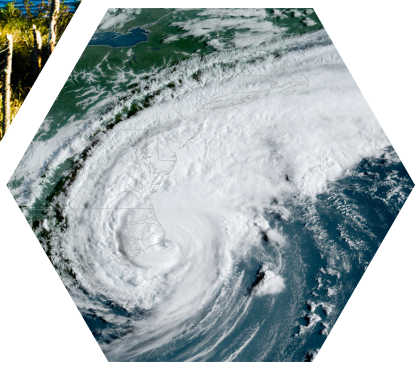
NORTH CAROLINA SEA GRANT

STRATEGIC PLAN

2024-2027



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Strategic Plan 2024–2027

Final Draft: October 2022

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VISION

North Carolina Sea Grant is a key leader in addressing the state's urgent and long-term needs in ocean, coastal, and watershed resource management. The program shares sound science, develops educational excellence, and builds diverse and effective partnerships.

MISSION

Through integrated research, outreach and technology development, North Carolina Sea Grant enhances the sustainable use of ocean, coastal, and watershed resources, benefiting communities, economies, and ecosystems.

INTRODUCTION

North Carolina Sea Grant is an inter-institutional program of the University of North Carolina system. This partnership between the National Oceanic and Atmospheric Administration and the state of North Carolina is one of 34 such Sea Grant programs across the nation.

North Carolina Sea Grant focuses on:

- in-house and extramural research, including grants and fellowships to early career and established scientists, to address the most relevant coastal and watershed challenges and opportunities at local, state, regional, and national levels;
- outreach via extension and communication, including the development, co-development and transfer of new research-based technologies, applications, and information resources; and
- educational and training programs that support a strong knowledge foundation for a wide range of people, including members of the academic community, government officials, businesses and industries, K-12 teachers and students, and the public.

Now in our sixth decade of serving the state, our innovative programs have provided nationally recognized leadership, forging strong, long-term collaborations that link the research portfolios of North Carolina's state public and private universities, colleges, and community colleges with a variety of critical needs. North Carolina Sea Grant drives sound science and builds enduring relationships and partnerships that support the co-creation of applied solutions. With headquarters at NC State University in Raleigh, the program has coastal offices at East Carolina University's Coastal Studies Institute near Manteo; NC State University's Center for Marine Sciences and Technology in Morehead City; and the University of North Carolina Wilmington's Center for Marine Science. The program has a long track record of communicating science, informing policy, and translating research for many audiences via a cadre of specialists, targeted products and platforms, and engaging events.

North Carolina Sea Grant's team has close working relationships with two other long-term state/federal programs based at NC State. The Water Resources Research Institute of the University of North Carolina System is a partnership with the U.S. Geological Survey; while NC Space Grant has NASA as its federal partner.

Coastal Setting and a Changing Climate

North Carolina's 322 miles of oceanfront and the second largest estuarine system (bays, sounds, and wetlands) in the country amount to 12,331 total miles of coastal shoreline. Our state also includes 17 major river basins, 12 of which flow to the Atlantic Ocean. Eleven originate in North Carolina, but only four are contained entirely within the state's borders: the Cape Fear, Neuse, White Oak, and Tar-Pamlico. Those four are all in the coastal region and contribute toward healthy coastal ecosystems.

North Carolina's numerous waterways and the state's extensive coastline present new and ongoing coastal and inland challenges for our program to address, especially as climate change continues to impact our state. The rate of sea level rise on North Carolina's coast varies depending on location and time frame. By 2045, based on existing gauge rates, estimates of sea level rise range from 2.4 inches at Southport (on the southern N.C. coast) to 5.4 inches at Duck (on the northern N.C. coast). Under various scenarios that the Intergovernmental Panel on Climate Change has considered, combined with vertical land movement, sea level rise will vary from 5.8 to 6.8 inches at Wilmington (southern coast) and from 7.1 to 8.1 inches at Duck (northern coast).

Sea level rise, as well as related impacts from higher-intensity precipitation events and storm surge, causes marshes to move inland, brings more frequent tidal flooding, expands 100-year floodplains, contaminates wells with saltwater, affects on-site septic systems, impairs transportation routes, and offers other challenges. As climate change continues, North Carolina Sea Grant is actively involved in statewide programs looking at climate impacts, often with a focus on resilience to coastal storms. We provide coastal planners, local and state policymakers, and residents access to expertise and the latest science to inform their decision-making.

Changing Communities

North Carolina's population grew 9.5% in the 10 years ending in 2020, adding 903,905 new residents and topping 10.4 million in total, making the state the 9th most populous in the country. Across the nation, North Carolina had the fourth largest population increase since 2018, growing at twice the rate of the national average.

Much of the growth continues for inland metropolitan areas that are home to headwaters for watersheds of coastal rivers. The largest coastal city, Wilmington, at the mouth of the Cape Fear, had 126,669 residents in 2020, an 18.7% increase over the previous decade. Two of the fastest growing counties in the state are coastal: Brunswick and Currituck. In addition, Onslow County (home to

Jacksonville and Surf City) was one of two rural counties in the state that grew enough to be re-classified as “regional cities/suburban counties.”

Over the course of the past three decades, net migration accounted for approximately two-thirds of North Carolina’s population growth. A few oceanfront counties — such as New Hanover (home to Wilmington) and adjoining Brunswick County — have seen significant population increases that are expected to continue, with an estimated 21% increase by 2030. That growth includes an influx of retirees, a group that also will bring social, health, and economic challenges and opportunities.

At the same time — because most of the coastal plain does not reap the benefits of oceanfront tourism — a majority of the 20 counties in the state’s Coastal Area Management Act region showed population losses in the 2020 census. Many rural counties are losing early-career adults in search of jobs, and local officials there continue to seek sustainable economic development.

North Carolina is also becoming more ethnically diverse, and the latest projections show continued increases in diversity over the next 30 years. The 2020 census showed a significant increase in the share of individuals identifying as multiracial, up 161% — an increase of 251,094 people over the previous census. Foreign-born residents make up 8% of the state’s population, accounting for over 800,000 people living in the state.

Rural areas in the state, including much of the coast, face a combination of urgencies, including access to broadband services for families and schools; the availability and affordability of health care services in a state where over three-quarters of the rural counties face health professional shortages; access to adequate capital and technical resources for small businesses; access to affordable housing; and insufficient community water and wastewater systems. In addition, environmental hazards, toxins, and pollutants continue to pose challenges. Many vulnerable communities in coastal North Carolina have and are expected to continue to suffer the adverse effects of environmental and social stressors disproportionately. Thus, our team and funded researchers work across an increasing range of fields and disciplines, such as: emergency preparedness, epidemiology, public health, mental health, and infectious disease.

The COVID-19 Pandemic

North Carolina Sea Grant continues to work with state partners and local communities to adapt program priorities and utilize a variety of technologies to address the near-term and anticipated long-term impacts of COVID-19. In addition to the pandemic’s dire public health impacts, the state now faces economic and social impacts, some of which will be long lasting, shaping the future landscapes of communities, industries, and government. Current Sea Grant research is looking at how these impacts have added especially heavy burdens to traditionally underserved communities.

In addition to the pandemic posing new hurdles for communities, our own researchers and extension team members have had to reconceive how to interact with partners, collaborators, and the many

others we serve and support, facing heightened challenges in reaching underrepresented and vulnerable communities. From the start of the pandemic, North Carolina Sea Grant has nimbly adapted our activities to meet new challenges and shifting priorities, while fulfilling our mission and vision. Many of the changes, such as teleconferences and distance learning, will remain ingrained in society. Other long-term impacts are not yet understood, but our program is already looking at impacts on traditionally underserved communities. As a result, North Carolina Sea Grant – as well as many state agencies and communities – must consider internal capacity, while continuing to build partnerships and leverage expertise and resources.

CORE VALUES AND PRINCIPLES

This updated strategic plan, now informing our work through 2027, will guide our program's investments to respond effectively to urgent and long-term challenges and opportunities. Those efforts will benefit communities, ecosystems, and economies across the state, region, and nation. As North Carolina's population continues to grow and diversify, our program's relevance increasingly will rely on how well we embody diversity, equity, inclusion, justice, and accessibility. We will strive to:

- proactively recruit and retain a workforce that reflects diversity across all levels of our organizational structure.
- engage and serve people, partners, and communities representative of the broader populations where our programs operate.
- create and facilitate research opportunities that equitably fund under-targeted and underserved faculty and students.
- foster research with real-world outcomes that benefit underserved communities, including communities disproportionately suffering the adverse effects of climate, pollution, contaminants, and other hazards.

In addition to our program's commitment to diversity, equity, inclusion, justice, and accessibility, we will execute our mission based on these core values and cross-cutting principles:

- Identifying emerging and ongoing needs and seeking innovative opportunities and co-created solutions through collaborations with partners from international, federal, tribal, state, and local communities, as well as from academia, nongovernmental organizations, and industry.
- Embracing interdisciplinary approaches that incorporate research, outreach, and education to address complex challenges.
- Supporting sound science through merit-based peer review of research results.
- Developing cadres of cross-trained students across multiple disciplines to develop the next generation of experts on coastal topics.
- Translating and communicating science-based information, solutions, and best practices in an accessible and inclusive manner for a range of engaged users and decision makers so that they can make informed choices and educate future generations.

- Operating with accountability, integrity, and transparency, while maintaining quality and relevance in all functional areas, including program management.
- Advancing sustainability through environmental stewardship practices and by communicating the value of the services that the coastal, watershed, and ocean ecosystems provide the state.

These values are integral to the program's organizational approaches, and team member's duties, with constant self-evaluation. We reinforce them through professional development within our team, as well as the strong connections across our portfolio of projects and activities. We adapt our operations as we draw on information from our own diversity, equity, inclusion, justice, and accessibility committee, the North Carolina Sea Grant Advisory Board, state and federal agencies, and partners in academia, local governments and communities, business and industry, and other organizations.

CROSS-CUTTING MEASURES

North Carolina Sea Grant's integrated research and outreach programs are designed to be cross-cutting and address multiple state focus areas, goals, and outcomes, as well as the national performance measures identified by the National Sea Grant College Program. (See the Appendix).

FOCUS AREAS

To meet our mission and to continue to expand our impacts in supporting the ocean, coastal, and watershed resource management needs of the state, North Carolina Sea Grant will concentrate efforts in the following strategic areas:

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

These focus areas, along with respective goals and outcomes, arose from an in-depth process that included a series of five facilitated strategic-planning focus groups in 2022 with partners, affiliates, collaborators, community leaders, and others; a statewide online survey that also reached new audiences; and national perspectives from the National Oceanic and Atmospheric Administration and National Sea Grant College Program. Facilitated group discussions included the North Carolina Sea Grant Advisory Board as well as North Carolina Sea Grant's experienced research, extension, and communication team members to ensure state-based applicability and relevance. Three virtual facilitated sessions incorporated broad representation from local, state, federal, industry, academia, and nonprofit perspectives, as well as including representation from the North Carolina mountains, piedmont, and coastal regions.

North Carolina Sea Grant is committed to program advancement in each focus area by explicitly integrating a spectrum of activities. Our goals and desired outcomes position the program to leverage current capacity, expand and develop new partnerships and funding avenues in support of program goals, and extend program investments to new challenges and opportunities in North Carolina's natural resource management. As designed, these focus areas are synergistic, each building upon and complementing one another for program efficiencies and effectiveness. Additionally, North Carolina Sea Grant is a trusted partner for local communities, including county and municipal governments, organizations, and business sectors. Thus, our program will continue to grow in facilitation and co-creation, engaging with and listening to local priorities and incorporating on-the-ground perspectives into Sea Grant research and outreach investments.

ENVIRONMENTAL LITERACY AND WORKFORCE DEVELOPMENT

North Carolina's future relies on choices that sustain our coastal and ocean resources for the benefit of communities, economies, and ecosystems. Through engagement, North Carolina Sea Grant fosters an environmentally literate public that understands, appreciates, and considers the health and sustainability of our coastal, ocean, and watershed resources and our coastal communities.

North Carolina Sea Grant engages diverse participants and recipients through our environmental literacy and workforce development efforts. Preserving, protecting, and managing our state's coastal resources involves everyone living in and visiting North Carolina. We will continue to broaden our reach to piedmont and mountain audiences, as well as to visitors to our coast. Our team works with partners to develop educational programs for a variety of learners from young students to continuing education participants and lifetime learners.

We will continue our education investments, in and out of the classroom, by providing access to talented educators, skill-building experiences, career-enhancing opportunities, and tailored educational products. With those efforts, we will help develop communities and a workforce skilled in science, technology, engineering, arts, and mathematics — known as "STEAM." This combination of skills will help current and future leaders to be environmentally friendly, participatory community members. Our workforce training also can include basic business management, thus helping even wider audiences to have broader understanding to address complex issues concerning coastal and ocean resources; and help to position North Carolina to compete economically at a global scale.

Fostering a spectrum of communications and engagement among a breadth of educational professionals and decision makers in other spheres — including leaders in government, business, and community organizations — will ensure effective information sharing. Sea Grant's outreach and engagement specialists support consensus building and encourage informed decision making that considers a balance of economic and environmental priorities. North Carolina Sea Grant will continue to support existing partnerships and seek new avenues and collaborators to strengthen educational

investments, with attention to those serving underrepresented groups across the coastal region, the state, and the nation.

Environmental Literacy and Workforce Development Goal 1

An environmentally literate public, including key decision makers, that understands, appreciates, and considers the health and sustainability of our state's watersheds, inner and outer coastlines, nearshore ocean resources, and the communities who depend on these ecosystems.

Outcomes

- North Carolina Sea Grant's communication and outreach will expand access to up-to-date coastal and ocean research, extension, and environmental educational materials through a range of products (e.g., *Coastwatch* magazine, newsletters, and other print, video, and online products) for multiple audiences in homes, classrooms, informal education facilities, festivals, conferences, and other uses.
- In collaboration with formal and informal education facilities and coastal industries, and other partners, we will develop user-defined workshop content (e.g., presentations, trainings) and continuing education programs, which we will archive for continued use.
- We will develop outreach programs to expand our reach to new and diverse audiences, including the state's piedmont and mountain regions, underserved communities, and coastal businesses and industry.
- Through targeted programming and communication, we will engage local and state officials and policymakers, along with other partners, to discuss and build greater understanding of scientific information, collaborate on law and policy briefings, and share available tools to support decision making that incorporates social, environmental, and economic considerations.

Environmental Literacy and Workforce Development Goal 2

Educators in K-12 and college classrooms, and less formal educational settings have access to resources and training to bring coastal science, heritage, policy, and history for current students and future leaders.

Outcomes

- New curricula, workshops, and professional development sessions will equip educators with tools to build environmental literacy in classrooms, facilitate at-home and distance-learning, and serve other audiences. Those materials will remain available for recurring access.
- An educational advisory group continues to inform the direction of North Carolina Sea Grant's educational programming, as well as to evaluate its utility for multiple groups across spheres and disciplines to ensure ongoing adaptations to changing needs and requirements.

- Local, state, regional, and national educational organizations partner with North Carolina Sea Grant to utilize educational products, magnifying the effectiveness and reach of educational lessons and activities.
- Hands-on and remote-learning research experiences are developed for teachers and students across the state in partnership with Sea Grant-funded researchers, graduate students, community science partners, and other formal and informal educators
- Current and emerging distance-education technology will broaden the reach of educational training across multiple audiences throughout the state, including colleges, community colleges, and K-12 schools that are historically underserved and underrepresented.

Environmental Literacy and Workforce Development Goal 3

The next generation of coastal and ocean professionals have scientific and technical skills and the necessary business acumen to creatively solve complex resource problems to support a robust coastal economy, alongside healthy ecosystems and communities.

Outcomes

- Opportunities for interdisciplinary fellowships and research experiences for undergraduate and graduate students will increase as a result of partnerships with diverse institutions, organizations, and small businesses across the state, region, and nation.
- A greater pool of graduate and undergraduate students who represent a breadth of diversity apply for and receive support under our program's research funding and outreach opportunities.
- Professional training and retraining opportunities for students and adult learners strengthen employability and opportunities for leadership roles after graduation.
- Industry and business partners expand or create professional intern programs to support technical training and employment pipelines for current and post-graduate students at various levels — high school, community colleges, and universities.
- North Carolina Sea Grant provides quality professional development and continuing education sessions that qualify participants toward new or renewed professional licenses and certificates.

HEALTHY COASTAL ECOSYSTEMS

Healthy coastal ecosystems are the foundation for life along the coast and for providing goods and services, including food and storm protection for inland North Carolina. However, coastal development, land-use practices, and other human activities: contribute to challenges related to water quality and quantity and associated human health impacts; cause compound flooding; increase marine debris; degrade aquatic and terrestrial habitats for fish and other species; diminish wetlands and biodiversity; and facilitate the proliferation of invasive species.

As North Carolina Sea Grant and many of our partners work to restore and maintain coastal ecosystems, we need to better understand such threats — along with heightened challenges arising from climate change — to provide a foundation for updating and developing adaptation and mitigation strategies. North Carolina Sea Grant will continue its two decades of collaborations for the state's Coastal Habitat Protection Plan that identifies specific critical habitats that should be considered across a broad range of state agencies and programs.

Because of the strong links between healthy ecosystems, community health, and sustainable economic development, North Carolina Sea Grant will continue to serve as a key partner in promoting the Blue Economy, a sustainable ocean and coastal economy that reflects the long-term capacity of resilient and sustainable ecosystems to support human activities, including a thriving tourism industry. In addition, a greater reliance on renewable energy also will necessitate planning for the integration of new kinds of infrastructure (e.g., wind and solar farms) into our state's coastal regions in ways that are sustainable for ecosystems and communities.

In light of significant economic investment and potential returns, North Carolina Sea Grant must offer leadership and collaborate on coastal protection and restoration issues. This includes initiatives generating natural or nature-based solutions that improve ecosystem functions while also supporting community health and vitality.

Working with partners in academia, industry, agencies, and local communities, our Sea Grant team will continue to play a key role in listening, prioritizing, identifying, and assessing impaired ecosystems, as well as supporting the co-development of potential policies, technologies, and processes with existing and new partners that lead to the improvement of watershed, coastal, and ocean ecosystems. With our partners, we will accomplish this through rigorous natural, physical, and social science approaches that work synergistically to advance knowledge of coastal ecosystems. Because watersheds and ecosystems extend beyond government boundaries, regional and/or multi-state projects also will be a part of our Sea Grant portfolio.

A key component of supporting healthy coastal ecosystems is successful outreach by Sea Grant extension and communication specialists, along with the management team, working with funded researchers and partners across the state. Together, we engage residents, community leaders, and policy makers to prioritize information and best approaches and to translate the latest knowledge into practice, maximizing benefits to people and ecosystems at the coast and upstream.

Healthy Coastal Ecosystems Goal 1

North Carolina Sea Grant will continue to use a combined human/natural systems/watershed approach, focused on present-day and emerging ecosystem conditions, to create and support the generation of new knowledge and applications. We will work to co-develop applied and interdisciplinary research with community members and other partners — making use of multiple ways

of knowing, including traditional ecological knowledge — to assess the health, functions, threats, and resilience of coastal ecosystems, communities, and residents.

Outcomes

- Collaborative research couples upstream outputs (e.g., sediment, nutrients, toxins, plastics, flows) with downstream impacts, in turn improving understandings of watershed scale and risks of environmental contamination to coastal ecosystems, communities, and people, such as residents using wells, seafood consumers, and subsistence and recreational fishers.
- Researchers, planners, and other partners better understand ecological and economic impacts of adaptation, mitigation, restoration, and policy activities via existing and newly developed methodologies and technologies.
- Our team, funded researchers, and community partners explore nature-based solutions, including green infrastructure, to address social, ecological, and economic challenges of climate change and continued development.

Healthy Coastal Ecosystems Goal 2

North Carolina Sea Grant will help maximize habitat protection and restoration, as well as related economic and social benefits, through applied research, outreach, and engagement.

Outcomes

- To strengthen the translation of research to applications related to habitat functions, North Carolina Sea Grant will continue to collaboratively engage resource managers, design professionals, coastal residents, state and community leaders, and industries to increase the understanding of ecosystem benefits — environmental, social, and economic. This will include our innovative communication products, geospatial analytics, decision-support tools, and engagement techniques.
- Scientific studies quantify habitat changes over time and link them to drivers, such as climate change, changing land-use/cover and water quality. Our work, reflecting research and local environmental knowledge, informs restoration practices that can then be evaluated to confirm intended habitat enhancements.
- In collaboration with diverse partners, communities, and populations across the coast and inland, we will demonstrate, execute, and evaluate innovative technologies, sustainable designs, and restoration practices, including natural and nature-based approaches.
- North Carolina Sea Grant will develop new partnerships to identify coastal ecosystem issues and opportunities, foster inclusivity of local knowledge, prioritize community-driven projects, and increase awareness of our program's products and expertise.
- Through collaborative projects, new tools and outreach programs based on existing science and new research will support decision making, policy development, and environmental

literacy — and will be accessible and available for communities that represent the diversity of North Carolina.
- Environmental justice will serve as a lens for establishing priorities, addressing the equitable distribution of ecosystem and economic benefits as well as addressing communities that bear adversity disproportionately.

SUSTAINABLE FISHERIES AND AQUACULTURE

With U.S. population growth and increasing rates of seafood consumption, maintaining and expanding a domestic seafood supply is of great importance. North Carolina's unique location and varied waters provide a wide array of seafood to consumers via the commercial fishing industry and a developing marine aquaculture sector, as well as through subsistence and recreational fishing.

In recent years, there have been changes to our fisheries. Some stocks or seasons are changing, as water temperatures increase due to climate change. Regulations are regularly updated by state and federal authorities. Economic factors range from pandemic impacts to staffing shortages and even potential habitat changes that could come with the development of offshore wind energy. There also is potential for user conflicts over access to waters, fish stocks, etc.

Our state's commercial fishing industry harvests wild-caught seafood. North Carolina Sea Grant's 2020 economic impact analysis showed the state's wild-caught seafood industry contributed nearly $300 million and 5,500 jobs to the state's economy. Top species by dock value include blue crabs and shrimp. In many cases the fishing industry is part of the cultural fabric of smaller coastal communities that traditionally had featured working waterfronts. But a Sea Grant-funded study in 2021 found that North Carolina continues to lose seafood processing capacity. The state currently has 76 active seafood wholesalers, a 41.5% reduction since 2000.

Meanwhile, marine aquaculture presents an opportunity to meet growing in-state and out-of-state consumer demand, while also creating new jobs and helping local coastal economies. North Carolina's small, but rapidly growing, marine aquaculture industry generated a 2021 farm gate value of $6.5 million, based on oysters ($4.75M), hard clams ($0.35M), and soft crabs ($1.44M). Developing finfish aquaculture includes striped bass and black sea bass.

Each year, the for-hire recreational fishing industry, including charter and head boats, affords access to seafood to multitudes of anglers. In all, marine recreational anglers took 16.4 million trips in 2020, landing spotted sea trout, mahi mahi, and bluefish the most. The industry focuses on the sport, because for every fish an angler lands, they catch and release almost three. The N.C, Division of Marine Fisheries data indicates recreational fishing supported 34,010 jobs and over $4 billion in spillover sales impacts in 2019.

Expanded research and extension programming with this sector would advance for-hire business operations, fishery management decisions, as well as tourism and marketing efforts for coastal communities. Our partners suggest that improved communication with these groups could enhance understanding and compliance with regulations, boost conservation efforts, and improve local economies in coastal communities and beyond.

In addition to the formal industries, many people also fish to sustain their diets, and Sea Grant research shows that they share their catch with family and friends. Thus, a continued safe and sustainable seafood supply means many sectors must be responsive to social and environmental needs, along with changing markets. Increasing demands for fresh seafood provide opportunities both for educational efforts to raise consumer comfort levels for cooking seafood at home and to further enhance in-state markets – including direct-to-consumer sales for North Carolina marine seafood products. Strategies for supporting a strong supply chain and economic structure have come into greater focus as the pandemic brought restaurant closures and shifted consumer attention to retail and direct seafood sales for wild-caught and aquaculture products.

Effective conservation and strategic management of seafood resources depend on the collection of basic, applied, and sometimes novel scientific information. Currently, some North Carolina fish stocks lack sufficient data, particularly a direct index of abundance on which to base policy decisions.

This focus area requires a research and engagement strategy with commercial harvesters, aquaculture producers, recreational anglers, fishery managers, seafood consumers, commercial seafood buyers, and others. These efforts seek to ensure a safe and sustainable seafood supply for the coming years.

Sustainable Fisheries and Aquaculture Goal 1

Improved science and management will advance conservation and sustainability of North Carolina living marine and estuarine resources and dependent ecosystems.

Outcomes

- New research approaches and strategies facilitate the collection of essential fishery information and fill identified data gaps for managing living marine resources and aquatic ecosystems, particularly considering a changing climate.
- Research and pilot testing of advanced technologies and techniques in fisheries science and data management will reduce research costs and support efforts of resource managers.
- Community members participate in science projects to collect monitoring and management data that would not be possible to gather using traditional research practices alone; such projects will foster marine stewardship, greater trust in scientific data, and involvement from underserved and underrepresented communities.

- We will encourage, develop, refine, and/or implement research and outreach regarding technologies and fishing practices with and for our partners and the public to help reduce commercial bycatch and recreational fishing mortality.
- Our research will assess environmental impacts and/or threats related to human activities — including seafood harvests, impacts of fishing activities, marine aquaculture, renewable energy, introduction of non-native species, and emerging contaminants (microplastics, persistent organic pollutants, etc.). We will share results and data among partners to support and implement responsible and sustainable practices.

Sustainable Fisheries and Aquaculture Goal 2

North Carolina wild-caught seafood and marine aquaculture industries employ optimal business strategies, become more competitive in the marketplace, and provide economic benefits to coastal communities.

Outcomes

- North Carolina Sea Grant will support research, development, and transfer of new and refined wild-caught seafood harvest and aquaculture production technologies, including those for emerging species.
- Our workforce and business development efforts will better equip people across the wild-caught seafood and marine aquaculture industries to initiate and manage new technologies and expanding opportunities, as well as to navigate hurdles resulting from rapid market disruptions.
- Our programs, workshops, and services enable a younger and more varied workforce to enter career paths in supplying seafood, whether that be via wild-harvest, farm-raised, or recreational guide services (e.g., charter/head boat).
- Members of the public and those involved in fisheries and aquaculture have varied opportunities to learn about competing uses for coastal waters, such as the siting and approval processes for shellfish leases, and for renewable energy leases.
- Coastal and inland businesses have access to innovative marketing and supply-chain approaches, including direct marketing to targeted audiences, encouraging services and products that enhance the economic value of N.C. seafood to fishers and producers, restaurants, retailers, and consumers.
- Businesses identify and define opportunities and problems by using qualitative and quantitative market-research techniques, including learning principles for adding value to marine seafood commodities, and use resources for public-sector and private-sector guidance on various stages of product development.
- Harvesters, growers, processors, restaurant chefs, retailers, and regulators have opportunities to learn to prevent, eliminate, or reduce to safe levels various biological, chemical, and physical hazards that have public-health significance.

- Our research collaborations will help industries deal with diseases and other mortality events for wild and aquaculture stocks.

Sustainable Fisheries and Aquaculture Goal 3

Marine recreational anglers and other waterway users increase their understanding and appreciation of aquatic resources.

Outcomes

- Individual anglers, fishing clubs and organizations, and for-hire charter industry members better understand management practices and opportunities for stewardship in recreational fisheries.
- Infrastructure and business opportunities enhance marine recreational fishing opportunities, including improved community awareness of social and other benefits associated with recreational fishing, including the participation of people of all backgrounds, ages, abilities, and incomes.
- Recreational boaters have new sources of information regarding safety, compliance with water-quality regulations, marine debris challenges, and efforts to reduce the loss of fishing-related gear.
- We support awareness of the role of subsistence fishing in varied communities and encourage practices that promote seafood safety and sustainability.

Sustainable Fisheries and Aquaculture Goal 4

Consumers are better educated about the value of eating North Carolina's wild-caught and cultured seafood, with related businesses building upon connections consumers have with seafood products and communities.

Outcomes

- Seafood consumers learn to evaluate the variety of seafood choices available to them, including wild-caught and aquaculture products, and better understand the potential for changing availability due to environmental, regulatory, and other market conditions. This includes a focus on species landed locally or in the state, as well as others from U.S. waters.
- Seafood consumers better understand the nutritional benefits and risks of seafood products; how to judge seafood quality at the point of purchase; how to handle, prepare and/or cook seafood safely in the home; and how to minimize risks of environmental contamination in the catch for subsistence and recreational fishers.
- Chefs and other business leaders build strategies tailored for N.C. seafood, such as tourism collaborations that may relate to seasonality of seafood choices, recipes and cooking instructions, and fishing communities' heritage.

RESILIENT COMMUNITIES AND ECONOMIES

Offshore, nearshore, coastal, estuarine, and freshwater environments shape social and economic characteristics of our state. Healthy and robust ecosystems are valuable to economies dependent upon these resources, and to community culture and identity. North Carolina also has a greater awareness about chronic shocks and disturbances that impact communities and economies in our coastal watersheds, while public health concerns, and shifting market forces also are ongoing issues.

In a changing climate, North Carolina is expected to get hotter, wetter, and more humid, with increased frequency and magnitude of heavy precipitation and flooding, sea level rise and major storms, and periods of drought. Other non-climate stressors — such as rapid population growth and land development, social vulnerabilities and inequitable conditions, housing insecurities, public health threats, aging and vulnerable infrastructure, and manmade disasters such as chemical and other spills — can exacerbate and even increase the likelihood of impacts to communities from coastal and climate hazards, particularly for people who have been subject to historical discrimination and injustice.

North Carolina has experienced significant setbacks due to frequent and intense storms, flooding, extreme temperatures, droughts, saltwater intrusion, and beach erosion. For example, in 2018, Hurricane Florence caused $22 billion of damages in our state, for which recovery continues. Hurricane Florence was a slow-moving storm with record rainfall that caused extensive flooding, much of which impacted inland coastal plain counties and low-income communities. North Carolina Sea Grant is actively working with varied state programs and partners to identify best management practices — including natural and nature-based mitigation and adaptation features — to reduce the vulnerability of people, infrastructure, businesses, and communities to environmental stressors, as well as to advance ways communities can mitigate, adapt, manage, and recover from these events.

Environmental and public health challenges also have been on the rise. Issues like deteriorating water quality contribute to harmful algal blooms with negative impacts on the ecosystem and human health. Such public health risks are more acute for socioeconomically vulnerable populations; lower income, rural, and other underserved North Carolinians have less access to health care and experience greater rates of adverse health outcomes, including mental health issues, substance abuse, obesity, and other chronic health impairments. As climate change accelerates, natural disasters become more frequent, displacing families, creating and amplifying economic instability, and worsening mental and physical health. Public and environmental health experts must be collaborators to address these issues.

Market forces shift constantly due to local and global economic trends, requiring communities and businesses to be nimble and adaptive. One example is the growing focus on renewable energy. Across many sectors, employment opportunities and labor force demands have changed considerably in recent years. Remote work is now commonplace, contributing to increased population growth in rural and traditionally tourist-driven communities. Housing affordability and cost of living have become

major concerns in both urban and rural areas. Few industry sectors are purely local; rather, they rely on complex supply chains and disparate consumer markets, requiring real-time data and advanced forecasting tools to stay competitive.

Communities need tailored information, guidance, and support to manage and reduce risk from current and future stressors, to prioritize and coordinate efforts, and to build resilient communities, ecosystems, and economies that both mitigate and adapt to changing conditions in the short-term and long-term. North Carolina is striving for a holistic and collaborative approach, founded on best available knowledge and information, to support proactive planning, preparedness, and response. Strategic integration and coordination of plans and efforts across multiple disciplines and scales will facilitate effective decision-making and implementation of these plans, policies, and practices.

North Carolina Sea Grant contributes by working with partners to identify barriers — financial, informational, cultural, systemic, and legal — to effective planning, as well as challenges in implementing local policies and solutions when multiple property owners, decision makers, and managers are involved. This includes assisting communities in accessing and using scientific and technical information to address stressors, including weather and climate related hazards, and working directly with communities to ensure the use of interdisciplinary decision-making tools, research-based science, and innovative solutions. Sea Grant plays a vital role in connecting community managers and leaders to identify vulnerabilities, and then translates this information back to state and regional agencies to prioritize investments and ensure efforts that will provide the greatest resilience to communities.

Resilient Communities and Economies Goal 1

Resilient coastal economies are supported by a diverse range of existing and emerging sectors that enable sustainable use of marine and coastal resources.

Outcomes

- Research, conducted by our team and by funded research collaborators that include local partners, assists coastal communities to identify, evaluate, and support the roles of traditional business and industry, as well as emerging sectors, in diverse coastal economies.
- Communities understand needs and opportunities for sustaining vital infrastructure; preserving cultural heritage and coastal access; increasing the value of sustainable, water-dependent industries, including working waterfronts, recreation, and tourism; and encouraging emerging sectors with environmentally and economically sustainable business practices.
- In consideration of changing conditions, communities engage in technical planning based on best available information that will support diversified, sustainable, and resilient economies, ecosystems, and neighborhoods. Outreach programming engages communities in co-developing an understanding of how planning and management decisions affect ecosystem

and human health, how degraded coastal ecosystems can negatively impact human health, and how healthy coastal ecosystems can support profitable local business and industry.
- Communities engage in technical assistance programs that include decision-support tools, including those developed through Sea Grant efforts, that reflect their needs and priorities and enable them to consider integrated strategies for resource management and other best management practices.
- Extensive partnerships among our Sea Grant team and funded researchers, non-profits, the private sector, community leaders, and local, state, and federal governments identify and develop opportunities for resilience.

Resilient Communities and Economies Goal 2

Communities and individuals understand risks associated with living, working, and doing business along the coast and in coastal watersheds and make informed decisions that enhance ecosystem, community, and economic resilience and sustainability.

Outcomes

- Our team and collaborators use interdisciplinary research and outreach to improve awareness of current and future hazards, risks, and potential impacts to communities, ecosystems, and economies related to changing conditions and climate change.
- Communities have direct access to information they need to understand their risk and vulnerabilities to hazards and the impacts of climate and non-climate stressors, and they are prepared to undertake planning and implementation that enhances their resilience.
- Local leaders, at the community, county, and/or regional scale, understand opportunities to incorporate research-based information, best management practices, and adaptive and holistic strategies into their local planning, policies, and implementation measures.

Resilient Communities and Economies Goal 3

Communities and economies have the capacity to effectively plan for, respond to, mitigate, and adapt to current and future risks, changing conditions, and impacts of coastal and climate hazards both in the short-term and long-term.

Outcomes

- Through Sea Grant leadership and collaborations, communities participate in coordinated community-level and regional-scale planning efforts that support proactive disaster preparedness and response, resilient future land use and development, and innovative solutions that consider natural and nature-based infrastructure and ecosystem services.
- Communities use their knowledge to inform planning and policy decisions to increase their resilience to current and future impacts and changing conditions.

- Communities receive technical assistance in climate adaptation and mitigation at the local level to address short-term and long-term impacts, and they possess the resources to facilitate the integration of resilience into local plans, processes, and frameworks.

CONCLUSION

North Carolina Sea Grant is committed to providing timely research regarding coastal resources and policy, as well as to the dissemination of research results, products, tools, and technologies to engaged partners and collaborators — including state and local decisionmakers, industry practitioners, community leaders, and the public. Our program has a tradition of engaging with diverse partners across the state, region, and nation so that North Carolina's communities, ecosystems, and economies will thrive now and into the future. We will continue to build and broaden these collaborations.

Visit *NCSeaGrant.org* or contact Executive Director Susan White: *snwhite3@ncsu.edu*.

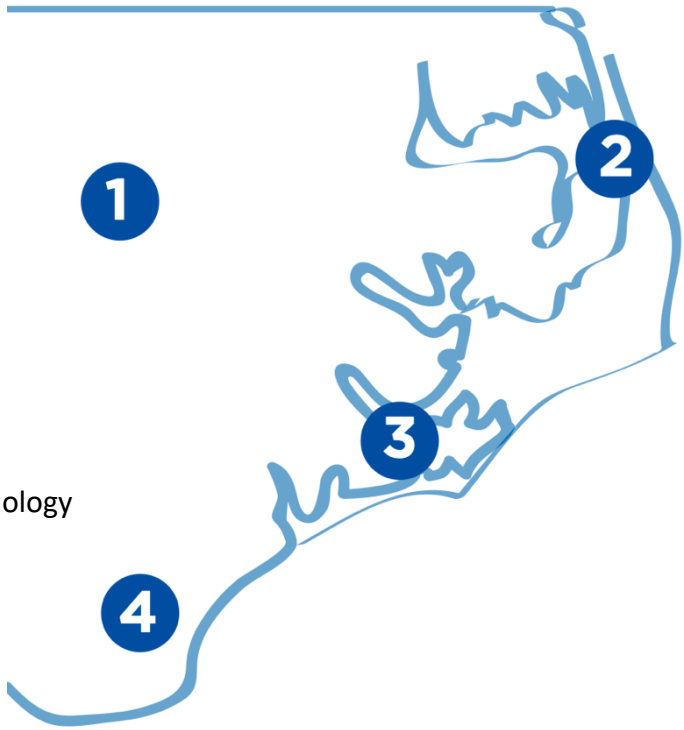
North Carolina Sea Grant's Locations

1
NC State Centennial Campus
850 Main Campus Drive
Toxicology Building, Suite 105
Raleigh, NC 27606

2
Coastal Studies Institute
850 NC Highway 345
Wanchese, NC 27981

3
NC State Center for Marine Sciences and Technology
303 College Circle
Morehead City, NC 28557

4
UNC-W Center for Marine Science
5600 Marvin K. Moss Lane
Wilmington, NC 28409



APPENDIX:
CORRESPONDING NATIONAL SEA GRANT COLLEGE PROGRAM PERFORMANCE MEASURES AND METRICS

PERFORMANCE MEASURES BY NATIONAL FOCUS AREAS

North Carolina Sea Grant's goals and outcomes correspond with the performance measures of the National Sea Grant College Program.

Environmental Literacy and Workforce Development (ELWD)

- Number of Sea Grant products that are used to advance environmental literacy and workforce development.
- Number of people (youth and adults) engaged in Sea Grant-supported non-formal education programs.
- Number of Sea Grant-supported graduates who become employed in a job related to their degree within two years of graduation.

Healthy Coastal Ecosystems (HCE)

- 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.
- Number of acres of coastal habitat protected, enhanced, or restored as a result of Sea Grant activities.

Sustainable Fisheries and Aquaculture (SFA)

- Number of fishers, seafood processors, aquaculture industry personnel, or seafood consumers who modify their practices using knowledge gained in fisheries sustainability and seafood safety as a result of Sea Grant activities.

Resilient Communities and Economies (RCE)

- Number of communities that adopt/implement sustainable economic and environmental development practices and policies as a result of Sea Grant activities.
- Annual number of communities that adopt/implement hazard resilience practices to prepare for and respond to/minimize coastal hazardous events.

CROSS-CUTTING NATIONAL PERFORMANCE MEASURES

In addition to the corresponding national performance measures included within the specific focus areas above, North Carolina Sea Grant addresses these cross-cutting national measures:

- Number of Sea Grant tools, technologies, and information services that are used by our partners/customers to improve ecosystem-based management.
- Economic and societal impacts and benefits derived from Sea Grant activities (market and non-market; jobs and businesses created or sustained; patents).

CROSS-CUTTING NATIONAL PERFORMANCE METRICS

North Carolina Sea Grant's goals and outcomes also correspond with these performance metrics of the National Sea Grant College Program:

- Sea Grant Staffing: Number of individuals and full-time equivalents (FTEs) devoted to Sea Grant
- Core Funding Proposals: Number and Origination of Core Funding Pre- and Full- Proposals
- Number of Volunteer Hours
- Number of Postsecondary Students and Degrees Financially-Supported by Sea Grant in Higher Education Programs (Undergraduate, Graduate)
- Number of P-12 Students who participated in Sea Grant-supported formal education programs
- Number of P-12 Students Reached Through Sea Grant-Trained Educators
- Number of educators who participated in Sea Grant-supported professional development programs
- Number of Sea Grant-Sponsored/ Organized Events
- Number of Attendees at Sea Grant-Sponsored/ Organized Events
- Number of Public or Professional Presentations
- Number of Attendees at Public or Professional Presentations
- Number of Marinas Certified as "Clean Marina" by the Clean Marina Program as a result of Sea Grant Activities
- Number of individuals certified or recertified in Hazard Analysis Critical Control Point (HACCP) as a result of Sea Grant activities
- Number of peer-reviewed publications produced by Sea Grant