

VIRGINIA SEA GRANT

STRATEGIC ACTION PLAN 2010-2014

PRELIMINARY DRAFT

Virginia's Coastal and Marine Ecosystem Services

In December 1606, three ships departed England for a new land of opportunity. They landed in Jamestown, Virginia, in May 1607, beginning a journey into history that literally changed the world. The cradle of American democracy, the "mother of Presidents," and the birthplace of the Internet, Virginia has a rich, truly American history that is tightly bound to its ecosystem services, products, and functions.

Ecosystem Services: Ecosystem services are direct and indirect benefits that people derive from ecosystem structure, function and processes, ranging from moderating weather and its impacts, dispersing larva, cycling nutrients, and protecting shorelines from erosion, to purifying air and water, regulating disease, and supplying seafood.

{Insert historical image}

The unique coastal and marine ecosystems of Virginia provided the Jamestown Settlement with numerous valuable products and services. In fact, the 104 Englishmen who first landed on the banks of the James River were sponsored by the Virginia Company of London, which hoped to make a profit from the natural resources of the New World. They selected the Jamestown site for its deep-water anchorage and geographically defensible position. While these ecosystem characteristics were beneficial, others presented challenges. The unfamiliar climate, brackish water supply, and lack of food, which may have been aggravated by a prolonged drought, led to disease and death.

Today, Virginia's ecosystems provide valuable goods and services for about 5 million people in our coastal zone. Our seafood industry supplies 123 million meals a year from 562 million pounds of finfish and shellfish caught in our rivers, and in our coastal and Atlantic waters. Virginia is the nation's third largest seafood producer and the largest on the U.S. Atlantic coast. The Chesapeake Bay is the nation's largest and most biologically diverse estuary. Nationwide, 75% of commercially harvested fish and shellfish depend on estuaries and nearby coastal waters for some part of their life cycle. Coastal watershed counties in the U.S. contribute approximately 50% of the nation's gross domestic product (GDP).

Coastal development, a substantial national security and defense presence, offshore energy resources, and the prospect of expanded maritime trade in Virginia's deep-water ports have all contributed to growing local economies. The port in southeastern Virginia supports nearly 200,000 jobs, almost \$700 million in local taxes, and about \$5 billion in payroll revenues. Virginia's Eastern Shore, containing a stretch of natural barrier islands and the last pristine section of the Delmar Peninsula, is home to watermen tilling the tides, family farms, and a multi-million dollar clam aquaculture industry. Coupled with the beauty of the Chesapeake and Mid-Atlantic, these economic strengths give Virginia a highly desirable quality of life.

However, like the original Jamestown Settlement, Virginia today faces serious challenges. Some of our fisheries are in decline. Persistent and emerging threats to our coastal and marine

ecosystem are undermining its health and resilience. Virginia is experiencing coastal land-use transformation, which has implications for natural systems and is leading to a socioeconomic transition that is altering the heritage and character of coastal communities.

Compounding these emerging issues is climate—a powerful agent that is altering sea level, storm surges, and nutrient and water cycles and enabling new invasive species to gain a foothold. Climate change could dramatically impact ecosystem structure and function and the goods and services that ecosystems produce. For example, blue crabs, eelgrass, and oysters could decline or disappear as salinity and temperature increases and precipitation patterns fluctuate. Coastal wetlands will be lost from sea-level rise, while freshwater coastal wetlands will be threatened from saltwater intrusion; both types of wetlands provide critical habitat for many species. Oxygen levels in the Bay are expected to decrease, harming striped bass, blue crabs, and oysters. Climate change will exacerbate the threats from invasive species, pathogens, and pollution. As the water absorbs more carbon dioxide, acidification in the Bay and Mid-Atlantic Ocean will affect shellfish, jellyfish, sea grasses, and other aquatic life. These are complicated and dynamic phenomena, and our citizens, businesses, policy makers, and resource managers are demanding to be informed by the best available science to help them solve the resulting problems.

We are confident that Virginia, its people, and their ingenuity will continue to be at the forefront of American history. We will rise to the occasion and address the challenges we face. Virginia has unmatched coastal and marine infrastructural, professional, and human resources. Virginia's academic and research community is one of the nation's largest and most productive, with nationally ranked institutions and cutting-edge research and technology development. Sitting at the mouth of the Chesapeake Bay, Virginia is uniquely positioned where the Chesapeake watershed and estuary meet the sea. Virginia Sea Grant (VASG) will be here to help us fully benefit from these strengths—funding research, conducting extension and education activities, and producing communication materials that advance safe and sustainable seafood, promote healthy coastal and ocean ecosystems, enhance sustainable coastal development, and ensure that the population is literate about coastal and ocean issues.

Vision

[A] broker of policy alternatives...expands (or at least clarifies) the scope of choices (i.e., alternatives, policy options, forks in the road, etc.) for decision-making. The honest broker enables the freedom of choice by decision-makers.

- Roger A. Pielke, 2007, *The Honest Broker: Making Sense of Science in Policy and Politics*. Cambridge University Press.

VASG is a neutral broker, an intermediary. We take action to advance ecological and socioeconomic resilience and sustainability in coastal and marine ecosystems and communities. We are science-based, advancing research, extension, and education to develop and supply the critical scientific information needed to illuminate options and inform decision making. We do not advocate for any single stakeholder.

With our finger on the pulse of science and our feet on the docks and in the businesses, management boards, and classrooms, VASG is able to anticipate challenges, foresee conflicts,

and help society be proactive regarding coastal resource and marine issues and find constructive solutions.

In this strategic action plan, VASG sets an ambitious road map to tackle the dynamic coastal and marine resource challenges facing Virginia, the region and the nation. While the challenges appear immense and overwhelming, VASG is adaptable, nimble, and innovative. We will enter strategic partnerships and leverage resources to achieve synergistic benefits and magnify our impact.

Mission

VASG's mission is to enhance the ecological, economic, and social sustainability of coastal and ocean communities and the ecosystem services they depend upon through university-based research, extension, education, and communication that provide science-based information to decision makers.

Strategic Imperatives:

- **Partnerships.** VASG operates in partnership with other organizations to achieve synergistic benefits that are effective and efficient. We work with many types of partners, from core functional collaborators to project-specific strategic partners.
- **Relevance and impacts.** VASG strives for demonstrable, real-world impacts on critically important problems and challenges.
- **Integration.** VASG advances the integration of extension, education, communication, and research functions to achieve science-to-management impacts, the broad adoption of technological innovation, and the utilization of science by decision makers.
- **Science-based information.** VASG applies only science-based information in support of decision makers. Science directs our work and supersedes the pressure of political necessities, personalities, or short-term opportunities.
- **Responsive national and regional network.** VASG is part of a national network and is closely aligned with national Sea Grant priorities, we are responsive to the Commonwealth's needs and opportunities, and we pursue regional approaches for multi-state issues.

Core Assets:

- **Experienced, highly talented extension and education staff.** VASG's staff has over 540 years of experience as research, extension, and outreach professionals, marine educators, and communicators. Staff members have direct links and long-term professional relationships with coastal and marine stakeholders throughout the Commonwealth, the region, and the nation.

- ***World-class researchers.*** The Commonwealth of Virginia has an extensive university and college system whose research capacity has been second only to California in the number of National Science Foundation dollars secured over the last five fiscal years.
- ***Graduate student training.*** Sea Grant administers and funds prestigious graduate fellowships, both through its research funding and through dedicated fellowship programs, such as the Knauss Marine Policy Fellowship. Only Washington State has had more of its students hold Knauss Fellowships than Virginia.
- ***Research funding and capacity.*** VASG administers competitive, peer-reviewed research funding programs and maintains organizational capacity to administer and monitor the implementation of research funding.
- ***Advanced communication capabilities.*** VASG maintains a communication center with dedicated staff and advanced communication technologies and strategies to promote science-to-management impacts, the transfer and adoption of technologies, and increased awareness of coastal and marine issues among citizens, policy makers, and resource managers.
- ***Core collaborators.*** In addition to our project-specific partners, VASG operates in partnerships with other organizations and maintains core collaborators that are essential to our function and operations. Our core collaborators include:

Virginia Institute of Marine Science (VIMS)

VIMS is unusual in its melding of three essential public functions: advisory and outreach services, basic and applied research, and formal and informal education and training. With over 550 employees (including 350 scientists, technicians, and students), the Institute is diverse. Nearly every marine science discipline and sub-discipline is represented on the faculty, including marine biology and ecology, marine geology, marine chemistry and geochemistry, physical oceanography, computer modeling, aquaculture, genetics, immunology, toxicology, and coastal management and policy. The *Marine Advisory Services* (MAS) program at VIMS is the central organizational unit for advisory services to the commercial fishing, aquaculture, recreational fishing and boating, and coastal and marine education communities.

VIMS also contains the School of Marine Science, the graduate school in marine science for the College of William & Mary. Chartered in 1940, VIMS is currently among the largest marine research and education centers in the United States.

Virginia Tech

The Virginia Seafood Agricultural Research and Extension Center (VSAREC) was established by Virginia Tech in 1975 in Hampton, Virginia. VSAREC is located in a 9,600 square foot facility on the water adjacent to seafood processing firms and commercial fishing docks, with classrooms, laboratories, and facilities for pilot processing operations. VSAREC provides education, scientific and technical guidance, support, and leadership to the commercial seafood and aquaculture industries throughout

Virginia and the nation, helping them remain economically competitive on a global scale. VSAREC is a component of the *Commercial Fish and Shellfish Technologies* (CFAST) program located on Virginia Tech's main campus in Blacksburg. CFAST works closely with faculty and staff from four Virginia Tech colleges (Agriculture and Life Sciences, Engineering, Natural Resources, and the Virginia-Maryland Regional College of Veterinary Medicine) to implement research and demonstration projects in fisheries and aquaculture.

VASG also maintains close coordination and working relationships with Virginia Tech's Agricultural Experiment Station (VAES), which has faculty in thirteen agricultural research and extension centers in the colleges of Agriculture and Life Sciences, Natural Resources, and Veterinary Medicine.

Old Dominion University

Established in 1969 as the Institute of Oceanography, the *Department of Ocean, Earth and Atmospheric Sciences* is in the College of Sciences. The Department is located in new facilities containing laboratories for biological, chemical and geological studies. In 1991, the Commonwealth Center for Coastal Physical Oceanography began operation and it houses all the physical oceanography laboratories. The Department maintains a 55-foot research vessel, the R/V Fay Slover, and several smaller nearshore vessels. Old Dominion University is a member of the Chesapeake Research Consortium (CRC), the Consortium for Ocean Research and Education (CORE), and an associate member of the University National Oceanographic Laboratory System (UNOLS) and the University of Atmospheric Research (UCAR).

The College of Science consists of seven departments, 160 faculty members, and nearly 30 programs with 2,514 majors (2,116 undergraduate and 498 graduate). Research funding exceeds \$12 million annually, led by the Department of Ocean, Earth and Atmospheric Sciences and the Department of Biological Sciences. The nuclear physics and oceanography programs are nationally ranked.

University of Virginia

Created in 1969, the *Department of Environmental Sciences* in the College of Arts and Sciences offers instruction and conducts research in ecology, geosciences, hydrology, and atmospheric sciences. While the Department's breadth has expanded since its inception, the original emphasis was placed on Virginia and Mid-Atlantic coastal environments, including Chesapeake Bay and the coastal barrier islands. Departmental facilities include labs and computer facilities used by the Global Environmental Change Program (GECP) for processing samples collected at field sites, running computer simulation models, and for remote-sensing, and wet and dry laboratories, dormitories, and meeting facilities on Virginia's Eastern Shore at the Anheuser-Bush Coastal Research Center (ABCRC) in Oyster, Virginia.

The College and Graduate School of Arts & Sciences is the largest of UVA's ten schools, offering more than fifty undergraduate majors and concentrations and more than two

dozen graduate programs. The College comprises more than 10,000 students and more than 750 faculty members.

Planning Process: A commitment to broad-based stakeholder engagement

While strategic planning is a process with a very specific output (i.e., a five-year strategic plan), VASG views the strategic plan as a living document, with our week-to-week, month-to-month, and year-to-year activities and objectives adapting to the needs of the Commonwealth and the region. The strategic planning process is one part of an ongoing dialogue with our stakeholders, who will inform us about what's working, what's not, and what emerging issues are critical to advancing our coastal communities and sustaining our coastal and ocean ecosystem services. VASG is committed to maintaining these lines of communication well beyond the production of a strategic plan document.

The process that initiated this strategic plan began in May 2008, with a meeting of VASG external advisors, followed by a set of meetings with staff and leaders at our academic partner institutions. These meetings set the groundwork and approach for strategic planning, including VASG's four primary focus areas:

- Safe and Sustainable Seafood
- Healthy Coastal and Ocean Ecosystems
- Sustainable Coastal Communities and Hazard Resilience
- Coastal and Ocean Literacy

The Executive Management Team (i.e., Director, Assistant Director, Associate Director, and Communication Director) and senior staff had overall coordinating and oversight responsibilities for the assembly of the strategic plan. Workgroups composed of staff, past or current research principal investigators, external advisors, partner institution advisors, and one or two additional stakeholders were established for each topical focus area. The workgroups were co-chaired by staff and charged with generating text detailing the context, issues, and strategic goals and objectives for each topic area.

VASG maintained a blog dedicated to the development of the strategic plan. The blog included a central calendar of workgroup meetings and activities, updates on progress, opportunities to provide comments, links to existing plans and resources, and workgroup-specific pages where workgroups could share information, review and comment on draft documents, and coordinate workgroup activities. Workgroups were also provided access to a wide range of electronic tools (e.g., blog, wiki, survey monkey, etc.) and resources (e.g., workgroup budgets) to enhanced their reach and engagement and let them target specific stakeholder audiences with the outreach tools that would be most appropriate and effective.

A set of listening sessions, initiated in the fall 2008 and continued in coordination with the workgroup activities through the winter and early spring 2009, were held to solicit stakeholder input. Some meetings were dedicated to strategic planning (e.g., sessions held at partner academic institutions), while others were integrated into existing meetings to optimize stakeholder engagement, input and convenience (e.g., industry association meetings, state-wide

resource management agency annual conference, regular coastal and marine policy and management team meetings, etc.). In total, nearly 100 meetings involving thousands of individuals were part of the VASG strategic planning process—that is, thousands of face-to-face conversations plus hundreds of electronic communication events.

In the spring 2009, the external and partner institution advisory committees will gather to endorse the strategic plan, discuss detailed implementation activities, and provide input on next steps. VASG will host annual participant meetings to ensure continuous reflection, organizational learning, and adaptation—strategic planning never stops.

Focus Areas: Goals and objectives

I. Safe and Sustainable Seafood

Commercial and recreational fisheries and the seafood industry are an integral part of the Commonwealth's past, present, and future economies. It has been estimated that the combined economic impact of the commercial and recreational fisheries exceeds \$1 billion annually. Unfortunately, most historically exploited stocks are experiencing declines in abundance from a combination of environmental factors, habitat changes, water quality deterioration, and over-harvesting. The consequences of these declines could include changing fishery practices and techniques or locations, increased regulatory oversight, more frequent user conflicts, and labor force reductions. Aquaculture has also recently emerged as a major contributor to the Virginia seafood industries and is considered to be the fastest growing segment of U.S. agriculture. This increase in aquaculture has resulted in rapidly changing production technologies, new target species, and expanding markets. From workforce training and safety compliance issues to marketing of new products and consumer education, the landscape is also changing rapidly for Virginia's seafood processors.

VASG aims to maintain sustainable and thriving fisheries (commercial and recreational) and aquaculture production and seafood processing capacity in Virginia.

- 1. *Support and conduct basic and applied fisheries and aquaculture research and extension activities on harvest, environmental impact, conservation, and viability.***
 - a. Support research and conduct extension on innovative, adaptable, and viable business models for working watermen.
 - b. Provide extension services that help individuals enter and remain competitive in the aquaculture industry.
 - c. Support research and conduct extension services for the optimization of culture conditions, including equipment, technology, and water quality issues.
 - d. Develop information on the growth rates of species in culture and evaluate opportunities to improve upon growth rates.
 - e. Provide or develop information on disease management in aquaculture (shellfish and finfish), including identification and control.

- 2. *Provide extension services for diversification and optimization efforts, to include emerging species utilization, gear engineering, and culture technologies.***

- a. Conduct bycatch reduction research, including studies on improved gear selectivity and release strategies for non-target species.
 - b. Investigate the potential utilization of bycatch and regulatory discards to minimize resource wastage.
 - c. Assist industry in developing viable harvesting technology for underutilized species by addressing economical harvesting methodology, safety issues, harvest sustainability, and market development and sustainability.
 - d. Conduct investigations of new species for culture potential and ongrowing potential, including alternative market strategies for culture species.
 - e. Develop technology for live-fish production from wild harvest fisheries, by addressing candidate species and appropriate harvest, handling, and transport technologies for both short-term and long-term holding periods.
 - f. Provide extension services for fishing and aquaculture operations leading to optimization of their businesses and expansion through collaborative enterprises.
 - g. Promote better energy efficiency in all areas and investigate the use of energy co-product utilization for processing or culture activities.
3. ***Provide stakeholders with the best available science.***
- a. Increase awareness among regulatory staff and stakeholders about availability and access to the most current peer-reviewed science.
 - b. Promote effective regulatory actions and resource allocations between user groups by employing the best available science.
 - c. Increase awareness among resource managers on efficiency improvements to harvesting technologies and the efficacy of bycatch-reduction methodologies.
 - d. Investigate and explain how emerging regulations are influencing fishing practices and the unintended consequences on stocks and ecosystem health.
 - e. Increase awareness among stakeholders about the relationships between best available science and resource sustainability.
4. ***Facilitate stakeholder engagement in decision-making.***
- a. Increase awareness among fishing and aquaculture businesses, and local and state officials about jurisdictions of regulatory authorities for all aspects of fisheries and aquaculture.
 - b. Facilitate consideration of social impacts in the decision making process for proposed regulatory actions.
 - c. Facilitate education, collaboration and networking among all sectors of fisheries.
5. ***Support and conduct basic and applied research in seafood safety, product development, processing, and sustainable energy use.***
- a. Encourage participation of seafood scientists and industry in VASG research, including leveraging VASG funds with other research funding sources and training graduate students in technical areas to meet emerging needs in seafood science and processing.
 - b. Promote the use of sustainable energy practices in seafood processing, including the identification of existing sustainable energy models for seafood processors, creation of new models, demonstration of sustainable energy practices, and

facilitation of collaboration and partnerships among seafood processors and energy technology providers, utilities, and others.

- c. Develop an innovative, integrated model for industry product development.

6. *Provide technical support and guidance to industry on the implementation of Hazards Analysis Critical Control Points (HACCP) and other seafood safety regulations and production of quality products.*

- a. Improve industry understanding of food safety hazards and increase compliance with regulatory requirements by providing effective and efficient methods and materials for workforce training in safe seafood handling and processing (sanitation, procedures, employee hygiene, etc.), demonstration workshops for processors, and technical assistance in developing HACCP plans.
- b. Promote the implementation of up-to-date post-harvest technology to increase the safety and improve the quality of seafood products through demonstration workshops for processors, technical assistance for seafood companies in establishing site-specific Good Management Practices, and continuing education for staff in emerging technologies

7. *Increase awareness and understanding of health, safety, and sustainability issues among consumers and the culinary community to enable them to make informed seafood choices.*

- a. Develop current, science-based information resources that are specific and relevant to Virginia and Chesapeake Bay audiences and that emphasize health benefits of seafood, clarify seafood consumption risks, and explain preventative practices.
- b. Develop science-based, current information resources on sustainable fisheries and seafood that are specifically relevant to Virginia and Chesapeake Bay regional audiences.
- c. Promote dialogue among the myriad suppliers of seafood consumer-choice information.

II. Healthy Coastal and Ocean Ecosystems

Virginia's coastal and ocean ecosystems supply valuable ecosystem products and services despite being threatened by persistent, long-standing challenges from reduced water quality, declines in critical species and habitats, pollution, pathogens, and invasive species. In addition, new threats have been emerging and are expected to intensify in the future—for example, the cumulative impacts of coastal land use transformation and new offshore and coastal development, more frequent harmful algal blooms, and larger low oxygen dead zones. Further compounding all threats are the ominous impacts of climate change. Virginia's coastal zone, and particularly southeastern Virginia, is considered one of the most vulnerable in the U.S. to the impacts of sea-level rise because of its unique geology—it is sinking—coupled with its low elevation, urban development, and position along the Mid-Atlantic hurricane corridor.

VASG aims to enhance ecosystem resilience across scales and sectors, transcending the watershed-estuarine-ocean transition, and including near- and offshore interactions.

1. ***Develop and provide sound scientific information to support ecosystem-based approaches to managing the coastal and marine environment and enhancing ecosystem resilience.***
 - a. Support research and conduct extension on ecosystem function, structure, processes, goods, and services, including the interactions between biological, physical, and socio-economic factors required for ecosystem health and resilience.
 - b. Support research and conduct extension on the interactions between ecosystem health, services, and resilience and fisheries and aquaculture, including, for example, water quality and fisheries productivity, predator-prey relationships, the role of essential fish habitats, fish life history and population dynamics, temporal variability, and the feasibility and impact of aquaculture.
 - c. Support research and conduct extension on how ecosystem health, services, and resilience respond to sea-level rise, storm surges, altered wave and tidal action, and human responses to adapt to these and other climate change impacts.
 - d. Expand future scientific capacity in support of ecosystem-based approaches to management, including fellowships, new faculty assistance, and collaborative research capacity among scientific, private, and non-profit sector partners.
2. ***Support research, policy and management experimentation, and the use of integrated, ecosystem-based approaches to managing coastal and marine resources and enhancing ecosystem resilience.***
 - a. Support research on social, policy, and legal dimensions of ecosystem-based policies and management, including ecosystem services, socioeconomic impacts, community resilience, marine spatial planning, and governance options.
 - b. Support research that develops and tests indices of ecosystem health and resilience, community resilience, and management effectiveness, including indices that link human activities to ecosystem health, services, and resilience.
 - c. Support research that develops and tests tools and monitoring protocols that provide real-time feedback for integrated, adaptive management.
 - d. Conduct extension that uses indices, maps, and other observational systems, monitoring data, and decision-support tools for constructive public deliberations, policy making, and management surrounding challenging societal trade-offs inherent in ecosystem-based approaches to management.
 - e. Provide extension services to partners undertaking integrated, ecosystem-based management approaches, (e.g., spatial mapping and the application of spatial planning in integrated, ecosystem-based management, ecosystem-based fisheries management, and area management).

III. Sustainable Coastal Communities and Hazard Resilience

The Commonwealth's emerging coastal economy will represent a mixture of both traditional and new activities. Rural coastal communities must implement programs that enable residents to remain competitive and remain contributors to future economic activities in their communities. Suburban communities must confront myriad issues related to unbridled growth and sprawl within an overall changing economic climate. Urban waterfront communities must meet the

challenge of redeveloping declining water-dependent industries to accommodate a new economic base that is primarily information and service based. Among all coastal communities, public access to coastal waters for both recreational and commercial uses is a future challenge. All of these challenges are magnified as the inevitable changes to coastal communities proceed at a time of declining coastal environmental quality. Sea level rise, the increased number and intensity of coastal storms, and other natural and human hazards are also putting more people and property at risk along Virginia's coast with major implications for human safety and the economic and environmental health of coastal areas.

VASG aims to enhance the sustainability and viability of coastal communities, from Virginia's rural Eastern Shore and Chesapeake Bay communities, to our suburban coastal communities in the Northern Virginia—Richmond corridor, to the urban centers in the Hampton Roads and Virginia Beach areas.

- 1. *Advance healthy coastal economies with working waterfronts, recreation, tourism, coastal access, and vibrant green technology jobs.***
 - a. Complete regional socioeconomic impact and carrying capacity analysis, legal and policy studies, and other applied social science projects to inform coastal land- and water-use decision making.
 - b. Investigate new methods of public financing for working waterways and waterfronts infrastructure development and maintenance.
 - c. Conduct fiscal impact analysis for potential infrastructure development applications.
 - d. Support research, extension and outreach on green building design and development practices.
- 2. *Promote coastal communities that efficiently use and protect land, energy, and water resources.***
 - a. Translate scientific information into formats readily available and understood by city and local officials, planning commissions and voting citizens.
 - b. Increase awareness in the university-based scientific community about how local governments function and are structured in order to advance effective science-to-management at the local level.
 - c. Conduct inventories, forecasts, and demand and supply analyses for local government and industry.
 - d. Support science and policy research, extension, education, and communication that address marine energy development (e.g., wind, algal or bacterial biofuels, tidal, wave, oil and gas, or other coastal or marine resource) and other green job technologies.
 - e. Assess the cumulative impacts of coastal community planning and development requirements and activities.
- 3. *Nurture coastal citizenry, leaders, and industry that recognize social, environmental, and economic complexities and work together for sustainability and balance.***
 - a. Design and deliver professional development programming to citizen members of planning bodies and commissions.

- b. Conduct needs assessments related to local community development and planning initiatives.
 - c. Provide specific technical assistance in the development of grant applications in the area of green infrastructure development and climate change adaptation.
- 4. *Build coastal community capacity to prepare, adapt and respond to sea-level rise, increases in storm intensity, altered tidal action, and other natural and human hazards.***
- a. Develop education and outreach materials that translate research data on storm events, tides, waves, and sea-level rise into a local context for city and local officials, planners, marine trade groups, and the general public.
 - b. Develop and extend solution-based Best Management Practices to targeted coastal industries and governments.
 - c. Develop and offer leadership training to coastal communities on long-term climate-related processes and impacts.
 - d. Support research to better predict and envision impacts of storm events, tides and wave action, and sea-level rise at the local level.
 - e. Support research to develop methods for integrating storm events, tides and wave action, and sea-level rise data from multiple sources.
 - f. Develop socioeconomic impact assessments, legal and policy studies, and other applied social science research related to sea-level rise, storm surge, altered tidal and wave action, and other impacts from climate change.

IV. Coastal and Ocean Literacy

The challenges facing Virginia and the nation—from climate change to community development issues to globalization—make it critical for all Virginians, and indeed all Americans, to understand the importance of the marine environment and why we literally cannot live without it. Unfortunately, most students in the United States receive little if any in-depth classroom instruction in ocean sciences during their K-12 classroom years. The economic crisis and recession have exacerbated the trend toward reduced federal, state, and local funding for educational efforts. Although the economic stimulus package has temporarily postponed severe cuts to K-12 education in Virginia and a few other states, the situation remains dire, with cuts going forward in many states and the threat of future cuts still looming in the Commonwealth. Other challenges for teachers include the need for subject-area professional development in coastal and ocean science and the growing gap in technical knowledge between scientists and non-scientists. Teachers are faced with an exponentially increasing amount of subject-related information available online, but they often lack the technical expertise to filter that information for reliability, accuracy, and good scientific grounding.

VASG seeks to increase the coastal and ocean literacy of citizens, students, policy-makers, resource managers, and business and industry leaders.

- 1. *Improve the ability of educators to teach about coastal and ocean science.***
- a. Translate science-based information about the coast and ocean to make it accessible and useable for classroom teachers, informal educators, and outreach staff at non-governmental organizations and government agencies.

- b. Provide easy access to online resources for use in teaching coastal and ocean science through the Bridge and other web portals.
 - c. Build capacity for distance learning.
 - d. Design and implement teacher professional development based on educational best practices.
 - e. Develop and implement a state-of-the-art program evaluation and monitoring protocol to assess effectiveness, provide real-time feedback, and identify impacts of educational programs.
- 2. *Prepare scientists to better communicate their work to coastal and ocean stakeholders.***
- a. Train graduates students, post-doctoral staff, and early career scientists in effective techniques and strategies for communication to non-scientists.
 - b. Collaborate with scientists to design effective outreach activities which fulfill their “broader impacts” grant requirements.
 - c. Collaborate with VASG and other outreach and extension programs to enhance their impact through integration of educational tools, skills, and strategies into education and outreach efforts in their focus areas.
- 3. *Elevate awareness and understanding of coastal and ocean science among targeted audiences so they can become more informed decision makers.***
- a. Increase awareness of coastal and ocean science issues among non-coastal community members and leaders.
 - b. Engage K-12 students in exciting and motivating interdisciplinary activities aimed at fostering life-long interest in and awareness of watersheds, coastal and ocean sciences.
 - c. Provide fisheries information and resources to chefs and culinary students to foster their interest in and application of sustainable practices.
 - d. Foster collaboration with state agencies, local organizations, and other stakeholder groups to enhance the effectiveness of Meaningful Watershed Educational Experiences (MWEEs).

Integration: Achieving more than the sum of our parts

VASG advances the *integration* of extension, education, communication, and research functions to achieve science-to-management impacts, the broad adoption of technological innovation, and the utilization of science by decision makers. Integration has often been thought of in a linear fashion—Sea Grant-funded research produces critical knowledge that Sea Grant extension and education staff use in the design and development of outreach programming and Sea Grant communicators use to translate information into a wide array of communication products tailored specific end users. Further, Sea Grant’s integration function has aimed to produce a feedback loop to the research community, as end-users inform extension, education, and communication staff about their informational needs and interests.

Today, as Sea Grant programs nationwide look for greater productivity out of federal and state funding, integration needs to be immediate, providing real-time value-added services within individual research, extension, education, and communication activities. For example, VASG’s

coastal and ocean literary goals include adding value to the experiences of graduate students, post-docs, and early career scientists by supplying programming on communicating science to non-scientists. VASG-funded research engages a cohort of Sea Grant Scholars who will be provided this value-added service as a component of their VASG-funded graduate student experience. Further, VASG aims to use, develop, test, refine, and apply rigorous and feasible evaluation methodology in extension, education and communication programming to obtain real-time feedback on what works, what doesn't, and why—thus enhancing VASG's ability to practice adaptive program management.

Last, the strategic planning process has identified overlapping content areas that provide further opportunity for integration across function area and across our institutional partners. In particular, critical cross-cutting themes include:

- Ecosystem–Human well-being interaction. People impact the ecosystem and the ecosystem impacts people. Any activity in one part of the interconnected system produces a response in other parts—some responses are understood, while many are unintended and surprising. Changes are occurring now and rapidly in all areas of the ecosystem–human well-being system (biological, physical, socio-economic, cultural).
- Watershed-Estuarine-Ocean Transition. Virginia sits in the mixing bowl of many ecosystem and human systems, bridging natural, physical and social conditions. We are where the Chesapeake watershed meets the sea. Our ocean witnesses the mixing of northern and southern Atlantic species and our shores experience converging human uses of terrestrial, coastal, and marine resources. Virginia's ports link the America with the global market.

By functioning as a broker and integrating across our research, extension, education, and communication functions in an adaptive program management strategy, VASG aims to advance ecosystem and human well-being and help Virginia function and adapt to the rapidly changing world we all face.

Impacts: How we know we are making a difference

VASG is committed to adaptive program management. We will develop indices of performance that will be used in an on-going discussion with external advisors and in an annual project participants meeting to enable VASG to function as a reflective practitioner. We aim to build a culture as a learning organization.

[INSERT EXAMPLES CURRENTLY UNDER DEVELOPMENT IN IMPLEMENTATION PLAN.]

Conclusion: Committed to continuous dialogue

Strategic planning is a tool, and while it produces an output, its greatest value is in establishing a culture of openness, transparency, and commitment to an on-going dialogue with stakeholders. VASG will listen to stakeholders in Virginia, the Mid-Atlantic and Chesapeake region, the nation, and beyond—not only during strategic planning, but daily. We will listen to and engage

not only those stakeholders that VASG has worked with for years, but those with whom we have never worked. 2008 and 2009 have been an exciting time of renewal at VASG. We have re-organized, relocated our headquarters to VIMS, and re-committed ourselves to the coastal and ocean issues of Virginia, the region and the nation. It is a new day at VASG.

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