboration between VIMS Sea Grant Marine Advisory Program and the American Culinary Federation's Virginia Chefs Association, with course credit available.
- * Bridges ocean literacy and fisheries—marine scientists and chefs provide the latest information on seafood science, fisheries issues, and cooking techniques.
- * Annual program held its 20th symposium in 2011.
- * Hosted 563 culinary students and professionals from 2008-2011.

