Delaware Sea Grant College Program

Strategic Plan
2018 - 2021

Delaware Sea Grant: Strategic Plan (2018–2021)

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PREAMBLE

Those of us who live along the coast look to it for sustenance, economic value, and recreation. It is important for us to recognize that these uses are not mutually exclusive, but rather that the environment and the economy are linked. Maintaining and supporting healthy coastal ecosystems and the ecological services they provide ultimately results in greater economic benefit for our communities. Ensuring that coastal development proceeds in a sustainable way reduces the impact of coastal hazards and means that we benefit now and in the future from that growth.

In this strategic plan, the Delaware Sea Grant College Program renews its 40-year commitment to providing sound scientific information and policy analysis on issues related to our coast and our coastal economies. Our committed staff, researchers, and partners work to translate science into applications that have positive impacts for our fellow citizens. The information we provide helps people make or save money, protects lives, assists with decision-making, and enhances public understanding of critical coastal events, opportunities, and issues.

Our Delaware Strategic Plan is closely aligned with the new 2018-2021 National Sea Grant Strategic Plan. In addition to addressing needs relevant to the citizens of Delaware, we contribute to the national capacity, mobilizing our efforts in concert with those of others along our country's coasts to help achieve goals that are important not only to Delaware, but also to the nation. This plan takes note of the multiple challenges that face the coastal environment, including population growth, climate change, development, balancing access to multi-use resources, and hazard resilience.

Delaware Sea Grant works with partners in the state, region, and nation to adapt to and mitigate the effects of these challenges by developing the next generation of technologies that allow us to better monitor our waterways, understand vital habitats for valuable aquatic species, keep our communities safe from coastal hazards, and ensure that vital ecosystem services are preserved. Our partners include government leaders, businesses, educators, environmental organizations, and concerned citizens on a state, regional, and national scale. Our goal is to ensure that society benefits from the ocean and coasts—and works to protect and improve them—today and in the future.

DELAWARE AND ITS COASTAL ENVIRONMENT

Overview and Context

Delaware is strategically located on the East Coast, halfway between New York City and Washington, D.C. Approximately 15 percent of the nation's population lives within a 200-mile radius of Delaware's world-class Atlantic coast beaches. With only three counties and a land area of 1,982 square miles, Delaware is the second smallest state in the nation, yet only five U.S. states are more densely populated. The state's current population density is 485 people per square mile with a population increase of 6% between 2010 and 2016. Demographics are also shifting, with an increasing proportion of retirees, estimated as a 2.6% increase in the population that is 65 and older.

Delaware includes 381 miles of tidal shoreline, with 24 miles of ocean coastline and about 90,000 acres of tidal wetlands. No point in Delaware is more than 8 miles from tidal waters. Two major estuaries—the Delaware Estuary and the Inland Bays—have been designated National Estuary Programs. The Chesapeake and Delaware Canal, which connects Chesapeake Bay with Delaware Bay, is an important asset to the nation's commerce, carrying not only recreational boaters, but also commercial vessels navigating between the busy ports of Baltimore, Philadelphia, and Wilmington, Del.

Extending 134 miles from its mouth to the falls at Trenton, N.J., the Delaware Estuary is one of the largest estuaries on the Atlantic coast. Its drainage basin includes portions of Pennsylvania, New York, New Jersey, and Delaware and measures 13,500 square miles. The watershed contains the population centers of Philadelphia, Trenton and Camden, N.J., and Wilmington, Del. In total, it includes 22 counties, 500 municipalities, and an estimated 8.2 million people. The Delaware Estuary receives heavy inputs of nutrients, and while trends in water quality indicate improving conditions, many species of fish continue to exceed contaminant thresholds for consumption. Very recent passage of the Delaware River Basin Conservation Act (2016) has energized efforts to restore and protect habitat throughout the watershed through leadership by the US Fish and Wildlife Service.

More than 200 species of fish have been identified in the estuary, including 31 commercial species. The eastern oyster and the blue crab historically have been among the estuary's most commercially valuable species. While the oyster population has seen sharp declines, recent efforts to restore and build the Delaware Bay oyster populations are showing promise. Blue crab populations have remained viable. Atlantic sturgeon are an endangered species known to traverse the Bay to spawn in the Delaware River. Recently, the National Marine Fisheries Service has designated upper reaches of the Delaware River as critical habitat with final designations pending review of comments submitted through September 2016. Recreational fishing in the estuary is popular and has a higher economic impact in the region than the commercial fishing industry, including the revived striped bass fishery.

The Delaware Estuary is internationally recognized for its critical role in providing habitat for migrating shorebirds. With the world's largest population of horseshoe crabs, the Delaware Bay draws bird watchers who travel to the bayshore during the annual spring spawning of the horseshoe crab to see hundreds of thousands of Red Knots, Ruddy Turnstones, Semipalmated Sandpipers, and other migratory birds feasting on horseshoe crab eggs. Limited use of the horseshoe crab supports the medical industry; their blood was recently valued at $60,000 per gallon and is used in FDA-required testing of medical devices. Horseshoe crabs are captured, up to 30% of their blood harvested, and returned to their habitat.

Two recent studies shed light on the contribution of coastal systems to the economy of Delaware and the region. Delaware Sea Grant funded a study, published in 2012, to determine the economic contributions of the coastal ocean economy to the state of Delaware. A report completed in 2011 for the Partnership for the Delaware Estuary reviewed the economic contributions of the Delaware Estuary as a whole to the region. When the two studies are reviewed collectively, a picture of the importance of our ocean and bay economies emerges, and the need to maintain the integrity of our natural assets becomes clear. In Delaware alone, coastal systems contribute more than 100,000 jobs and generate 3 and 4 percent, respectively, of the federal and state taxes collected. In addition, the Delaware Estuary contributes an additional $2.5 billion in annual ecosystem services to the state, including water quality maintenance, health benefits, and carbon storage. Delaware's Atlantic coast contributes $6.9 billion in total industry production from direct, indirect, and induced economic activity related to the shore.

The Delaware Estuary is also a major transportation corridor and home of the world's largest freshwater port complex. Currently, ports along the Delaware River and its tributaries handle in excess of 120 million tons of imports and 75 million tons of exports with a total combined value of $41 billion annually. Economic contribution to the region is estimated at $2.4 billion, and oil tankers account for approximately 65 percent of the imports to the upper Delaware River. Delaware's Port of Wilmington is ranked first in North America for imports of fresh fruit, bananas, and juice concentrate and has the largest dockside cold storage facility in the nation. It is a full-service, deep-water port and marine terminal handling more than 400 vessels per year with an annual import/export cargo tonnage of 5 million tons.

Delaware's Inland Bays include three interconnected water bodies—Indian River Bay, Rehoboth Bay, and Little Assawoman Bay—that were awarded National Estuary status by the Environmental Protection Agency (EPA) in 1995. These are "crown jewels" of a coastal recreation and tourism industry valued at more than $665 million per year. The bays have a drainage area of about 300 square miles; Sussex County encompasses the watershed and reports an average population density of 210 people per square mile. While the Inland Bays continue to suffer from nutrient overload (eutrophication) that causes unwanted phytoplankton blooms, with a resultant decline in oxygen and light penetration, nutrient loads have reduced more than 80% since the 1990s. Development pressures continue to increase

impervious surfaces in the immediate watershed, but conversion from septic tanks to centralized wastewater disposal is having an impressive impact on reducing nutrient loads. Runoff from intensive agribusiness operations, intrusion of nutrient-contaminated groundwater from agricultural and domestic sources, sewage treatment effluents, and intense residential and commercial development all still contribute to the compromised water quality. Major harmful algal bloom-forming species have been identified in the bays. Coordinated efforts to restore the ecosystem have begun to reverse the trends in ecosystem impairment. Nutrient reductions from voluntary measures and data-supported improvements in water quality in portions of the Inland Bays are reasons for optimism.

The Issues

Population Growth

The state of Delaware continues in a period of unprecedented population growth and development, especially along its coastal zone and associated watersheds. Population growth in the already saturated coastal area grew by more than 50 percent between 1990 and 2000 and the rates of growth are still incredibly high. While the Delaware Estuary watershed population increased by 5.1 percent between 2000 and 2010, in two of Delaware's three counties population increased by 24 percent—the highest rates in the watershed. Because of its proximity to four major metropolitan areas (Washington, D.C., Baltimore, Philadelphia, and New York City), eastern Sussex County, which borders on the Delaware Bay, Atlantic Ocean, and Inland Bays, has transitioned into a major Mid-Atlantic tourism and retirement destination.

Hazard Resilience

The rapid development and urbanization of the coastal zone has resulted in an explosion in the number of residents, visitors, homes, and infrastructure exposed to coastal processes, beach erosion, and storm hazards. Delaware coastal communities are at risk from a variety of natural hazards such as wind, waves, and floods generated by coastal storms. Additional threats to coastal development result from the dynamic nature of the land/sea interface—the constant impact of waves, longshore currents, and sea-level rise on sediment transport resulting in short- and long-term shoreline change. Climate change will further exacerbate these impacts on coastal communities.

Delaware, like many other coastal states, must deal with the problem of eroding beaches. As the need for beach nourishment increases each year and the cost of keeping sand in front of coastal communities rises, the ability to build beaches to last as long as possible and best serve those who pay for it becomes increasingly imperative.

Sustainable Development

In addition to physical changes along the shoreline and increased potential for storm hazards, a growing population has caused congested highways and greater impacts on the state's natural resources. Coastal communities need sustainable development policies. Insightful planning

requires awareness of a community's natural capital and a commitment to sustainability. Preserving open space and conserving agricultural land is a major concern. Working farms, coastal areas with panoramic vistas of our bays and coastline, and quiet country roads are being converted to residential developments, retail outlets, schools, and workplaces. It is not uncommon for Delaware's smaller towns and communities to be without a full-time professional planner on staff. Such communities are challenged by rapid growth as they work to comply with state requirements for comprehensive land-use plans to address sprawl, balance growth, and protect the environment. As growth continues, protecting water quality and preserving natural resources in the coastal region has become increasingly difficult.

Healthy Coastal Ecosystems

State resource managers are faced with an array of environmental problems and issues related to point and nonpoint source pollution from municipal, industrial, and agricultural sources. Current issues of concern include rising sea level, reduced water quality, anoxia and hypoxia, macroalgal and toxic microalgal blooms, declining fishery stocks, habitat loss, reduced biodiversity, and non-native species introductions. These environmental problems and trends pose a serious long-term threat to Delaware's coastal ecosystems and, if left unchecked, will impact public health, economic stability, and overall quality of life in Delaware's coastal communities.

Balancing Public Access to Multi-Use Resources

Like many coastal communities across the nation, Delaware resource managers seek to balance stakeholder access to multi-use resources. This means managing conflicting goals to ensure sustainable environmental and economic benefit. Coastal tourism is an economic force in the state, with more than 5 million visitors contributing more than $665 million to Delaware's economy. The majority of this tourism occurs in Sussex County, but significant activity occurs in smaller communities adjacent to Delaware Bay, which supports thousands of full-time and seasonal jobs. Across Delaware, nearly 59,467 boats were registered in 2015. The $269 million annual contribution to the Delaware economy from wildlife-associated recreation such as birding, hunting, and fishing in the estuary is directly dependent upon ecosystem health.

The infrastructure of ports and harbors and their operation are also critical to the vitality of our region and to our quality of life. More than 3,500 commercial vessels transit the state's waters annually, most of them en route to the nearby Pennsylvania/New Jersey petroleum refineries. With the recent deepening of the river channel to accommodate Panamax ships, commercial traffic—along with vessel size—is expected to increase.

Delaware's coastal waters are rich in fish and shellfish harvested for their recreational and commercial value, although the commercial fishing sector in Delaware is relatively small by comparison to neighboring states in the Mid-Atlantic region. For example, across Delaware Bay, Cape May, N.J., is the second-largest commercial fishing port on the East Coast. The National Marine Fisheries Service reports total commercial landings for 2015 [including blue crabs,

oysters, hard clams, eels, conchs (whelks), and different species of finfish including sea trout and summer flounder] at $6.8 million. The blue crab is Delaware's most valuable commercial fishery with a dockside value of nearly $4.5 million reported in 2015. Increasing harvest pressure, stock reductions, pathogens, disease, and the impacts of eutrophication and sedimentation on habitat loss and recruitment are major factors affecting sustainability of the state's fisheries resources.

Public Education

Because of the ever-present and increasing challenges described above, a well-informed, engaged public is crucial for ensuring that public policies promote economic growth while protecting environmental resources. Without reliable, accurate information based on solid scientific theory and reinforced with data, state, local, and federal officials will find it difficult to plan wisely for our future. Communication of our knowledge of, research in, and need for the protection of coastal ecosystems is important. A well-informed public can consider all the pressures our coastal systems are facing.

Through a partnership between Delaware Sea Grant and the Delaware Department of Natural Resources and Environmental Control (DNREC) a survey was conducted of Delawareans to gauge their understanding and opinions of climate change and sea level rise. Overall, Delaware residents recognize the threats posed by climate change and sea-level rise and want action (Figure 1, following page). Delaware residents are receptive to new information, ideas, and suggestions for how to plan wisely for our future to protect and maintain their homes, livelihoods, and coastal resources.

DELAWARE SEA GRANT VISION, MISSION, GOALS, AND VALUES

Vision

The Delaware Sea Grant College Program, housed within the College of Earth, Ocean, and Environment at the University of Delaware, is uniquely positioned to provide a forum where science-based information about coastal resources and processes can be shared and exchanged with stakeholders to enhance decision-making that will help to realize the full economic potential of our coastal resources while sustaining environmental integrity. As a federal, state and academic partnership that is part of a national network of Sea Grant Colleges, Delaware Sea Grant can leverage the expertise and assets of partners who are focused on the wise use and management of U.S. marine and coastal resources, leading to a sustainable economy and a more resilient environment.

Mission and Goals

Delaware Sea Grant's mission is to advance the understanding, development, use and conservation of state and regional marine and coastal resources through an integrated program of excellence in research, education, and outreach built upon active partnerships with state and

federal agencies, the private sector, and citizens at large. Our organizational goals are to:

- Provide academic and educational leadership to address issues and problems facing coastal communities throughout the state, region, and nation.

- Create and nurture strategic partnerships that help build and sustain programmatic initiatives that solve problems and produce lasting impacts.

- Identify and address emerging coastal issues with accurate, timely and science-based information for industry, government officials, educators and the public.

- Maintain the highest quality marine research, outreach and education programs within the state of Delaware to engage and inform coastal constituents.

Core Values

Every Delaware Sea Grant activity must satisfy three major criteria. They must: (1) be based on a strong rationale; (2) demonstrate scientific merit as determined by national experts in the field; (3) produce application-oriented results that are clearly useful in industry, management, education, and/or science. Core values underpinning these criteria include:

- *Excellence*—All projects are funded on a competitive basis after undergoing external merit evaluation. New and existing programs are strategically developed and monitored to ensure synergistic connections to ongoing research, state, University of Delaware, and partners' programs. Public education efforts must use the most effective technologies to achieve maximum output and distribution of science-based information.

- *Relevance*—A strong, involved advisory process is used to define research priorities, support outreach and education programs, and measure programmatic impact. It also is used to build public and private support for Delaware Sea Grant.

- *Integrity*—The conduct of honest, unbiased research, outreach, and education; clear statement of all findings; and provision of fact-based, forthright conclusions are central to the neutral, "honest broker" role of a university. Declarations of any potential conflict-of-interest situations are expected to be made prior to the initiation of all projects.

- *Teamwork*—High value is placed on involving institutions and organizations beyond the University of Delaware. Diversity within the human resource talent pool—faculty, graduate students, and other collaborators—is critical. Faculty, students, and citizens all benefit from the team approach in addressing challenging issues.

- *Accountability*—Performance-based evaluations from both internal and external perspectives are used to measure achievements. These include tracking of scholarly publication output and graduation of sponsored students, documenting the contributions to society of scientific discoveries, measuring behavioral change of the public upon receipt of educational programs, and determining the economic and social impact resulting from research and technology transfer.

Cross-Cutting Principles (Partnerships, Organizational Excellence, Diversity & Inclusion)

Cross-cutting principles emphasizing new and existing partnerships, organizational excellence, and improved attention to diversity and inclusion will be addressed across our program, and in all areas of our work. Building on our strong networks, our management team, advisory service, and education and outreach offices will all be challenged to identify new strategic partnerships, and potential new audiences, for Sea Grant's work. For instance, a new climate resilience network for the state is an opportunity to expand program capacity, extend reach, and conduct needs assessments in new communities. Partners include additional funding agencies, topical experts, and community leaders from historically underserved neighborhoods. This type of partnership will be one of the high-impact activities in our coming funding cycles.

Delaware Sea Grant strives for organizational excellence in all of its endeavors. In Delaware and within our national networks, our program is recognized as a leading neutral, science-based organization, backed by the strength and reputation of the University of Delaware. Our team provides research and outreach leadership and support to address environmental and policy challenges across our state and region. In addition to forging partnerships, we identify and leverage federal and private funding and facilitate public engagement to identify pressing societal issues and work towards solutions.

Under the leadership of Dr. Nancy Targett — who served not only as the previous UD President, but also the Director of Delaware Sea Grant — the commitment of the University of Delaware to expanding the diversity of backgrounds of students, faculty, and staff across our University was documented in the action plan "Inclusive Excellence: An action plan for diversity at UD." Resources, including staff expertise and professional development programming, are already being leveraged at the Sea Grant program to ensure that the stakeholders we reach reflect the population of Delaware at large. From our Advisory Council through our staff, researchers, and students, Delaware Sea Grant will continue to examine how we engage others and proactively seek opportunities to reach underserved communities.

DELAWARE SEA GRANT STRATEGIC PLANNING: A DYNAMIC PROCESS

Involving constituencies—both internal and external to Delaware Sea Grant—has been a longstanding and integral component of developing our strategic plan. From the very first

Delaware Sea Grant initiatives four decades ago, stakeholders from the broad marine community of organizations and individuals in Delaware and the Mid-Atlantic region have been asked for their advice on high-priority ocean and coastal issues that need attention. That practice continues today. Numerous forums contribute to the programmatic definition of Delaware Sea Grant. They include regular meetings with the Delaware Sea Grant Advisory Council (SGAC), communication with the governor and members of the General Assembly, and citizen surveys in our Sea Grant annual report, on our web sites, at workshops and public lectures, and at our annual Coast Day event that attracts as many as 10,000 visitors who come to our coastal campus to learn about the environment.

Delaware Sea Grant began the process of developing this strategic plan by reviewing existing planning documents of federal and state agencies, and non-profit groups (Box 1).

Box 1: Organization reports and plans informing the Delaware Sea Grant 2018-2021 Strategic Plan.

Annual Report, NOAA Oceanic and Atmospheric Research Strategic Plan, 2014
NOAA Next-Generation Strategic Plan, NOAA Social Science Vision and Strategy – 2016
Delaware National Estuarine Research Reserve Management Plan 2013 – 2018
Delaware Sea Grant Strategic Plan 2014-2017
Delaware and Ocean Acidification: Preparing for a Changing Ocean, 2015
The Delaware Center for the Inland Bays: Three-Year Strategic Plan, April 2015 – April 2018
Partnership for the Delaware Estuary: Strategic Plan 2013-2018

Results of a comprehensive online stakeholder survey from our previous planning exercise (2012) were reviewed to guide development of four focus group discussions. Stakeholder focus group sessions were held in May and June 2016 for each of the four focus areas – Healthy Coastal Ecosystems, Sustainable Fisheries and Aquaculture, Resilient Communities and Economies, and Environmental Literacy and Workforce Development. Participants included faculty researchers, educators, state and local planners, members of the media, industry liaisons, and non-profit, federal, and state agency staff. Facilitated discussions were lively and in-depth, and they resulted in concrete suggestions for areas where Delaware Sea Grant's role could be expanded, strengthened, or even introduced. Areas that the program may begin to reduce effort were also discussed as conversations continued into relative priorities.

In June 2016 the Delaware Sea Grant Advisory Council (SGAC) met to review and provide input on the outcomes of these focus group sessions. In mid-October our Sea Grant Marine Advisory Service staff met to review and refine comments and input from our stakeholder audiences, and in late-October final comments, suggestions and input were solicited from the SGAC (Table 1). Discussions with this group included an examination of three grand challenges in relation to the four focus areas – climate change, population growth and aging, and jobs or economic growth. Draft goals and outcomes were shared and discussed with our National Sea Grant program officer. The goals and outcomes contained herein will be used to guide the

development and refinement of current and future requests for proposals, investment of program development funds, initiation of new partnerships and collaborations, and sustenance of existing collaborations.

Table 1. 2017 Delaware Sea Grant Advisory Council (SGAC).

Delaware General Assembly
Ruth Briggs-King, Representative
David B. McBride, Senator
F. Gary Simpson, Senator

Business/Industry
Gene R. Bailey, Executive Director
Diamond State Port Corporation

Bill Baker, Owner
Bill's Sport Shop

Gerard Esposito, President
Tidewater Utilities Inc.

Betsy Reamer, Executive Director
Lewes Chamber of Commerce & Visitors Bureau

Paul Sample, Consultant
Sample Inc.

Stuart Widom, Manager of Governmental and Regulatory Affairs
Calpine Corporation

Resource Management Agencies
Thomas J. Fikslin, Manager
Delaware River Basin Commission

Christopher Moore, Executive Director
Mid-Atlantic Fishery Management Council

Dave Saveikis, Director
Division of Fish and Wildlife
DE Department of Natural Resources and Environmental Control

Kimberly Cole, Administrator
Delaware Coastal Programs
DE Department of Natural Resources and Environmental Control

John Schneider, Program Manager
Watershed Assessment Branch
DE Department of Natural Resources and Environmental Control

Private Citizens
Jeanie Harper, Treasurer
Samuel & Sons Seafood (Retired)

William J. Miller, Jr. (Past Director)
Delaware River and Bay Authority (retired)

Academia, Education (Formal and Informal)
Dyremple Marsh, Dean
College of Agriculture and Related Sciences
Delaware State University

Tonyea Mead, Education Associate, Science
Delaware Department of Education

Daniel Leathers, Delaware State Climatologist and
Professor University of Delaware

Michelle Rodgers, Associate Dean
Cooperative Extension Service
University of Delaware

Halsey Spruance, Executive Director
Delaware Museum of Natural History

Hilary Valentine, Instructor
Delaware Technical Community College

Katherine Ward, Board Member
Delaware Press Association

Non-Governmental Organizations
Jennifer Adkins, Executive Director
Partnership for the Delaware Estuary

Chris Bason, Executive Director
Delaware Center for the Inland Bays

Kate Hackett, Executive Director
Delaware Wild Lands

Brenna Goggin, Director of Advocacy
Delaware Nature Center

Sarah Cooksey, Director of Conservation Programs
Delaware Nature Conservancy

Local, State, and County Government
Sharon Lynn, City Manager
City of Rehoboth Beach

NATIONAL AND STATE FOCUS AREAS, GOALS, AND OUTCOMES

Delaware Sea Grant has traditionally—and will continue to—support research, outreach and education in each of the four national focus areas:

Healthy Coastal Ecosystems
Resilient Communities and Economies
Sustainable Fisheries and Aquaculture
Environmental Literacy and Workforce Development

Over the coming four-year cycle, Delaware Sea Grant will address all of the national goals through a collection of state-level outcomes, as outlined in the tables that follow. Key objectives and performance measures and metrics for each outcome are provided. Organizational Goals are supported by the Outcomes; Objectives are the steps we are taking to ensure our outcomes are met. Performance measures and metrics measure our progress.

HEALTHY COASTAL ECOSYSTEMS (HCE)

Delaware's terrestrial, emergent, and subaqueous habitats will support a rich diversity and abundance of wildlife through habitat enhancement, protection, or restoration. With the lowest mean elevation of all 50 states (20 meters), Delaware faces uncertain impacts of accelerated sea level rise, and consideration must be given to disparate impacts on both natural and hardened shorelines. Delaware's extensive coastal marshes are at the forefront of encroaching tides, and their future is perhaps the most uncertain. Responsible, sustainable use of coastal resources relies increasingly on economic valuation data to inform natural resource policy and management.

Delaware Sea Grant will continue to provide research, education and outreach leadership throughout the state and region with competitively funded research, integrated and sustained outreach efforts, and dynamic K-12 and science initiatives. In addition, emphasis on ecosystem valuation will improve understanding of both the intrinsic and extrinsic values of protecting, preserving, and efficiently using our natural coastal resources. Characterization of these contributions in economic terms is necessary for strategic decision making to make the best use of our natural resources. New and existing regional collaborations will be initiated and nurtured to ensure ecosystem valuation research is applied to existing and emerging natural resource challenges.

Statewide Objectives, Outcomes, and Performance Measures

HCE Goal 1. **Habitat, ecosystems and the services they provide are protected, enhanced, and/or restored.**

Objective 1. Results of competitively awarded research projects addressing the impacts of human activities on coastal ecosystems will be communicated with resource managers, community officials and the public through presentations, peer-reviewed articles, outreach materials, and technical publications.
Outcome: High quality research informs resource managers and community officials of the interdependence of human activity and ecosystem health.
Performance Measure: By 2021, 5 resource managers and 5 community officials will consider scientific information when managing coastal and ocean resources.

Objective 2. Through recruitment, education, and support for active citizen monitors, the Citizen Monitoring Program will continue to thrive, and new citizen monitoring efforts will be explored.
Outcome: Citizen science initiatives provide high quality data to enhance coastal stewardship.
Performance Measure: By 2021, the Delaware Sea Grant will recruit and train 20 new citizen scientists and new monitoring efforts will be explored.

Objective 3. Partnerships with local resource managers sustain existing—and implement new—citizen science programs to fulfill data and research needs.
Outcome: New partnerships with state, county, and municipal officials enhance the Citizen Monitoring Program leading to improved coastal water quality stewardship.
Performance Measure: By 2021, 2 new partnerships will be developed to expand citizen science programs and assist researchers in data collection.

Objective 4. New water quality monitoring techniques will be deployed and tested for feasibility by the network of volunteers of the Citizen Monitoring Program and other citizen science initiatives.
Outcome: Experienced volunteers expand their suite of knowledge and practices related to water quality monitoring and coastal stewardship leading to improved monitoring practices.
Performance Measure: By 2021, 2 new water quality monitoring techniques/protocols will be deployed and tested for feasibility to enhance citizen scientists' capabilities.

Objective 5. Economic valuation research will be conducted to improve understanding of the value of coastal resources and ecosystems within Delaware and the region.
Outcome: Economic valuation research supported by Delaware Sea Grant advances the socioeconomic understanding of the importance of ecosystem services provided by coastal

habitats, living resources, and physical/biological processes.
Outcome: Resource managers, and others, have another tool at their disposal to improve decision-making.
Performance Measure: By 2021, 3 economic valuation research projects will be funded to improve resource manager', and others, understanding of the value of coastal resources and ecosystems within Delaware and the region.

6. Objective. New and existing regional collaborations will be initiated and nurtured, and communicated effectively, to ensure ecosystem valuation research is applied to existing and emerging natural resource challenges.
Outcome: Local officials, resource managers, and the public are more informed of the economic importance of coastal resources and ecosystems and the impacts of their decisions.
Performance Measure: By 2021, 500 local officials, resource managers, and members of the public will increase their awareness of economic valuation research through outreach materials and/or by attending presentations, workshops, trainings, volunteer/stewardship activities and/or through outreach materials.

Objective 7. Competitively-awarded research projects will address the impact of projected environmental and social changes on the coastal resources and economies of Delaware and the region.
Outcome: Research results supported by Delaware Sea Grant improves understanding of projected changes within coastal ecosystems and the impacts of those changes on coastal natural resources and economies.
Performance Measure: By 2021, 3 research projects will identify the economic and environmental benefits, and social changes on the coastal resources and economies of Delaware and the region.

HCE Goal 2. **Land, water and living resources are managed by applying sound science, tools, and services to sustain ecosystems.**

Objective 1. Coastal habitats, organisms, and ecosystem processes are investigated through laboratory, simulation modeling, terrestrial and aquatic research.
Outcome: Understanding of organisms, habitats, and ecosystem function improves as a result of Sea Grant supported research.
Performance Measure: By 2021, 5 Delaware Sea Grant funded research projects will provide sound science to better understand organisms, habitat and ecosystem function in Delaware's coastal regions.

Objective 2. Resource managers and community officials benefit from high quality research to advance their understanding of organisms, habitats, and ecosystem processes.
Outcome: Resource managers are informed of advances in the scientific understanding of organisms, habitats, and ecosystem function to help make sound resource management

decisions.
Performance Measure: By 2021, 5 resource managers will draw on scientific information provided by Delaware Sea Grant researchers.

Objective 3. Resource managers and other stakeholders receive decision-support tools, technologies, and approaches to help manage land, water, and living resources.
Outcome: Gap analyses are conducted with resource managers to identify and prioritize management needs for improved sustainable management of land, water, and living resources.
Outcome: Innovative approaches are developed to improve decision-support tools, technologies, and approaches for land, water, and living resource management.
Outcome: New tools, technologies, and approaches are shared with resource managers and stakeholders to improve sustainable management of land, water, and living resources.
Performance Measure: By 2021, Delaware Sea Grant Researchers and Marine Advisory Service Specialists develop 5 decision-support tools to aid resource managers in managing coastal resources.

National Sea Grant Performance Measures, Metrics, and Targets

1. Number of resource managers who use ecosystem-based approaches in the management of land, water, and living resources as a result of Sea Grant activities. **80**

2. Number of acres of coastal habitat preserved, enhanced, or restored as a result of Sea Grant activities. **100**

3. Number of Sea Grant tools, technologies and information services that are used by our partners/customers to improve ecosystem-based management. **Products developed: 8; Products used: 4.**

RESILIENT COMMUNITIES & ECONOMIES (RCE)

Resilience of Delaware communities to storms, flooding, accelerated sea level rise, and changing climate requires thoughtful, informed consideration for appropriate infrastructure improvements and planning. Considered a coastal state in its entirety, all municipalities, counties, and communities within Delaware should be aware of, and planning for, storms, flooding, and climate change. With advanced planning, appropriate building codes, and informed zoning, communities can minimize their risks to life and property and reduce recovery costs.

Demographics across Delaware highlight enormous differences in overall community population structures. Population growth in southern Delaware's Sussex County continues nearly unabated with growth of 9.4% between 2010 and 2015, largely comprising retirees and second homes. Nearly one of four residents is over the age of 65. Meanwhile, in northern

Delaware's New Castle County, growth continued at about 3.4% (2010-2015) and is home to more than ½ of the state's population (approximately 557,000). Kent County, in the middle of the state, continues to see growth rates higher than the national average, consisting largely of young families with moderate to low incomes. These counties have distinct challenges facing very different populations. Coastal flooding is more than a nuisance in portions of all three counties and causes widespread damage and evacuations. It demands improvements in planning, construction, investment, insurance, and resilience efforts.

Located within a day's drive of New York City, Philadelphia, and Washington, DC, Delaware's economy is heavily dependent on beach tourism. With a strong history of leadership in rip current research and awareness campaigns, as well as a recent surf zone injury research program, Sea Grant will continue to provide cutting-edge research and outreach to improve safety at ocean beaches.

While both current weather and climate data and detailed projections of Delaware's future climate are available, the hydrodynamic response is much less clear. Water resources so critical for Delaware communities will face change, but it is not yet certain what those changes will be. For instance, groundwater recharge necessary for drinking water, industry, and agricultural systems is not clearly understood within the future climate projections. A need for better understanding of the water flows in the surface, subsurface, and tidal flows—and the forcing factors behind those flows—is impeding progress in planning for sustainable water supplies. Delaware Sea Grant can play a role in improving our understanding of water sources, flows, and sinks in light of climate projections to improve long-term management of storm water, water supply for communities and agriculture, and ecosystem function.

Statewide Objectives, Outcomes, and Performance Measures

RCE Goal 1. **Coastal communities use their knowledge of changing conditions and risks to become resilient to extreme events and economic disruptions.**

Objective 1. Coastal hydrology, modeling, engineering, geomorphology, geochemistry, and similar interdisciplinary studies are competitively selected for support by Delaware Sea Grant with results intended to inform technical and management audiences on the role of coastal systems in hazard mitigation and resilience.
Outcome: Delaware Sea Grant research describes the impact of natural systems in hazard mitigation and resilience for technical and management audiences' use in decision-making.
Performance Measure: By 2021, 3 Delaware Sea Grant funded research projects will provide detailed information on addressing hazard mitigation and resilience.

Objective 2. Sea Grant participation in the Delaware Community Rating System (CRS) User Group and other partnerships will assist in providing resilience training to community officials, resource managers, emergency responders, planners, consultants, builders, and residents.

Outcome: Community officials and regional hazard resilience and response professionals receive specialized hazard resilience information and training leading to reduced insurance premiums for cities and towns.

Performance Measure: By 2021, 6 Delaware communities will realize reduced insurance premiums due to leadership and information provided by Delaware Sea Grant.

Objective 3. Beach communities benefit from information and data to improve swimmer safety.

Outcome: Research and outreach expands understanding of surf zone risks to swimmer health and safety to improve beach monitoring, public awareness, and emergency response.

Performance Measure: By 2021, 3 Delaware coastal communities will use Delaware Sea Grant generated safety information to educate the beach-going public about surf zone risks and hazards.

Objective 4. Communities are supported in developing diverse, healthy economies.

Outcome: Engage coastal communities in planning processes that support the efforts of community leaders to identify and pursue sustainable economic development policies and programs.

Outcome: Communities receive targeted information and techniques to help them enhance their economic activities without diminishing the long-term health of the natural environment or community character.

Performance Measure: By 2021, 3 Delaware communities will realize enhanced economic benefits as a result of Delaware Sea Grant engagement and educational programs.

Objective 5. Traditional working waterfront communities benefit from economic development programming to ensure heritage interests are properly represented in long-range plans.

Outcome: Develop a conceptual framework for sustainable development, including identifying future business infrastructure needs in two working waterfront communities to enhance profitability.

Outcome: Produce a two-page summary report that will be used to inform stakeholders and the state's resource managers about the potential for creating sustainable working waterfronts.

Performance Measure: By 2021, 2 working waterfront communities will develop plans to enhance their communities' economic profitability through Sea Grant leadership and engagement.

Objective 6. Community leaders' understand changing conditions in their communities, including the impact of accelerated sea level rise on their environments, and improve implementation strategies with consideration of flooding, brownfields, and infrastructure impacts.
Outcome: Current evidence-based understanding of climate change impacts and associated risks are communicated to community leaders from across the state leading to enhanced resilience practices.
Performance Measure: By 2021, 10 community leaders will better understand and be prepared to address climate change risks in their communities.

RCE Goal 2. **Water resources are sustained and protected to meet existing and emerging needs of the communities, economies, and ecosystems that depend on them.**

Objective 1. Local communities and state officials benefit from improved understanding of the impact of weather and climate on coastal hydrology.
Outcome: Research supported by Delaware Sea Grant investigates the impact of weather and climate on coastal hydrology and results are communicated to local communities and state officials.
Performance Measure: By 2021, 10 Delaware communities and 5 state officials will be educated and informed of weather and climate impacts and effects.

Objective 2. Agency partners and communities benefit from interdisciplinary research into population trends and ecosystem interdependence.
Outcome: Research is conducted to describe, analyze, and potentially quantify impacts of changing demographics in population growth on coastal ecosystems and the services they provide. Results are communicated to targeted audiences.
Performance Measure: By 2021, Sea Grant's supported social science research will describe and analyze population and demographic changes in 5 Delaware coastal communities.

National Sea Grant Performance Measures, Metrics, and Targets

1. Number of communities that adopt/implement sustainable economic and environmental development practices and policies as a result of Sea Grant activities. **12**

2. Number of communities that adopt/implement hazard resiliency practices to prepare for and respond to/minimize coastal hazardous events as a result of Sea Grant activities. **Number of communities: 15; Number of hazard resiliency training/technical assistance provided: 12; Community hazard resiliency improved: 6**

SUSTAINABLE FISHERIES AND AQUACULTURE (SFA)

Commercial and recreational fishing and aquaculture communities in Delaware are not yet organized to provide a cohesive narrative to describe their needs and concerns for challenges to future fishery sustainability. While some commercial finfish aquaculture is underway in Delaware, shellfish aquaculture is not yet an industry in Delaware, but interest by numerous parties has been demonstrated. Sea Grant can provide the resources to begin to coalesce the concerns and interests of these business communities and explore possibilities for ongoing communication, networking, brand development, and marketing. Earlier Sea Grant workshops devoted to sustainable fisheries were popular, and stakeholders have clearly identified these workshops as important informational and networking opportunities that should be revived.

Legislation and ensuing regulatory policies are underway to establish a shellfish aquaculture industry centered in Delaware's Inland Bays. A new permitting process being established by the Delaware Department of Natural Resources and Environmental Control will allow growers to seed, grow, and harvest oysters in the Bays. Concerns expressed by local property owners include negative impacts of aesthetics and recreation in the Bays. Sea Grant is a purveyor of data and technical support that can assist with decision-making, and Sea Grant has the capacity to engage stakeholders in meaningful dialogue without the fear of agency officials who carry authority for drafting or enforcing regulations. Sea Grant must continue as a neutral arbiter in the ongoing deliberations and provide a setting and facilitation that will allow for a useful and productive exchange of data and ideas.

Changing ocean temperatures, observed changes in ocean pH, and geographic relocation of fish populations complicate already difficult challenges for fisheries managers. Management decisions have clear and important economic ramifications for commercial and recreational fishing operations. More broadly, coastal communities are reliant on those income sources as well as the resident fisheries populations themselves. Sea Grant will continue to identify and support research necessary to inform and improve fisheries management at the local and regional scale by providing high-quality research to inform fisheries management, including protected species such as marine mammals and ESA-listed populations.

Statewide Objectives, Outcomes, and Performance Measures

SFA Goal 1. **Fisheries, aquaculture, and other coastal and freshwater natural resources supply food, jobs, and economic and cultural benefits.**

Objective 1. Fisheries and aquaculture communities benefit from facilitated exploration of improved professional or organizational networks and collaborations.
Outcome: Two professional workshops will be convened to discuss improved practitioner and external communication about the size, scope, and economic importance of Delaware-

--based fisheries and aquaculture.
Outcome: Delaware Sea Grant will conduct a survey of local seafood producers to explore the benefits and challenges for cohesive marketing and branding strategies.
Performance Measure: By 2021, Sea Grant efforts with the commercial fishing sector will lead to a stronger, more cohesive, and organized fisheries/seafood network to enable the industry to better market and brand its products.

Objective 2. Stakeholders in the nascent Delaware shellfish aquaculture industry benefit from technical support and research provided by Sea Grant.
Outcome: Delaware Sea Grant, as a neutral scientific and technical advisory organization, will develop and distribute materials to inform the discussion and development surrounding commercial oyster aquaculture in the Delaware Inland Bays by supporting web resources, providing publications, and convening public meetings to discuss research, business, and property owner interests.
Performance Measure: By 2021, Sea Grant technical support to the emerging Delaware aquaculture industry will result in 8 local businesses being formed that create jobs and provide economic benefits to the local area.

SFA Goal 2. **Natural resources are sustained to support fishing communities and industries, including aquaculture and commercial, recreational, and subsistence fisheries.**

Objective 1. Delaware and regional fishery and aquaculture communities (practitioners, regulators, researchers) benefit from greater awareness of sustainable fishing and aquaculture practices through dialogue fostered at sustainable fisheries workshops.
Outcome: Sustainable fisheries workshops will be convened and deliver summary technical reports including the presenter's contributions, summary of finding and suggestions for action.
Performance Measure: By 2021, Sea Grant's partnership with DNREC's Fisheries Section will result in co-sponsoring annual workshops (4 total) to address new advances in sustainable fishing practices, including research, technology transfer, and economics to foster a viable Delaware fishing/seafood industry.

Objective 2. Technical and logistical assistance supports the Delaware Center for the Inland Bays' oyster restoration and stock enhancement program (oyster gardening).
Outcome: Facilitation of educational workshops and delivery of technical expertise improves oyster gardening efforts (e.g. quantity of gardeners, quality of gardens).
Performance Measure: By 2021, the DE Inland Bays Oyster Gardening Restoration and Stock Enhancement Program will increase the number of oyster gardeners by 30 individuals with technical assistance provided by Sea Grant, thus providing additional oysters for stock enhancement efforts throughout the bays.

Objective 3. High quality research assists fisheries managers in improving management of commercial, recreational and protected fisheries.
Outcome: Results of Delaware Sea Grant competitively-awarded research projects will be communicated with fisheries managers and industry agents through presentations, peer-reviewed articles, outreach materials, and technical publications to assist in improved management of fisheries resources.
Performance Measure: By 2021, 10 technical publications and/or outreach bulletins will be prepared for fisheries managers and industry agents from Delaware Sea Grant-funded fisheries and aquaculture research.

National Sea Grant Performance Measures, Metrics, and Targets

1. Number of fishermen, seafood processing and aquaculture industry personnel who modify their practices using knowledge gained in fisheries sustainability and seafood safety as a result of Sea Grant activities. **60**

2. Number of individuals certified or recertified in Hazard Analysis Critical Control Point (HACCP) as a result of Sea Grant activities. **20**

ENVIRONMENTAL LITERACY AND WORKFORCE DEVELOPMENT (ELWD)

Delaware is served by a patchwork of resource management and education programming, and Delaware Sea Grant has the opportunity to serve a distinct role with access to University of Delaware resources, dedicated educational program staff, and facilities across the state. Educational programming should be serving the needs of the audience, and it is an appropriate time to examine needs of existing and potential new stakeholders through an educational needs assessment.

Delaware Sea Grant will increase depth of knowledge and commitment to outreach and conservation across a wide range of audiences. For instance, the Citizen Monitoring Program is an active group of volunteers that boasts a 25-year history in Delaware. Community volunteers are trained to collect and analyze coastal water samples using quality assessment/quality control (QA/QC) standards, allowing them to see, sample, and understand water quality where they live, fish, and play. The volunteers provide critical data necessary for federal reporting under the Clean Water Act for use by the state agency. As a result, they are passionate ambassadors for coastal ecosystem health.

With professional staff dedicated to improving and expanding the skill sets of educators of all types, Sea Grant is well positioned to provide informal educators from the state and region with resources to enhance educators' knowledge of and familiarity with program and classroom

activities. Climate change—causes, impacts, mitigation, and resilience—can be challenging for educators, and Sea Grant is uniquely situated to provide in-depth professional development. Through an array of popular adult and family education programs (e.g., Osher Lifelong Learning Institute at the University of Delaware, Delaware State Parks) opportunities exist for new avenues to provide environmental literacy programming to audiences across the state. Professional audiences are included in this goal, through leveraging of societies and business organizations including the Chamber of Commerce. Sea Grant can continue to leverage University of Delaware expertise to provide unique and high-quality programming, in addition to educational activities provided by Sea Grant professional staff.

Opportunities for workforce development in topics within Sea Grant's mission exist across the state—students cannot choose careers they do not know exist. From middle and high school programming to 2-year institutions and 4-year institutions beyond the University of Delaware, Sea Grant can provide activities, curriculum, and even technical training to students during the critical years when career choices are being made. Improving awareness of career opportunities within coastal marine science, resource management, sustainable energy, and aquaculture fields is a unique role for Sea Grant in the state as we seek to support and recruit students to these STEM fields.

Sea Grant supports graduate student research and education by providing tuition and salary support in conjunction with a researcher's funded project. These students receive excellent research training, and Sea Grant has the opportunity to provide them with additional professional development and career-building supports, while equipping them to carry Sea Grant's mission with them as they advance their careers.

Statewide Objectives, Outcomes, and Performance Measures

ELWD Goal 1. **An environmentally literate public that is informed by lifelong formal and informal learning opportunities that reflect the range of diversity of the nation's coastal communities.**

Objective 1. Educational needs for coastal science, policy, and career information within Sea Grant's mission areas are outlined for K – 12, after school, and informal educational settings.
Outcome: Delaware Sea Grant completes a systematic review of existing school/Sea Grant partnerships across the state to identify opportunities and school needs relating to mission areas. An expanded effort includes outreach to potential new partners (e.g., Boys and Girls Club, YMCA, additional K – 12 schools).
Performance Measure: By 2021, a systematic review of K – 12 schools/Sea Grant partnerships is completed, a report prepared and disseminated, and new partnerships are identified.

Objective 2. Urban and rural K – 12 students receive coastal science, global climate change, and environmental career information related to Sea Grant's mission areas through classroom supports, after school programming, or in partnership with other Delaware informal education providers.
Outcome: Delaware Sea Grant delivers coastal and marine science and policy career information in person and online to K – 12 audiences through in – school and/or after school programming leading to more students pursuing science-related opportunities in the future.
Performance Measure: By 2021, 1,000 K – 12 students receive coastal and marine science career information to help encourage the next generation of scientists.

Objective 3. Middle schools, technical high schools, and community colleges across Delaware include innovative education and training programs in fields such as alternative energy, robotics, fisheries, and aquaculture.
Outcome: Educational materials for middle school through 2-year institution audiences is customized and delivered to student audiences across the state in fields such as renewable energy, robotics, fisheries, and aquaculture.
Performance Measure: By 2021, 5 customized modules will be prepared focusing on renewable energy, robotics, fisheries and aquaculture, and other identified fields of study. These modules targeted to middle school through 2-year institution students will highlight education and training opportunities.

Objective 4. Delaware Sea Grant provides professional development opportunities annually for K – 12 teachers and informal science educators to supply standards-aligned educational materials for classroom use.
Outcome: Educators from formal and informal settings use data-based, place-based, coastal, watershed, and ocean science classroom activities to deliver effective lessons on coastal resources to their learners.
Performance Measure: By 2021, Delaware Sea Grant will prepare and deliver 15 professional development opportunities for K – 12 teachers and informal science educators. Educational materials will be designed and developed to adapt into DE science literacy standards.

Objective 5. Public lectures and workshops are provided across the state to deliver educational content and materials on coastal and marine topics.
Outcome: Adult learners from diverse backgrounds (including recreational fishers, retirees, and those making a living from coastal resources, for example real estate agents, business owners, and insurance agents) benefit from high quality coastal resource, economic, and hazard resilience educational programming supported by engaging materials.
Performance Measure: By 2021, 10 "Focus on the Coast" public lectures and workshops will be targeted to select audiences on pertinent coastal/marine topics and issues.
Performance Measure: By 2021, 10 visual and performing arts presentations will be targeted to select audiences on pertinent coastal/marine topics and issues.

Objective 6. Delaware teachers participate in environmental research to gain content knowledge, skills, and an appreciation for scientific research as well as working relationships with scientists, graduate students, undergraduate interns, and post-doctoral students.
Outcome: Delaware classroom teachers participate in lab and field research projects with scientists at the University of Delaware's, College of Earth, Ocean, and Environment. Delaware Sea Grant educators will work with participants to develop lesson plans that will help integrate the research into their existing classroom curricula.
Performance Measure: By 2021, 8 Delaware classroom teachers (2 annually) will participate in lab and field research projects with the scientists from the University of Delaware's, College of Earth, Ocean, and Environment.

Objective 7. High quality internet-based resources deliver research-based information on the importance of fish consumption in healthy diets.
Outcome: Health care professional have access to up-to-date, in-depth information on the benefits of consuming seafood and are able to share with patients and the general public. The information is available globally through the Delaware Sea Grant maintained website <seafoodhealthfacts.org>.
Performance Measure: By 2021, the science-based <seafoodhealthfacts.org> website managed by DESG will reach more than 250,000 viewers to receive up-to-date information on safe, healthy and sustainable seafood.

Objective 8. The work of Delaware Sea Grant-funded researchers will be understood and acted upon by members of the public in coastal areas.
Outcome: Coast Day—the annual open house of Delaware Sea Grant and its academic home, the College of Earth, Ocean, and Environment--will be held to provide opportunities to share hands-on activities, tours, public lectures and poster presentations with interested community members.
Performance Measure: By 2021, four Coast Day events will reach 30,000 people from throughout Delaware and the Mid-Atlantic region.

ELWD Goal 2. **A diverse and skilled workforce is engaged and enabled to address critical local, regional, and national needs.**

Objective 1. Students at 2 and 4 year institutions receive information on coastal and social science, as well as careers related to Sea Grant's mission areas.
Outcome: Seminars highlighting Delaware Sea Grant's mission, goals, accomplishments, natural and social science research, and career opportunities will be delivered at Delaware State University and other higher education institutions in Delaware, including 2-year institutions.
Performance Measure: By 2021, Delaware Sea Grant will provide annual highlights (4 total) of funded research, outreach and educational accomplishments for students at 2 and 4 year

institutions to help engage students in environmental fields.

Objective 2. Delaware Sea Grant's graduate and undergraduate students are provided with educational and professional development opportunities to engage them in the mission of Sea Grant, introduce national network accomplishments, and provide science communication training, and information on the role of extension in connecting science and stakeholders.
Outcome: Semi-annual workshops will provide Delaware Sea Grant-funded graduate students and others with information and resources describing Sea Grant's mission, goals, accomplishments, and career opportunities.
Performance Measure: By 2021, 8 workshops will be offered through the Delaware Sea Grant management team to Sea Grant funded graduate students, and other students, to help build a foundation for students to compete nationally for SG fellowships and other awards.
Performance Measure: By 2021, 24 Delaware Sea Grant-supported graduates will become employed in a career related to their degree.

Objective 3. Delaware Sea Grant increases the environmental literacy of the general student body of UD while providing students with science communication training.
Outcome: Undergraduate and graduate students will participate in science communication courses where they will learn about coastal/marine topics and issues and share that knowledge with the UD community and stakeholders across Delaware.
Performance Measure: By 2021, 100 students will be educated in science communication courses featuring coastal/marine topics.

National Sea Grant Performance Measures, Metrics, and Targets

1. Number of Sea Grant products that are used to advance environmental literacy and workforce development. **20**

2. Number of people engaged in Sea Grant-supported informal education programs. **30,000**

3. Number of Sea Grant graduates who become employed in a job related to their degree within two years of graduation. **24**

ASSESSMENT AND REVIEW

This draft Delaware Sea Grant 2018-2021 Strategic Plan has been evolved from our program history, our stakeholders' identified needs, the National Sea Grant Program 2018-2021 Strategic Plan, and our current capacity. The intent is to provide a roadmap for our next four years, with a vision, actions, and measureable targets against which our program will be reviewed at the conclusion of the planning period. As our program is in the midst of leadership change at every level, from the new White House Administration right through our program Executive Director,

and continuing on to our Marine Advisory Service specialists, this draft plan is respectfully prepared by our Management Team and should be considered both conservative and subject to change within the coming two years. Targets for National Performance Measures and Metrics will be developed over the spring of 2017. Additional Outcomes and Objectives will be included in the final version. While disruptive transition within a program can be difficult for planning, it provides a very rare opportunity to re-envision our program, our stakeholders and how we serve them, and ultimately shape the legacy of Sea Grant in Delaware. We intend to do just that in the coming four years.

National Sea Grant Performance Measures, Metrics and Targets for 2018 – 2021			
Delaware Sea Grant Program			
	2018-2021 National Performance Measure and Metrics	**4 Year Target (2018-2021)**	**Brief Justification** (If targets are significantly different from the last 4-year cycle)
1	**Number of resource managers who use ecosystem-based approaches in the management of land, water, and living resources as a result of Sea Grant activities**	80	Estimate 20 resource mangers each year (80 over the 4 year time period) will use ecosystem-based approahces. Achieving this target will be dependent on building capacity in our program after recent retirements.
2	**Number of acres of coastal habitat protected, enhanced, or restored as a result of Sea Grant activities**	100	We have included small numbers (ACRES) related to oyster habitat restored/enhanced in the past. However, as the Delaware Aquaculture program begins in earnest over the next few years, at least 100 acres of leased land in Delaware's inland bays will be enhanced, producing shellfish and improving the environment of the bays. DESG technical assistance and demonstration projects have been vital in moving the industry along.
3	**Number of fishermen, seafood processing and aquaculture industry personnel who modify their practices using knowledge gained in fisheries sustainability and seafood safety as a result of Sea Grant activities**	60	With the growth of the aquculutre industry in DE, and with our outreach to the industry we estimate that approximately 30 aquaculturists will modify their practices based on DESG-related activities. In addition, as we build capacity after recent retirements, we plan to reach out to other members of the seafood industry to share technical information to assist them in modifying their practices as well.
4	**Number of communities that adopt/ implement sustainable economic and environmental development practices and policies as a result of Sea Grant activities**	12	Our continued work with communities will results in 3/year adopting or implementing sustainable economic and environmental development practices/policies? Building capacity in our Marine Advisory Service after recent retirements should help us achieve this target.
5	**Number of communities that adopt/implement hazard resiliency practices to prepare for and respond to/minimize coastal hazardous events as a result of Sea Grant activities**		
	Number of Communities	15	THESE METRICS ARE REPORTED IN ANOTHER SECTION OF PIER. Due to recent retirements in this programmatic area, future targets are lower than previously reported. Once our new Marine Advisory Service hazard/resilience specialist is recruited and on-board we can assume 15 communties throughout the state will be reached.
	Number of hazard resiliency training/ technical assistance provided	12	SEE ABOVE. Partnering with other agencies/organizations assume 3 trainings/year (or more), To total 12 over 4 years.
	Community hazard resiliency improved	6	SEE ABOVE. Will need to follow-up with certain communities to determine how they have improved their resilience.
6	**Number of Sea Grant products that are used to advance environmental literacy and workforce development**	20	Defer to C. Petrone on this, but are 5 products per year (20 total over 4 years) reasonable (e.g. homeowners' handbooks, curricula, publications, communications products)?
7	**Number of people engaged in Sea Grant-supported informal education programs**	30,000	This would include Coast Day attendance and other informal education programs (I assumed conservatively 7,500/year). We could go higher based on historical average of CD attendance.
8	**Number of Sea Grant-supported graduates who become employed in a job related to their degree within two years of graduation.**	24	Assume conservatively 6 students/year (24 over 4 years). Can include traditional employment, fellowships, internships postdocs, or pursuing advanced degrees)
9	**Number of Sea Grant tools, technologies and information services that are used by our partners/customers to improve ecosystem-based management.**		
	Number of Products 'developed'	8	THESE METRICS ARE REPORTED IN ANOTHER SECTION OF PIER. Assume 2/year (8 total over 4 years). Due to recent retirements, our projected targets are lower than previously reported. Once we build capcacity in our Marine Advisory Service program we will need to adjust these estimates.
	Number of Products 'used'	4	SEE ABOVE. Once capacity building is complete, the Marine Advisory Service staff will work to see that products are used.

	2018-2021 National Performance Measure and Metrics	4 Year Target (2018-2021)	Brief Justification (If targets are significantly different from the last 4-year cycle)
10	**Economic and societal impacts derived from Sea Grant activities impacts derived from Sea Grant activities (market and non-market; jobs and businesses created or sustained)**		SEE BELOW
	Economic Benefit	$1,000,000	Assume $250,000/year in leveraged funds in an average year (Total $1,000,000 in 4 years)? Leveraged funds can be reported (and noted as such); Cannot include Federal $ or match. Also, with growth of aquaculture industry we may be able to account for economic benefits from the growth of this industry.
	Jobs Created	8	Assume 8 new jobs in aquaculture over 4 year time period. Defer to J. Ewart. May be able to count individuals coming into aquaculture businesses due to DESG activities. . This is defined as a new position cealated and filled as a result of DESG activity.
	Jobs Sustained	??	This is difficult to assess. I don't think we have ever reported on this measure before. Defined as a filled position that is sutainned as a direct result of DESG activities.
	Businesses Created	5	Hopefully can count at least 5 new businesses from aquaculture over the year period. Defined as a new firm that was created as result of DESG activities.
	Businesses Sustained	??	This is difficult to assess. I don't think we have ever reported on this measure before. Defined as a previously existing form that is sutained as a direct results of DESG activities.
	Patents	4	Assume 1 patent per year from DESG funded research. (total of 4 during the 4-year period).
11	**Number of Marinas Certified as "Clean Marina" by the Clean Marina Program as a result of Sea Grant Activities**	0	No longer work in this area. However, DESG provided some of the early education in the area of Clean Marinas to get the program started 15 years ago, We never took credit for the 15-20 clean marinas that currently exist cross the state.
12	**Number of individuals certified or recertified in Hazard analysis critical control point (HACCP) as a result of Sea Grant activities**	20	Due to the recent retirement of our Seafood Technology Specialist, this performance measure isn't likely to receive the same level of effort as it previously did. However, a future hire of a fisheries/aquaculture specialist should provide a limited amout of effort to the industry to help achieve our estimated targets.
13	**Number of peer-reviewed publications produced by Sea Grant**	40	Assume 10/year (40 over the 4-year time period). Maybe we can look at past records and estimate a yearly average based on historical figures.
14	**Number of individuals and full-time eqivalents (FTEs) by Sea Grant**	NA	I AM ASSUMING THE REST OF THESE WILL BE INPUT ON A YEARLY BASIS AS WE REPORT TO PIER.
	Administration (# of Individuals)		
	Administration (# of FTEs funded by Federal SG$)		
	Administration (# of FTEs funded by Match and non-Sea Grant $)		
	Communications (# of Individuals)		
	Communications (# of FTEs funded by Federal SG$)		
	Communications (# of FTEs funded by Match and non-Sea Grant $)		
	Extension (# of Individuals)		
	Extension (# of FTEs funded by Federal SG$)		
	Extension (# of FTEs funded by Match and non-Sea Grant $)		
	Education (# of Individuals)		
	Education (# of FTEs funded by Federal SG$)		
	Education (# of FTEs funded by Match and non-Sea Grant $)		
	Research (# of Individuals)		
	Research (# of FTEs funded by Federal SG$)		
	Research (# of FTEs funded by Match and non-Sea Grant $)		
	Individual Staffing in Program in all areas		

	2018-2021 National Performance Measure and Metrics	4 Year Target (2018-2021)	Brief Justification (If targets are significantly different from the last 4-year cycle)
15	**Number and Origination of Core Funding Pre-and Full Proposals**	NA	
	Pre-proposals submitted (# of proposals)		
	Pre-proposals submitted (# of Institutions involved)		
	Pre-proposals submitted (# from home institution)		
	Full-proposals submitted (# of proposals)		
	Full-proposals submitted (/# of Institutions involved)		
	Full-proposals submitted (/# from home institution)		
	Proposals Funded (# of proposals)		
	Proposals Funded (# of Institutions involved)		
	Proposals Funded (# from home institution)		
16	**Number of Postsecondary Students Financially-Supported by Sea Grant in Higher Education Programs (Undergraduate, Graduate)**	NA	
	Undergraduate Students (# of new Students)		
	Undergraduate Students (# of Continuing Students)		
	MS/MA Students (# of new Students)		
	MS/MA Students # of Continuing Students)		
	PhD Students (# of new Students)		
	PhD Students (# of Continuing Students)		
	Other Sea Grant supported Professional Degree Graduate Students (# of new Students)		
	Other Sea Grant supported Professional Degree Graduate Students # of Continuing Students)		
17	**Number of Postsecondary Degrees Financially-Supported by Sea Grant in Higher Education Programs (Undergraduate, Graduate)**	NA	
	Undergraduate Degrees		
	MS/MA Graduate Degrees		
	PhD Graduate Degrees		
	Other Sea Grant supported Professional Degree Graduate Students		
18	**Number of P-12 Students Reached Through Sea Grant-Trained Educators or Directly through Sea Grant Education Programs**		
19	**Number of P-12 Educators who participated in Sea Grant education programs**		
20	**Number of Volunteer Hours**		
21	**Number of Sea Grant-Sponsored/Organized Events**		

	2018-2021 National Performance Measure and Metrics	4 Year Target (2018-2021)	Brief Justification (If targets are significantly different from the last 4-year cycle)
22	**Number of Attendees at Sea Grant-Sponsored/Organized Events**		
23	**Number of Public or Professional Presentations**		
24	**Number of Attendees at Public or Professional Presentations**		