



RETURNS ON INVESTMENTS

UNC-SG-10-14

North Carolina Sea Grant (NCSG) provides research, education and outreach opportunities relating to current issues affecting the North Carolina coast and its communities. Since 1970, North Carolina Sea Grant has prided itself on being a valuable resource for scientists, educators, local officials, government agencies, coastal businesses and the public to find unbiased, scientifically sound information about the state's coastal ecosystems.

By administering millions of dollars of research, outreach and education programs each year, North Carolina Sea Grant funds initiatives and projects that touch a broad range of topics, including fisheries, seafood science and technology, water quality, aquaculture, community development, law and policy, and coastal hazards. Through a combination of federal and state dollars, the program facilitates university-based research to answer complex questions about the state's diverse coastal ecosystems and to meet the needs of coastal communities. In turn, those research results fuel outreach and education programs that promote discovery, learning, new research and awareness across the state and the nation.

Headquartered at North Carolina State University, NCSG is an inter-institutional program within the University of North Carolina system and has offices in Manteo, Morehead City and Wilmington. Sea Grant researchers come from public and private universities across the state. As part of the National Sea Grant Network, we receive funding from the National Oceanic and Atmospheric Administration (NOAA).

Here are just a few examples of Sea Grant's impacts at work, grouped by focus area.

Michael P. Voiland, Executive Director

Healthy Coastal Ecosystems

NC Plan Protects Coastal Habitats

RELEVANCE: Six critical habitats — wetlands, shell bottom, hard bottom, soft bottom, submerged aquatic vegetation and the water column — are the focus of the NC Coastal Habitat Protection Plan (CHPP), an interagency strategy that outlines the coastal region's ecosystem management priorities. The plan is a joint effort of the state's Coastal Resources, Environmental Management, Marine Fisheries and Wildlife Resources commissions, and NC Department of Environment and Natural Resources.

RESPONSE: NCSG has been a key partner in CHPP from the initial concept through development of research and outreach goals and implementation. CHPP focuses on the quality of habitats and the

species they support to determine the environmental, economic and cultural health of communities in the coastal region. Many elements of NCSG's strategic plan (e.g., addressing sea level rise and other emerging issues) correlate with CHPP elements.

RESULTS: As the state completes its five-year CHPP review, many proposed updates are based on results provided by Sea Grant research and extension programs. State officials point to NCSG oyster studies and data on the use of strategic areas by river herring and striped bass. The current Marine Fisheries Fellow works directly on habitat issues in Pamlico Sound, based on the success of an earlier fellow's studies in Albemarle Sound, where analyses showed lower fish counts in areas with high levels of human alterations.

NCSG research in the surf zone serves multiple critical habitats — from the water column down to the benthic region. Additional NCSG/CHPP links are cited in *Coastwatch* magazine, Spring 2010.

RECAP: State environmental officials consider NCSG an important source of scientific data and recommendations for CHPP.

Stream Restoration Benefits Coastal Watersheds

RELEVANCE: Coastal sounds and tidal creeks in North Carolina are critical nursery areas that rely on the quality of the waters that flow through inland urban and agricultural areas — from the piedmont region to the riparian areas along estuaries. Greater attention to river-basin management includes restoring streams degraded by pollution or channeled underground for decades.

RESPONSE: NCSG's water quality specialist is a key member of the state's Stream Restoration Program, training engineers, landscapers, and local and state officials. Through NC State University's Water Quality Group, she links academic experts, state regulators and field professionals. NCSG has a strong history of stream demonstration projects, with leveraged funding from the NC Clean Water Management Trust Fund, state and federal transportation programs, EPA 319 funds, NC Division of Water Resources and local stormwater programs.

RESULTS: NCSG partnered with NC State to restore Rocky Branch that runs through campus. Completed in late 2009, with the NCSG specialist serving as lead, the decade-long \$8.3 million dollar project restored over a mile of stream once listed among the state's most polluted. The project restored 24 acres, and the final segment daylighted 235 linear feet in a culvert under a parking lot. Earlier phases constructed flood plains, riffles and pools to restore ecosystem services. The project offers a greenway for outdoor education and recreational activities. The stream is a test site in the development of an assessment protocol that state and local officials could use to evaluate stream restoration performance.

RECAP: NCSG continues to demonstrate its leadership in stream restoration training and research.

Ocean Literacy Topics Bring Coast to Classrooms

RELEVANCE: As state and federal officials look to strengthen science and math competencies, teachers are looking for real-life lessons to keep students' interest across varied disciplines. NOAA has developed fundamental principles of Ocean Literacy, many of which relate to the NC Standard Course of Study.

RESPONSE: NCSG's marine education focuses on teaching the teacher. As a partner in the Centers for Ocean Science Education Excellence – SouthEast, NCSG leverages regional efforts, including summer leadership institutes and daylong SEPORT workshops around the state throughout the year. NCSG's marine educator also serves as a local leader in the Maury Project and DataStrems courses of the American Meteorological Society, and links teachers and students to phytoplankton monitoring programs, as well as competitions to design remotely operated vehicles, resulting in state and national honors for the young scientists. Many more students increase their appreciation for the coastal region and develop a lifetime sense of environmental stewardship.

RESULTS: NCSG workshop participants reached nearly 10,000 students in 2009–2010. NCSG's educational emphasis also includes researchers who connect with teachers and students, including using their data in blue crab and oyster research projects. In 2009, NCSG was a founding partner in the Hatteras Connection project that helps students to understand the science behind the unique island/ocean ecosystems that provide their home and families' livelihoods.

RECAP: NCSG's marine education programs correlate Ocean Literacy principles to NC grade and course requirements, providing important lessons on coastal ecosystems, as well as fisheries, earth sciences and hazards, and emerging topics, such as climate change.

NCSG Research Advances Oyster Restoration

RELEVANCE: In North Carolina, oysters serve as seafood delicacies, as a critical habitat for many species and as natural filters to improve water quality. But the North Carolina oyster stocks have been ravaged by overharvest, pollution and disease since early in the last century, leaving resource managers and the public eager to restore reefs.

RESPONSE: NCSG has sponsored a wide range of oyster research and outreach, including identifying optimal locations for new oyster reefs, characterizing larval movement in currents, locating historic reef sites, determining effects of various reef shapes and evaluating the success of past restoration projects. Partners include scientists, fishermen, policy makers, residents and students. NCSG staff and researchers have participated in state planning efforts to revitalize the oyster stocks in the past decade, but lack of

funding had stymied a large-scale restoration effort.

RESULTS: NCSG research results provided a science-based framework and rationale for a \$5-million American Recovery and Reinvestment Act grant made through NOAA to the NC Coastal Federation (NCCF) in 2009 to restore more than 55 acres of reefs. NCSG researchers at NC State and UNC Wilmington are extending their studies through the stimulus project, and an NCSG specialist is tracking the use of the newly expanded reefs by recreational anglers. Over five years, the total project is expected to provide 195 jobs, including fishermen, barge workers, truck drivers and others. The project was selected as a 2010 NOAA Earth Day event.

RECAP: With the NCSG research results available to guide restoration activities, NCCF and its state partners were shovel-ready in 2009, with new jobs and active reefs already showing success by early 2010.

Hazard Resilient Coastal Communities

Flood Warning Information, Maps Help Protect Coastal Communities

RELEVANCE: Flooding is the number one weather-related killer in the U.S. For example, Hurricane Floyd produced catastrophic flooding in eastern NC. Sometimes floodwaters cause long-lasting effects, including potentially high levels of fecal bacteria in drinking or bathing water. Outreach programming is essential to ensure researchers can provide needed information to weather forecasters, emergency managers and coastal residents.

RESPONSE: NCSG is working with the NOAA National Severe Storms Laboratory (NSSL), National Sea Grant College Program, SC Sea Grant (SCSG) and other partners on a multi-faceted project focusing on the Tar-Pamlico and Neuse river basins affected by Floyd. The project — CI-FLOW — provides a research and demonstration program to evaluate/test new technologies and techniques to produce accurate and timely identification of inland, coastal and flash floods. NCSG links CI-FLOW researchers with information

providers and the coastal public. The NCSG coastal erosion and construction specialist also participated in a team that updated state flood maps, with his focus on the oceanfront counties with barrier islands.

RESULTS: NCSG, in concert with NSSL and National Weather Service (NWS) forecast offices, have developed an interactive procedure to improve and enhance the usefulness of results from the CI-FLOW model. Utilizing web-based displays, the team has determined the most important variables and the optimum display methods for forecasters to use this information when predicting potential flood conditions in tropical storm event scenarios. Local governments likely will be adopting the updated flood maps in 2010 or 2011.

RECAP: In response to devastating NC coastal riverine floods, NCSG is a key player on a research, demonstration, extension and outreach project to improve flood warnings and information. NCSG has ongoing partnerships with NC emergency

managers setting flood zones. The combined efforts are with the goal of saving lives.

Preparing for Climate Change: Helping Small Coastal Communities Adapt

RELEVANCE: Many NC coastal communities are increasingly concerned about climate change adaptation as actions at the federal and state-level increase. A strong need is evident to build capacity within local governments to assess their vulnerabilities from climate change and to develop strategies to deal such risks.

RESPONSE: NCSG initiated a demonstration project in Plymouth to develop planning guidelines for smaller coastal communities facing climate change impacts, such as sea level rise and salt-water intrusion. Lessons learned through the project will be shared throughout the coastal region via consultations and workshops. A planning guide for smaller coastal communities facing climate change impacts is under development.

RESULTS: A local advisory committee is reviewing enhanced inundation maps developed by the project team based on various sea level rise scenarios. Coastal clientele have been introduced to the challenges of climate change adaptation via websites, posters and publications developed in conjunction with the SCSG Consortium. Results of survey research in 2010 will assist the town with developing specific local strategies regarding infrastructure, planning, etc. Overall, NCSG's success in forming new partnerships with university researchers and agency experts will provide many communities with technical support to construct decision-making tools, such as maps and other visual products, to explain needs and options for local officials and residents.

RECAP: Climate change adaptation is a topic of concern to many NC coastal communities. A pilot demonstration project to develop a planning guide for smaller coastal communities facing climate change impacts will develop local process guidelines, technical support mechanisms and opportunities for communities to learn from each other.

NCSG Hazards Expertise Valued

RELEVANCE: NC barrier islands are prone to erosion — long-term, storm-induced, oceanfront, inlet and estuarine. The NC Coastal Resources Commission (CRC), NC Division of Coastal Management (DCM) and General Assembly need scientific information in order to develop related policies, regulations and laws.

RESPONSE: Since 1978, the NCSG coastal erosion and construction specialist has worked with local, state and federal officials; researchers; and property owners to validate available information. He has served on the NC Coastal Resources Advisory Panel since 1993 and on the NC Science Panel on Coastal Hazards and the NC Floodmapping Committee since 1999. The panel chair, an NCSG researcher, led the team through complex discussions on anticipated sea level rise in coming decades. The mapping group undertook a major overhaul of the state's maps after Hurricane Floyd and NC now offers considered the national standard for such maps.

RESULTS: NCSG has provided information on sandbag strategies and options for 30 years, with the Science Panel emphasizing size rather than time limits. The controversial topic is on the 2010 CRC agenda. NCSG was part of the Science Panel's recommendations on inlet hazard areas, which are before the CRC in 2010. Also a 2010 estuarine policy study will review results of NCSG research and outreach on erosion along the Inner Banks. In 2009, NCSG provided extensive assistance in preparing floodmaps for barrier islands. The new maps are under review, with the eight oceanfront counties and respective towns expected to adopt the maps as part of land-use/zoning plans.

RECAP: NCSG continues to provide science-based data and recommendations to officials who develop policies to protect lives and property in the coastal region.

Wind Insurance Mitigation Credits Reduce Insurance Costs, Increase Public Safety

RELEVANCE: Property owners pay high insurance premiums for coverage in wind zones near the oceanfront. Incentives for building owners to

increase wind resistance would also increase overall safety on barrier islands during coastal storms because of less flying debris.

RESPONSE: In a May 2005 presentation to the NC Joint Underwriting Association (NCJUA, or the state wind pool), the NCSG coastal construction specialist encouraged officials to consider mitigation credits for property owners who construct buildings that are more wind resistant and encourage wind retrofits to improve known weaknesses in existing buildings. In 2008, NCSG provided written recommendations to the Joint Select Committee on the Potential Impact of Major Hurricanes on the North Carolina Insurance Industry.

RESULTS: In 2009, the NC General Assembly required that the NC Department of Insurance consider mitigation credits for wind-resistant features for coastal homeowners and commercial insurance coverage. In 2010, the NC Rate Bureau

proposed mitigation credits. After review, the NC Insurance Commissioner implemented increased credits as an optional rating for all wind insurance coverage in the state and will offer 5 to 24 percent credits on their 2011 policies. Potential savings would apply to wind coverage on approximately coastal 200,000 policies, with premiums of approximately \$300 million annually. Many existing buildings will be eligible for the lower wind insurance rates beginning in 2011. NCSG is a partner in plans to promote wind-mitigation upgrades of existing buildings so that property owners can qualify for higher credits. Many new coastal NC buildings are expected to be designed for the highest credits.

RECAP: When state officials accepted NCSG recommendations to establish wind-resistance mitigation credits on coastal insurance policies, the result was twofold: increased safety and lower premiums for property owners who take the recommended actions.

Sustainable Coastal Development

Maritime Heritage Fellowship Identifies Novel Tools

RELEVANCE: Tourism is North Carolina's largest industry, prompting over \$22 billion in expenditures annually. Cultural travelers to the state spend nearly a third more than the national average and almost twice the per-day spending of general travelers to the state. Enhancing the cultural experience can attract more tourists, as well as prompt their additional expenditures in the state and locality.

RESPONSE: A joint NCSG-East Carolina University maritime heritage fellowship program supported a graduate student who re-analyzed the disturbed remains of the Confederate ironclad *Neuse*, displayed at the *CSS Neuse* state historical site in Kinston. New techniques applied — including CAD software, digital point cloud modeling and remote sensing — not only produced more information on the compromised remains of the *Neuse*, but also piloted the application of these novel techniques for use at other marine wreck sites around the world.

RESULTS: The project changed several basic historical assumptions about Confederate ironclad design and construction, thereby improving interpretation at the historic site. The director of the *Neuse* Memorial Site said project findings will boost educational programs about the vessel, as historians use the fellow's scientific model to create a more historically accurate and visitor-friendly virtual tour of the *Neuse*. Visitors will be able to take a tour without setting foot on the vessel. Lastly, the student received his master's degree.

RECAP: A formal NCSG-sponsored fellowship program in maritime heritage funded research that piloted the use of novel archeological research tools, thus providing a coastal community and a state cultural resources agency with new public interpretive information.

Potential Energy Resources Considered

RELEVANCE: The U.S. Department of Energy categorizes North Carolina's coastal wind power resource potential as: Outstanding. In 2008, the NC General Assembly charged the University of

North Carolina system to conduct a feasibility study of the state's coastal wind energy development. The UNC General Administration requested NCSG, through its NC Coastal Resources Law, Planning and Policy Center, to examine the legal and policy implications involved.

RESPONSE: The center led the study's legal and policy research effort, looking at statutory and regulatory barriers, and federal leasing regulations pertaining to alternative energy development on the outer continental shelf.

RESULTS: The NCSG contribution resulted in an entire chapter within the feasibility study's final report to the legislature, and also a peer-reviewed journal article in the *North Carolina Law Review*. It determined that the state was not fully prepared to encourage wise coastal wind energy development, inasmuch as certain agency jurisdictional conflicts needed resolution, specific coastal development policies needed modification and state submerged lands leasing statutes needed revision. Short of enacting legislation to address these concerns and promote full-scale coastal wind energy development, legislators appropriated funding for state participation in a wind-energy demonstration project in Pamlico Sound, which has been cancelled due to high cost. NC coastal managers also began updating regulations to consider wind turbines in pilot projects.

RECAP: In light of NCSG legal and policy research, the State of North Carolina now has a blueprint for legislative action needed to address jurisdictional, statutory and regulatory barriers to future coastal wind-energy development.

Collaborative Regional Efforts Help Align Federal/State Coastal Priorities

RELEVANCE: Over two dozen NOAA or NOAA-supported entities work in the Carolinas, each desiring enhanced stakeholder engagement and public awareness. At the same time, the four South Atlantic states could benefit from joining in a regional effort to identify and focus their common coastal resource interests.

RESPONSE: NCSG heightened interactions among NOAA components in the Carolinas. With NOAA's

Southeast and Caribbean Regional Team, NCSG led efforts for *NOAA in the Carolinas (NinC)*; (<http://www.carolinas.noaa.gov>) to retain the services of a part-time coordinator. Also, with Sea Grant programs in SC, GA and FL, NCSG encouraged and guided the governors in forming a regional alliance to help address common coastal issues and opportunities. Initial groundwork for the alliance was set during a previous workshop hosted by NCSG and UNCW.

RESULTS: An outreach professional, based at UNC Wilmington, coordinates many aspects of NinC, including steering committee sessions, conference planning, website development and sponsorship of an NWS Hurricane Hunter aircraft visit to Raleigh and Wilmington for public display and educational interactions with school groups. Separately, the Governors' South Atlantic Alliance (<http://www.southatlanticalliance.org>) was established to implement science-based policies and solutions that enhance and protect the value of coastal and ocean resources of the southeastern United States. The Alliance's priority work areas reflect those identified by Sea Grant's South Atlantic Regional Research Priorities study.

RECAP: Thanks to NCSG efforts, NOAA-related agencies in the Carolinas are more collaborative in their engagement with the public. Furthermore, a framework organization has been formed at the state Governors' level, addressing coastal concerns.

State Follows Ocean Policy Recommendations

RELEVANCE: In 2004, the U.S. Ocean Policy and Pew Oceans commissions each encouraged all levels of government to revisit ocean resource issues. In response, North Carolina updated its existing policies on ocean uses, which had been based on research and recommendations from NCSG and the NC Division of Coastal Management (DCM) in 1994 and 1984.

RESPONSE: DCM partnered with the NCSG and its law center to complete a study on the State's emerging ocean policy issues and potential challenges to the use of and access to ocean and coastal resources. Assembled and led by the Center's co-directors, a diverse team spent two

years reviewing issues, gathering public input and developing recommendations.

RESULTS: In 2009, the committee released its report, focusing on sand resource management, ocean-based alternative energy development, ocean outfalls, marine aquaculture and comprehensive ocean management. In autumn 2009, the NC Coastal Resources Commission started its report review by focusing on wind energy development in coastal waters, including changing the identification of a utility-grade wind turbine to a water-dependent structure. That step allowed DCM to move forward with additional regulation amendments regarding coastal wind energy. The ocean policy study was cited in the selection of the NCSG law and policy specialist as the state's 2009 Natural Resources Scientist of the Year by the governor. The success of the ocean policy review also spurred an NCSG study of the state's estuarine policy, with funding from the National Sea Grant Law Center.

RECAP: For three decades, NCSG has provided leadership in the state's review of coastal and ocean policy, including recent updates.

Helping Coastal Communities Consider Environmentally Sensitive Development

RELEVANCE: Local leaders in NC's coastal region often desire development that is sustainable environmentally and economically. Achieving that goal is a complex process for elected and appointed officials who do not have professional training in planning, design, natural resource management or engineering.

RESPONSE: The NCSG water quality planning specialist gathered a team of partners to develop a course on growth strategies to engage local officials through activities and discussions. Partners included NCCF, NC Cooperative Extension, the NC Natural Resources Leadership Institute and the UNC School of Government. For the 2009 course, the NCSG science communications fellow developed *The Sustainability Series*, factsheets that explain interactions between land use and water quality, especially coastal waters that are nursery areas for many fisheries.

RESULTS: Initial follow-up for the first workshop — held in 2008 in rural Pamlico County along the Inner Banks — shows participants are using and sharing the information received. The 2009 course brought representatives from a dozen towns or counties to Wilmington. Currituck County will host the 2010 workshop to encourage its neighbors in the northern coastal plain to attend and consider new strategies. Currituck leaders also requested and received NCSG planning and engineering assistance for the Currituck Goes Green campaign. For example, NCSG obtained funding from the Albemarle-Pamlico National Estuary Program to improve a stormwater system on county property in 2010. *The Sustainability Series* earned a national APEX award, and was cited when the fellow received a 2010 Jones award from NOAA.

RECAP: With leadership from NCSG, a training program for local officials provides groundwork for communities to consider environmentally sensitive growth strategies.

Safe and Sustainable Seafood Supply

Reliable Data Support FMP Updates

RELEVANCE: North Carolina's marine fisheries are managed through a complex series of species management plans updated regularly with a goal of sustainable harvests. The state also participates in offshore management plans through South and Mid-Atlantic councils and the Atlantic states commission.

RESPONSE: NCSG provides reliable scientific data and recommendations for management of a wide range of species, including finfish — from alosines to weakfish — as well as blue crabs, oysters and bay scallops. The NCSG/DMF fellowship provides statistical analysis on a critical state management plan issue each year. NCSG administers the state's Fishery Resource Grant (FRG) and the Blue Crab and Shellfish Research programs, that test fishermen's theories with academic rigor. NCSG

core projects provide in-depth fisheries study, while mini-grants offer rapid response and test initial concepts. Fisheries specialists and researchers also serve or assist state and regional advisory panels.

RESULTS: Recent findings from NCSG red drum studies had an immediate impact on the state and regional red drum plans for the state's saltwater fish. Managers used findings on size classes and mortality rates in a population model to assess the red drum stock. Estimated selectivity, and natural and fishing mortality rates cited in this study also were used in the regional SEDAR red drum assessment. A critical commercial fishery, flounder faces severe restrictions in light of sea turtle interactions. A current flounder plan review is considering NCSG and FRG findings, such as adjusting net settings and using seasonal closures to reduce bycatch mortality of sub-legal fish.

RECAP: NCSG provides reliable fisheries data for state and regional management plans.

NC Finfish, Shellfish Aquaculture Advanced

RELEVANCE: Half of all seafood consumed worldwide is cultured. Aquaculture, including fish and shellfish, is a well-established and growing industry in North Carolina, with estimated statewide revenues of \$54M annually. Continued growth relies on developing new culture species (such as black sea bass and red porgy) and improving production efficiencies for existing species (such as hybrid striped bass (HSB), flounder and various species of shellfish).

RESPONSE: NCSG efforts to encourage aquaculture include providing instructional opportunities and materials for facility construction or renovation, developing culture manuals and factsheets, and supporting demonstration projects.

RESULTS: Advances in flounder aquaculture include the development of cost-effective production diets, modifications to culture techniques and the development of higher-yield/value all-female populations. North Carolina now has three commercial flounder enterprises in development. Thanks to past NCSG efforts, the state is a major producer of hybrid striped bass (a

dozen farms generating \$9M in annual revenues), with recent research/outreach improving HSB diets, developing domesticated parental species stocks and wastewater BMPs. Advances in new species development include diet development and manipulation of environmental growth conditions for black sea bass and evaluating red porgy as a candidate species. Improvements to shellfish aquaculture include identifying growth differences in NC oyster seed stocks, better off-bottom oyster culture systems and potential methods to reduce system fouling. Blue crab shedding operations (300 in the state) have been improved by the introduction of closed-system designs and better water quality management.

RECAP: NCSG activities have enhanced the farming of established aquaculture species and the development of new species for culture.

Marine Mammal Bycatch Focus of Partnership

RELEVANCE: Bottlenose dolphins, a protected species, are often entangled and drown in fishing gear, which can result in the closure of, or restrictions on, a fishery. Pilot whales, another protected species, often interact with longline fisheries, and are inadvertently caught instead of the intended swordfish and tuna.

RESPONSE: NCSG administers a research program, funded by NOAA Fisheries, focusing on marine mammal bycatch reductions. Projects have examined using alternate net leaders to determine effects on fish catch in pound nets; adding warning pingers to nets to ward off mammals, monitoring the behavior of pilot whales in the vicinity of pelagic longline fishing gear via visual and acoustic monitoring and marine mammal interaction data from anecdotal captain's reports; and using variable strength hooks to reduce serious injury in pilot whale interactions with the pelagic longline fishery.

RESULTS: The research found that by changing the structure of the leaders in pound nets, bottlenose dolphin bycatch has been reduced. The new leader design has been adopted by about 75 percent of pound-netters in the Cape Henry region of Chesapeake Bay. Other researchers found the addition of pingers to nets — marketed as a

deterrent for dolphins — in effect did not deter, but rather acted as a dinner bell to attract the dolphins. Use of weak hooks was found to allow pilot whales to free themselves from longlines while still allowing target fish species to be captured.

RECAP: NCSG, in cooperation with NOAA Fisheries, supported projects that have advanced reduction in the bycatch of marine mammals in Atlantic Coast fisheries.

Safety, Handling and Processing of NC Finfish and Shellfish Improved

RELEVANCE: Much of the seafood business is a large-scale, international industry, yet the safety of that food supply remains paramount. To better compete against imported products, NC fishermen, processors, restaurant owners and consumers must place additional emphasis on the high quality and safety of locally caught or raised finfish and shellfish.

RESPONSE: NCSG has funded research on tracing the origins of seafood products (<http://www.fda.gov/Food/FoodSafety/HazardAnalysisCriticalControlPointsHACCP/SeafoodHACCP/default.htm>) that has drawn national and international attention. NCSG also continues to offer workshops for seafood dealers, processors and regulatory officials in seafood sanitation and Hazard Analysis and Critical Control Point safety guidelines. The *Quality Counts: A Consumer's Guide to Selecting North Carolina Seafood* (www.ncseagrant.org/images/stories/ncsg_pdf/documents/products/guides/Quality_Counts.pdf) poster helps shoppers determine the quality/freshness of seafood at the market. NCSG extension specialists conduct a variety of educational activities to make North Carolina's seafood safer, fresher and more flavorful. NCSG also assists local seafood dealers and fishermen to promote their catch and reach new markets.

RESULTS: NCSG training and materials have resulted in hundreds of HACCP certifications over the years, including 18 NC companies in 2009, and another 29 expected in 2010. These businesses will be able to remain in operation because of their certification and FDA requirement. Also, in 2009, 27 environmental health specialists, who

inspect seafood retail outlets, also completed training organized by NCSG and partners. The *Quality Counts* poster and other safe seafood handling tips are available on the *Mariner's Menu* blog that is testing a new outreach tool by the NC State Seafood Laboratory and partners in Carteret County. The blog is being accessed by an average of 30 visitors a day.

RECAP: NCSG research and extension programs have educated fishermen, processors, retail establishments and consumers about ways to increase seafood quality and safety.

Spiny Dogfish Fishery Expanded

RELEVANCE: The spiny dogfish, a small shark, has provided a reliable, abundant winter fishery in NC for generations. But federal managers had contended that the dogfish populations off the East Coast cannot sustain a viable fishery, and thus established quotas that severely restricted the NC catch. However, NC fishers reported that dogfish are bountiful south of Cape Hatteras — generating questions as to the accuracy/reliability of federal trawl data that are the basis for quotas.

RESPONSE: Several NC Fishery Research Grant projects administered by NCSG have focused on these dogfish movements. Over the past two years, 93 mature dogfish were captured, surgically implanted with acoustic tags, released and tracked for movement and swimming direction vis-a-vis changes in currents, temperature, time of day or other ecological factors.

RESULTS: The bounty of FRG dogfish research findings played a major part in developing recommendations to NOAA's Northeast Fisheries Science Center. For 2010-2011, based in part on FRG data, the ASMFC allocated 16 percent of a larger annual landings quota to North Carolina, resulting in an estimated economic impact of up to \$350,000. An additional benefit of the FRG research is the recording of passage of other acoustically tagged animals. For example, the listening fence detected Atlantic sturgeon, a potentially threatened species tagged in CT, NY, DE and GA. For more information, see *Coastwatch* magazine, Summer 2010.

RECAP: Acoustic tags tracked the movements and elucidated the number of spiny dogfish typically found off NC, while providing valuable information on other migratory species. These data have begun to help fishery managers improve sampling and population estimates, inform future management decisions, and improve fishing opportunity for NC boats.

Texting Delivers Recreational Catch Data

RELEVANCE: Recreational fishing data is often difficult to collect. The state relies on estimates from the Marine Recreational Information Program, a post-fishing-experience survey conducted via phone calls and random site visits. Enabling anglers to easily submit data in real time would augment existing survey techniques and help managers get a clearer picture about the health of important fisheries.

RESPONSE: With funding from an NCSG mini-grant, a fishery specialist and partner designed RECTEXT, a pilot project in which six Wilmington-area charter boat captains used pre-paid mobile phones to text their fishing reports through Twitter, an online text messaging service.

RESULTS: Based on the minigrant results, the DMF approved a grant underwritten by state Coastal Recreational Fishing License revenues to expand RECTEXT testing at several major NC offshore fishing tournaments. Successful full development of RECTEXT could expand available information on gamefish populations and angling and also could reduce the cost and labor involved in gathering recreational catch data. Accordingly, state, regional and federal managers are following RECTEXT developments closely. The project also has drawn attention from the online science community, where researchers are interested in using simple text messaging to receive data in a variety of citizen science programs.

RECAP: Recreational fishing data is often difficult to collect. To develop a more efficient and effective method for collecting catch data from recreational anglers, NCSG designed and tested a simple cell phone-driven approach based on texting to an online database. The experiment attracted state funding, and interest from public fishery

managers and organizers of citizen science programs.

Gear and Practice Changes Reduce Bycatch, Increase Efficiency & Profitability

RELEVANCE: Fisheries must be managed sustainably for current and future harvesting and for ecosystem health. Recreational anglers need gear and handling techniques that reduce catch-and-release mortality. Commercial fishermen need to reduce bycatch and overall cost while increasing fishing efficiency to remain profitable.

RESPONSE: NCSG has funded many research and outreach projects to improve gear. For example, NCSG developed a DVD that demonstrates the proper rigging of circle hooks, which NCSG-administered research shows decreased mortality in released fish. For commercial fisheries, NCSG offered demonstrations in five coastal locations to explain an innovative steel trawl door that Texas Sea Grant testing in the Gulf of Mexico revealed to be up to 40 percent more fuel efficient, while also causing less seabed disturbance. Applied research on black sea bass — funded through the FRG administered by NCSG — has provided insights into both gear modifications and potential management changes.

RESULTS: NMFS and NCSG distributed more than 2,000 copies of the circle hook DVD to help anglers meet requirements mandating circle hooks in many offshore fishing tournaments. NC interest in steel trawl doors has resulted in an FRG project looking at using the doors in NC waters that are shallower than in the Gulf. The project is also studying the use of lighter-weight netting. The South Atlantic Fisheries Management Council is reviewing FRG data and recommendations for black sea bass as it updates the regional species management plan.

RECAP: In encouraging sustainably managed fisheries for environmental and ecosystem health, NCSG researches new technologies and techniques, then shares the results with recreational anglers, commercial fishermen and policy makers.

Local Catch: Marketing, Branding and Consumer Education

RELEVANCE: Commercial fishing is an integral part of the NC coastal economy. Historically, fishermen here satisfied a strong demand along the East Coast for fresh, seasonal seafood. Since 1995, cheaper imports have taken significant market share. Many businesses are struggling to remain profitable. Product safety and local food movements, however, are compelling people to buy more domestic seafood.

RESPONSE: NCSG research and outreach have focused on seafood branding, direct marketing and consumer education. Coastal NC workshops covered enterprise diversification, market analysis and branding, contract production, value-added products and business/strategic planning. To educate consumers, a new blog showcases NC seafood dishes, fisheries/traditions, and safety/handling. NCSG and partners continue to share posters and cards that identify seasonal seafood. NCSG extension specialists were critical in the establishment and continuation of local

seafood branding/education initiatives highlighting seafood from Carteret, Brunswick, Ocracoke and Outer Banks communities.

RESULTS: As a result of NCSG extension support, two new businesses were created and others expanded. Four Local Catch programs and one community supported fisheries program were in place in NC by January 2010. The Outer Banks Catch public launch in 2010 is supported by \$150,000 in leveraged funding. The community supported fishery concept, developed through an NC Fishery Resource Grant project, and the Local Catch emphasis have spread throughout the U.S. and beyond. An NC extension specialist represents seafood on the new local foods advisory council established by the state legislature.

RECAP: To assist NC fishing communities in marketing/promoting local seafood, NCSG developed a variety of programs targeting fishing businesses, local catch efforts and consumer education.

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