



Strategic Plan (February 1, 2018–January 31, 2024)

Table of Contents

PREAMBLE	3
DELAWARE AND ITS COASTAL ENVIRONMENT	4
Overview and Context	4
The Issues	6
Population Growth	6
Hazard Resilience.....	7
Sustainable Development.....	7
Healthy Coastal Ecosystems	8
Balancing Public Access to Multi-Use Resources.....	8
Public Education	9
DELAWARE SEA GRANT VISION, MISSION, GOALS, AND VALUES	9
Vision	9
Mission and Goals	10
Core Values.....	10
Cross-Cutting Principles (Partnerships, Organizational Excellence, Diversity & Inclusion).....	12
DELAWARE SEA GRANT STRATEGIC PLANNING: A DYNAMIC PROCESS	13
NATIONAL AND STATE FOCUS AREAS, GOALS, AND OUTCOMES	16
HEALTHY COASTAL ECOSYSTEMS (HCE)	16

RESILIENT COMMUNITIES & ECONOMIES (RCE)	21
SUSTAINABLE FISHERIES AND AQUACULTURE (SFA)	25
ENVIRONMENTAL LITERACY AND WORKFORCE DEVELOPMENT (ELWD).....	28
ASSESSMENT AND REVIEW.....	34

PREAMBLE

Those who live and vacation 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 current 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 rivers, bays, 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 centrally 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 Delaware 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, Delaware.

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, NJ, and Wilmington, DE. 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, some species of fish continue to exceed contaminant thresholds for consumption, particularly resident species in historically polluted tributaries. 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 commercially important 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. Once a historically significant regional fishery akin to the Eastern Oyster and Blue Crab, Atlantic Sturgeon are now an endangered species known to traverse the Bay to spawn in the Delaware River. In addition to the species being listed under the Endangered Species Act, the National Marine Fisheries Service has designated the Delaware River, up to Trenton, NJ, as critical habitat highlighting the unique conservation need for this important species. Beyond species of conservation concern and significant commercial fisheries, the recreational fishing sector is popular in Delaware and generates greater economic impacts throughout the region than commercial landings.

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 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 bays serve a major role in Delaware's coastal recreation and tourism industry valued at more than \$665 million per year. The Inland 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 impact on reducing nutrient loads into tributary supply waters. 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. 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 such as erosion, storm hazards, and sea level rise. Delaware coastal communities are at risk from a variety of natural hazards such as wind, waves, and floods generated by coastal storms. Climate change will further exacerbate these impacts on coastal communities. Some populations, natural systems and types of infrastructure are more sensitive to impacts. Their capacity to adapt may also be more limited. Assessing vulnerabilities and developing strategies to manage risks are important components of hazard resilience. These strategies may involve active mitigation of risk through physical projects such as stormwater management and beach nourishment, for instance. Or they may include policy changes that reduce population exposure and vulnerability through land use reforms. Still other strategies involve helping communities adapt to risks such as tidal flooding while improving the capacity of local governments, businesses, and residents to prepare for, respond to, and then quickly recover from extreme events.

Building community resilience requires an interdisciplinary approach that blends the physical sciences with social sciences. Community engagement is central to this effort and must thread science into policies, plans, and designs. Above all else, building community resilience is proactive and anticipatory. It is always mindful of future climate, weather, and societal changes and how they influence risks.

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, marine debris, 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 2018 [including Blue Crabs, oysters, Hard Clams, American Eels, Knobbed and Smooth Conchs (whelks), and different species of finfish including Weakfish and Summer Flounder] at \$66.3 million. The Blue Crab is Delaware's most valuable commercial fishery with a dockside value of nearly \$7.6 million reported in 2018. 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), surveys were conducted of Delawareans to gauge their understanding and opinions of climate change and sea level rise in 2009, 2014, and 2019. Overall, Delaware residents recognize the threats posed by climate change and sea-level rise and want action. 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:

- Build an inclusive program that serves all people including those with unique needs, circumstances, perspectives, and ways of thinking.
- 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; and (3) align with Delaware Sea Grant's mission to advance the understanding, development, use and conservation of state and regional marine and coastal resources. Core values underpinning these criteria include:

- *Excellence*—All activities of Delaware Sea Grant are built on a foundation of excellence. Research projects are funded on a competitive basis after undergoing rigorous external merit evaluation by experts in the field. Outreach programs are designed to connect the public with relevant, up-to-date information based on peer-reviewed scientific research. Public education efforts use the most effective technologies to achieve maximum output and distribution of science-based information.
- *Relevance*—Delaware Sea Grant uses a strong, involved advisory process to define research priorities, support outreach and education programs, and measure programmatic impact while building public and private support for Delaware Sea Grant.
- *Integrity*—Central to Delaware Sea Grant’s role as a neutral, “honest broker” of information is the conduct of honest, unbiased research, outreach, and education; a clear statement of all findings; and provision of fact-based, forthright conclusions. Declarations of any potential conflicts of interest are expected prior to the initiation of all projects.
- *Teamwork*—Delaware Sea Grant addresses challenging issues using a team approach which benefits all stakeholders, including faculty, students, local municipalities and the general public. High value is placed on Delaware Sea Grant’s partnerships both at the University of Delaware as well as institutions and organizations beyond the university.
- *Diversity, Equity and Inclusion*—Delaware Sea Grant recognizes that diversity within the human resource talent pool—faculty, graduate students, and other collaborators—is critical and strives to support stakeholders of all ages, races, ethnicities, national origins, gender identities, sexual orientations, abilities, cultures, religions, citizenship types, marital status, job classifications, veteran status types, and socioeconomic status.
- *Accountability*—Delaware Sea Grant uses performance-based evaluations from both internal and external perspectives to measure achievements. These include tracking outputs such as scholarly publications, graduation of sponsored students, and documenting scientific discoveries; outcomes such as behavioral changes by state and local governments as well as by the public as a result of Delaware Sea Grant research, education and outreach activities; and the economic and social impact resulting from Delaware Sea Grant-sponsored 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 underserved neighborhoods. Expanding our partnerships is expected to have a high impact on education and outreach programming, as well as on research funded through our program.

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. Estella Atekwana, Dean of the College of Earth, Ocean, and Environment, the commitment of the University of Delaware and the college to expanding the diversity of backgrounds of students, faculty, and staff across our University has never been stronger, and is documented in the action plan "[Inclusive Excellence: An action plan for diversity at UD.](#)" Resources, including staff expertise and professional development programming, are 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 and vulnerable 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 Coast Day, an outreach event that attracts as many as 10,000 visitors annually 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 2018-2023 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 2016 our Sea Grant Marine Advisory Service staff met to review and refine comments and input from our stakeholder audiences, and later that month, 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 and were accepted as part of the final strategic plan that was intended to cover the period from February 1, 2018 through January 31, 2022.

However, from 2017 through 2019 our program underwent a significant transformation following the retirement of many long-time staff members, and the hiring of a new Director, Associate Director, Director of the Delaware Sea Grant Marine Advisory Service, and several staff members. Further, in late 2019, we were informed by the National Sea Grant Office that our strategic plan should be extended for an additional two years, until January 31, 2024.

Accordingly, our program revisited this document in 2020, affirming its vision and realigning portions of the strategic plan to coincide with our anticipated work and growth trajectory under our new management team and with our new staff in place. These revisions have been discussed with SGAC members and the National Sea Grant Office, and 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 through January 31, 2024.

Table 1. 2020 Delaware Sea Grant Advisory Council (SGAC).

Bill Baker Bill's Sports Shop	Tonyea Mead Delaware Department of Education
Chris Bason Delaware Center for the Inland Bays	Christopher M. Moore Mid-Atlantic Fishery Management Council
Mark Biddle Watershed Assessment, DNREC*	Martha Narvaez UD, Institute of Public Policy Water Resources Center
Tom Byrne Delaware Public Media	Betsy Reamer Lewes Chamber of Commerce & Visitors Bureau
Kimberly Cole Delaware Coastal Programs, DNREC*	Michelle Rodgers Delaware Cooperative Extension
Kathleen Doyle Dover Resident	John Clark Division of Fish and Wildlife, DNREC*
Malcolm D'Souza Wesley College	Guy Simmons Sea Watch International
Gerard Esposito Delaware Sea Grant Advisory Council, Chair Tidewater Utilities (retired)	Halsey Spruance Delaware Museum of Natural History
Heidi Gurdo Delaware Technical Community College— Stanton	Namsoo Suk Delaware River Basin Commission
Kate Hackett Delaware Wild Lands, Inc.	Terry Tieman Town of Fenwick Island
Simeon Hahn National Oceanic and Atmospheric Administration (NOAA)	Bryan Townsend Delaware General Assembly
Daniel Leathers Office of the Delaware State Climatologist, University of Delaware	Hilary Valentine Delaware Technical Community College— Georgetown
Sharon Lynn City of Rehoboth Beach	Stuart Widom Calpine Corporation
Dyremple B. Marsh Delaware State University	*Delaware Department of Natural Resources and Environmental Control

STATE AND NATIONAL FOCUS AREAS, GOALS, AND OUTCOMES

As it has traditionally, Delaware Sea Grant will continue to support research, extension 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 current six-year strategic plan cycle, Delaware Sea Grant will address a collection of state-level and national goals, as outlined in the text and tables that follow. Key objectives, and performance measures and metrics, for each outcome are provided. National Sea Grant performance measures are highlighted separately. 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. Like most coastal states, Delaware must also contend with the causes and effects of marine debris, invasive species, and degrading or highly variable water quality.

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. New and existing regional collaborations will also be initiated and nurtured so that programmatic efforts regarding the efficient use of our coastal resources are applied to existing and emerging 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 2023, the Delaware Sea Grant Marine Advisory Service will conduct at least 10 meetings with resource managers and/or community officials to share results of competitively awarded research projects so that the management of our coastal and ocean resources can be improved.

National Sea Grant Performance Measure: By 2023, at least 46 peer-reviewed publications will be produced by Sea Grant-funded researchers.

Objective 2. Through recruitment, education, and support for active citizen monitors, the Citizen Monitoring Program will continue to thrive, and new citizen monitors will be trained and utilized as part of the program.

Outcome: Through an expanded network of citizen monitors, community science initiatives provide high-quality data and science-based experiences to enhance coastal stewardship.

Performance Measure: By 2023, the Delaware Sea Grant will recruit and train 20 new community scientists.

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 community science efforts leading to improved coastal stewardship.

Performance Measure: By 2023, 2 new projects and/or partnerships will be developed to expand community 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 community 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 2023, 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 2023, 2 economic valuation research projects will be funded to improve the understanding of resource managers and others regarding the value of coastal resources and ecosystems within Delaware and the region.

Objective 6. New and existing regional collaborations will be initiated and nurtured, and outcomes will be communicated effectively, to ensure interdisciplinary research on the intersection of environment and society is applied to existing and emerging natural resource challenges.

Outcome: Local officials, resource managers, and the public are more informed of the economic, environmental and social importance of coastal resources and ecosystems and the impacts of their decisions.

Performance Measure: By 2023, at least one new regional partnership will be initiated and nurtured with the goal of addressing existing and emerging natural resource challenges.

Performance Measure: By 2023, 500 local officials, resource managers, and members of the public will increase their awareness of research findings on economic, environmental and/or social changes in coastal Delaware through outreach materials and/or by attending presentations, workshops, trainings, volunteer/stewardship activities.

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 improve understanding of projected changes within coastal ecosystems and the impacts of those changes on coastal natural resources and economies.

Performance Measure: By 2023, 3 research projects will address the impact of projected environmental 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, ecosystem processes, and impacts related to anthropogenic disturbances 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 2023, 5 Delaware Sea Grant-funded research projects will provide sound science to better understand organisms, habitat and ecosystem function, and anthropogenic disturbances in Delaware's coastal regions.

Objective 2. Resource managers and community officials benefit from high-quality research to advance their understanding of organisms, habitats, ecosystem processes, and impacts

related to anthropogenic disturbances, which will result in the protection, enhancement, and/or restoration of coastal habitats.

Outcome: Resource managers are informed of advances in the scientific understanding of organisms, habitats, and ecosystem function, and anthropogenic disturbances to help make sound resource management decisions.

National Sea Grant Performance Measure: By 2023, at least 150 acres of coastal habitat will be protected, enhances, or restored as a result of Sea Grant activities.

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, including planning and facilitation exercises, are shared with resource managers and stakeholders to improve sustainable management of land, water, and living resources.

National Sea Grant Performance Measure: By 2023, Delaware Sea Grant Researchers and Marine Advisory Service Specialists will develop 10 decision-support tools, technologies or information services, including administering planning and facilitation exercises, which will be used by resource managers to aid in managing coastal resources.

National Sea Gant Performance Measure: By 2023, 12 resource managers will use ecosystem-based approaches in the management of land, water, and living resources as a result of Sea Grant activities.

Delaware Sea Grant Performance Measures, Metrics and Targets

Number of meetings between the Delaware Sea Grant Marine Advisory Service and resource managers and community officials where results of competitively awarded research projects will be shared so that the management of our coastal and ocean resources can be improved.	10
Number of new community scientists that will be recruited and trained by Delaware Sea Grant.	20
Number of new projects and/or partnerships that will be developed to expand community science programs and assist researchers in data collection.	2
Number of new water quality monitoring techniques/protocols that will be deployed and tested for feasibility to enhance citizen scientists' capabilities.	2
Number of economic valuation research projects that will be funded to improve the understanding of resource managers, and others, of the value of coastal resources and ecosystems within Delaware and the region.	2
Number of new regional partnership that will be initiated and nurtured with the goal of addressing existing and emerging natural resource challenges.	1
Number of local officials, resource managers, and members of the public that will increase their awareness of research findings on economic, environmental and/or social changes in coastal Delaware through outreach materials and/or by attending presentations, workshops, trainings, volunteer/stewardship activities.	500
Number of research projects funded by Delaware Sea Grant that will address the impact of projected environmental and social changes on the coastal resources and economies of Delaware and the region.	3
Number of Delaware Sea Grant-funded research projects that will provide sound science to better understand organisms, habitat and ecosystem function in Delaware's coastal regions.	5

National Sea Grant Performance Measures, Metrics and Targets

Number of peer-reviewed publications produced by Sea Grant	46
Number of acres of coastal habitat protected, enhanced, or restored as a result of Sea Grant activities.	150
Number of Sea Grant tools, technologies and information services that are used by our partners/customers to improve ecosystem-based management.	10
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.	12

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 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 half 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 surf zone injury research, 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 2023, 2 Delaware Sea Grant-funded research projects will provide detailed information on addressing hazard mitigation and resilience.

Objective 2. Sea Grant participates in community capacity building efforts such as the Delaware Community Rating System and Resilient and Sustainable Communities League (RASCL) to provide technical assistance and resilience training to community officials, resource managers, emergency responders, planners, consultants, builders, and residents.

Outcome: Communities, organizations, and hazard resilience and response professionals receive specialized information and training to improved community capacity to prepare for and adapt to weather and climate hazards.

Performance Measure: By 2023, at least two organizations and/or resilience professionals will have implemented hazard resiliency practices to prepare for, respond to, or minimize coastal hazardous events as a result of Sea Grant activities.

National Sea Grant Performance Measure: By 2023, 40 Delaware communities will have implemented hazard resiliency practices to prepare for, respond to, or minimize coastal hazardous events as a result of Sea Grant activities.

Objective 3. 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 2023, at least 3 Delaware communities will realize enhanced economic benefits as a result of Delaware Sea Grant engagement and educational programs.

National Sea Grant Performance Measure: By 2023, 12 Delaware communities will implement sustainable economic and environmental development practices and policies as a result of Delaware Sea Grant activities

National Sea Grant Performance Measure: By 2023, \$500,000 of economic impacts¹ (market and non-market) will be realized, 10 jobs will be created, 5 jobs will be sustained, 8 businesses² will be created, and 5 businesses will be sustained as a direct result of Delaware Sea Grant activities.

Notes:

¹ This total will result from the direct involvement of Delaware Sea Grant with our coastal communities, as well as economic benefits derived from our environmental literacy and workforce development programs, research activities, and extension. Economic benefits are only being noted in this strategic plan here for clarity and ease of tracking.

² Businesses created are anticipated to result from the work of Delaware Sea Grant within the burgeoning shellfish aquaculture industry, but are documented here for ease of tracking. Additional information can be found in the Sustainable Fisheries and Aquaculture portion of this strategic plan.

Objective 4. 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 multi-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 2023, 2 working waterfront communities will develop plans to enhance their communities' economic profitability through Sea Grant leadership and engagement.

Objective 5. Community leaders understand changing conditions in their communities, including the impact of accelerated sea level rise on their environments, and take steps to improve emergency preparedness and community resilience.

Outcome: Current evidence-based understanding of climate change impacts, risk mitigation, and adaptation strategies are communicated to community leaders from across the state leading to enhanced resilience practices.

Performance Measure: By 2023, 6 policies, plans, or implementation strategies will be undertaken by state, county, and community officials to better understand and prepare for weather and climate change risks in their communities.

RCE Goal 2. The interrelationship between the built and natural environment is communicated and characterized so that 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 local communities and state officials benefit from improved understanding of the impact of human activity, land use practices, infrastructure design, weather, and climate on coastal hydrology, ecosystem health, and community resilience.

Outcome: Delaware Sea Grant communicates research and best practices related to managing weather and climate impacts through sound land use practices, infrastructure planning and design.

Performance Measure: By 2023, 15 Delaware communities and/or state officials will be educated and informed of research and best practices related to managing weather and climate impacts through sustainable and resilient land use practices, infrastructure planning and design.

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 2023, Sea Grant will fund at least three interdisciplinary research projects focused on human-environment interactions.

Delaware Sea Grant Performance Measures, Metrics and Targets

Number of Delaware Sea Grant-funded research projects that will provide detailed information on addressing hazard mitigation and resilience.	2
Number of organizations and/or resilience professionals that will have implemented hazard resiliency practices to prepare for, respond to, or minimize coastal hazardous events as a result of Sea Grant activities.	2
Number of Delaware communities that will realize enhanced economic benefits as a result of Delaware Sea Grant engagement and educational programs.	3
Number of working waterfront communities that will develop plans to enhance their communities' economic profitability through Sea Grant leadership and engagement.	2

Number of policies, plans, or implementation strategies that will be undertaken by state, county, and community officials to better understand and prepare for weather and climate change risks in their communities.	6
Number of Delaware communities and/or state officials that will be educated and informed of research and best practices related to managing weather and climate impacts through sustainable and resilient land use practices, infrastructure planning and design.	15
Number of interdisciplinary research projects focused on human-environment interactions that will be funded by Delaware Sea Grant.	3

National Sea Grant Performance Measures, Metrics and Targets

Number of communities that implemented hazard resiliency practices to prepare for, respond to, or minimize coastal hazardous events as a result of Sea Grant activities.	40
Number of communities that implemented sustainable economic and environmental development practices and policies as a result of Sea Grant activities.	12
Economic (market and non-market; jobs and businesses created or sustained) impacts derived from Sea Grant activities.	Economic Impact: \$500,000 Jobs Created: 10 Jobs Sustained: 5 Businesses Created: 8 Business Retained: 5

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. Nor have these communities been well informed with relevant scientific findings and significant levels of communication regarding changes to natural resource management. While some commercial finfish aquaculture is underway in Delaware, shellfish aquaculture is a blossoming industry in Delaware. 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, and applied cooperative research initiatives, 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 now in-place for a long-term, established shellfish aquaculture industry centered in Delaware's Inland Bays. A permitting process established by the Delaware Department of Natural Resources and Environmental Control allows 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 applied cooperative research with industry representatives.

Outcome: 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.

Performance Measure: 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.

Performance Measure: Delaware Sea Grant will conduct a survey of local seafood producers to explore the benefits and challenges for cohesive marketing and branding strategies.

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: Delaware Sea Grant will work with industry members to identify and partner on two applied research activities such as remote setting oysters or analyzing Atlantic Sturgeon habitat usage in the Delaware River Estuary.

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 2023, Sea Grant's partnership with DNREC's Fisheries Section will result in co-sponsoring 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 assistance supports the Delaware Center for the Inland Bays' oyster restoration and fish monitoring programs.

Outcome: Delivery of technical expertise improves oyster restoration efforts and precision of data analyses in regards to the Center's fish sampling surveys.

Performance Measure: By 2023, Delaware Sea Grant will collaborate with the Delaware Center for the Inland Bays on at least two projects, thus providing additional expertise to the scientific mission of the environmental data collection program of the Center for the Inland 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 2023, 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 Measure: By 2023, at least 28 fisherman, seafood processing and aquaculture industry personnel will modify their practices using knowledge gained in fisheries sustainability and seafood safety as a result of Sea Grant activities.

Delaware Sea Grant Performance Measures, Metrics and Targets

Number of professional workshops to be convened to discuss improved practitioner and external communication about the size, scope, and economic importance of Delaware-based fisheries and aquaculture.	2
Number of surveys of local seafood producers intended to explore the benefits and challenges for cohesive marketing and branding strategies.	1
Number of applied research activities, such as remote setting oysters or analyzing Atlantic Sturgeon habitat usage in the Delaware River Estuary, that will be collaboratively pursued by industry members and Delaware Sea Grant	2
Number of workshops co-sponsored by Delaware Sea Grant and the Delaware Department of Natural Resources and Environmental Control Fisheries Section that will address new advances in sustainable fishing practices, including research, technology transfer, and economics to foster a viable Delaware fishing/seafood industry.	4
Number of collaborative projects that will be undertaken by Delaware Sea Grant and the Delaware Center for the Inland Bays	2
Number of technical publications and/or outreach bulletins that will be prepared for fisheries managers and industry agents from Delaware Sea Grant-funded fisheries and aquaculture research.	10

National Sea Grant Performance Measures, Metrics and Targets

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.	28
--	-----------

ENVIRONMENTAL LITERACY AND WORKFORCE DEVELOPMENT (ELWD)

Delaware is served by a patchwork of resource management and education programming, and Delaware Sea Grant serves a distinct role with access to University of Delaware resources, dedicated educational program staff, and facilities across the state. Educational programming, including efforts focused on both environmental literacy and workforce development, 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 through, for example, Osher Lifelong Learning Institute at the University of Delaware or 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 2023, 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, after-school, and online programming leading to more students pursuing science-related opportunities in the future.

Performance Measure: By 2023, 1,250 urban and rural K-12 students receive information on coastal and marine science careers 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 2023, 7 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.

Performance Measure: By 2023, at least 30 students at 2-year institutions will be engaged in workforce development programs focused on teaching applicable, real-world skills that meet the emerging needs of our coastal state.

National Sea Grant Performance Measure: By 2023, at least 42 Delaware Sea Grant products will be used to advance environmental literacy and workforce development.

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 2023, Delaware Sea Grant will prepare and deliver 17 professional development opportunities for K-12 teachers and informal science educators. Educational materials will be designed and developed to align with current state science standards.

Objective 5. Public lectures, workshops, and interactive exhibits/activities are provided across the state and virtually 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 2023, 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 2023, 10 visual and performing arts presentations will be targeted to select audiences on pertinent coastal/marine topics and issues.

Performance Measure: By 2023, 10 interactive exhibits/activities will take place at festivals, etc. across the state, or virtually, and specifically target adult learners.

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 2023, 2 Delaware classroom teachers 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 professionals 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 2023, 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.

National Sea Grant Performance Measure: By 2023, at least 40,000 people will be engaged in Sea Grant-supported informal education programs, primarily through four Coast Day events, which will reach people from throughout Delmarva 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 2023, Delaware Sea Grant will provide four seminars summarizing 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 2023, 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.

National Sea Grant Performance Measure: By 2023, 18 Delaware Sea Grant-supported graduates will become employed in a career related to their degree.

Objective 3. Delaware Sea Grant increases environmental literacy while providing students with science communication training.

Outcome: Undergraduate and graduate students will participate in science communication workshops where they will learn about coastal/marine topics and issues and how to share that knowledge with stakeholders across Delaware.

Performance Measure: By 2023, 100 students will be educated through in-person and virtual science communication classes or workshops featuring coastal/marine topics.

Delaware Sea Grant Performance Measures, Metrics and Targets

Number of systematic reviews of K-12 schools/Sea Grant partnerships identifying areas of growth and opportunities for new partnerships to be completed.	1
Number of K-12 students that will receive information on coastal and marine science careers to help encourage the next generation of scientists.	1,250
Number of customized modules that 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.	7
Number of students at 2-year institutions that will be engaged in workforce development programs focused on teaching applicable, real-world skills that meet the emerging needs of our coastal state	30
Number of professional development opportunities for K-12 teachers and informal science educators that will be prepared and delivered. Educational materials will be designed and developed to align with current state science standards.	17
Number of "Focus on the Coast" public lectures and workshops that will be targeted to select audiences on pertinent coastal/marine topics and issues.	10
Number of visual and performing arts presentations will be targeted to select audiences on pertinent coastal/marine topics and issues.	10
Number of interactive exhibits/activities that will take place at festivals, etc. across the state, or virtually, and specifically target adult learners.	10
Number of Delaware classroom teachers that will participate in lab and field research projects with the scientists funded by Delaware Sea Grant	2
Number of viewers that will receive up-to-date information on safe, healthy and sustainable seafood at the science-based seafoodhealthfacts.org website, managed by DESG.	250,000
Number of seminars summarizing funded research, outreach and educational accomplishments for students at 2- and 4-year institutions to help engage students in environmental fields.	4

Number of workshops that 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.	8
Number of students that will be educated through in-person and virtual science communication workshops featuring coastal/marine topics.	100

National Sea Grant Performance Measures, Metrics and Targets

Number of Sea Grant products that are used to advance environmental literacy and workforce development.	42
Number of people engaged in Sea Grant-supported informal education programs.	40,000
Number of Sea Grant-supported graduates who become employed in a job related to their degree within two years of graduation.	18

ASSESSMENT AND REVIEW

The Delaware Sea Grant 2018-2023 Strategic Plan was developed following a careful review of 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 six years, with a vision, actions, and measurable targets to guide programmatic planning and against which our program will be reviewed at the conclusion of the planning period. As a Living Document, additional Outcomes and Objectives may be included in future versions of this plan in response to new challenges and opportunities that arise during the 2018-2023 timeframe. Changes to this Strategic Plan since it was first developed in 2017 provides us an opportunity to revisit our programmatic goals and objectives, take a closer look at 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 years.