LET'S CELEBRATE! northinlet.sc.edu/30years

North Inlet & Winyah Bay Bulletin

North Inlet-Winyah Bay National Estuarine Research Reserve

celebrate with us in september

North Inlet – Winyah Bay
National Estuarine Research Reserve

Free Events
Celebrating 30 Years

Know the NERR

Join Reserve staff to learn more about the research, education and stewardship at the Reserve since its designation in 1992.

Georgetown County Museum Tuesday, September 6, 5:30 pm
Waccamaw Branch Library Thursday, September 8, 10 am
Andrews Branch Library Saturday, September 10, 11am
Georgetown Main Library Tuesday, September 13, 10 am
Southern Georgetown Library Thursday, September 15 , 3 pm
Carvers Bay Branch Library Saturday, September 17, 11 am

Then/Now/Future- 30 Years of Research and Conservation

Special guest speakers at Kimbel Lodge at Hobcaw Barony will reflect on long-term changes in the salt-marsh habitats of North Inlet. All talks start at 6:00 PM.

Are marshes keeping up with sea level rise? Dr. James Morris, Wednesday, September 7
Cool planktonic critters in warm estuarine waters Dr. Dennis Allen, Thursday, September 15
Seabirds and Shorebirds in North Inlet Mary-Catherine Martin, Wednesday, September 21

Visit us- Public Programs

Biking - Fish Printing - Kayaking -Hiking

Visit northinlet.sc.edu/upcoming-events to see what's happening and to register

Party
9 am – 2 pm

Saturday, September 24
Hobcaw Barony Discovery Center

Reserve tours - Fish printing - Face painting -Games -Live animals

northinlet.sc.edu/30years

CELEBRATING NATIONAL ESTUARIES MONTH & OUR 30TH ANNIVERSARY!

Explore the North Inlet-Winyah Bay NERR through guided programming at Hobcaw Barony.

Sept. 1st 3pm-4pm **Fish Printing**
Sept. 3rd 10am-12pm **Ride for the Tide!**
Sept. 6th 9am-1pm **Paddle North Inlet**
Sept. 9th 3:30pm-5:30pm **Seining on the South End**
Sept. 10th 10am-12pm **King Tide Marsh Stroll**
Sept. 20th 9am-1pm **Paddle North Inlet**
Sept. 22nd 3pm-4pm **Feeding Frenzy**
Sept. 23rd 10am-12pm **Ride for the Tide**
Sept. 24th 9am-2pm ****Estuary Open House Party****

North Inlet - Winyah Bay
National Estuarine Research Reserve

Off-site Library talks include:
Waccamaw Branch Library Thursday, September 8th 10:00am
Andrews Branch Library Saturday, September 10th 11:00am
Georgetown Main Library Tuesday, September 13th 10:00am
Southern Georgetown Branch Library Thursday, September 15th 3:00pm
Carvers Bay Branch Library Saturday, September 17th 11:00am

RESEARCH & MONITORING

> ***The Research & Monitoring team at North Inlet-Winyah Bay NERR actively investigates the habitats, flora, and fauna of North Inlet Estuary and Winyah Bay. The System-Wide Monitoring Program at NI-WB NERR continues to provide high temporal resolution information about environmental conditions in our estuaries.***

Continuous water quality data collection and weather monitoring, conducted via the NERR System-Wide Monitoring Program, has been operational throughout 2022. Check out a summary of conditions in North Inlet and Winyah Bay between 2012-2021 at the end of the newsletter, and access current water quality and weather conditions using the Real Time Data Application on www.nerrsdata.org.

Quarterly surveys for blue and stone crabs in North Inlet and Winyah Bay continue, with the goal of investigating temporal variation in crab population dynamics within the Reserve and to allow for comparison with other estuaries in the southeast US. These surveys utilize trap-based sampling to collect data on species composition, size, sex, maturity stage, and relative abundance.

We've continued with an effort to use un-occupied aerial systems (AKA drones) as a way to monitor the health of our salt marshes. We're excited about the possibilities for this technology, and our results could have impacts for marsh monitoring methods in estuaries all over the country.

The Reserve's current Margaret A. Davidson Graduate Fellow, Johanna L'Heureux was in-residence at NI-WB NERR during summer 2022. Johanna prepared plants within the BMFL's marsh organs for an experiment to investigate the combined effects of sea level rise and nutrient loading on salt marsh vegetation. We are excited to welcome our next Davidson Fellow, Gwen Hopper, who will start her tenure in September. Gwen is a PhD student at UofSC conducting dissertation research on sources and sinks of dissolved organic matter in the Winyah Bay watershed. Congratulations and welcome (back) to the Reserve, Gwen!

A research project with the Reserve, University of South Carolina, and USC-Beaufort is examining how oyster harvesting may affect the animals that use the oyster reefs as habitat.

Research staff and UofSC undergraduate students recently completed data collection for a study investigating the effects of oyster picking on the animals that utilize oyster reefs as habitat. In addition to sample shellbaskets, which are used to characterize the oyster reef faunal community, we have partnered with faculty and students from USC-Beaufort to analyze environmental DNA (eDNA) collected on and around oyster reefs.

We look forward to a busy field season during summer and fall 2022. If you are interested in being a regular, long-term contributor to a community science project monitoring crabs in the salt marshes of North Inlet, please reach out to the Research Coordinator, Robert Dunn (robert@baruch.sc.edu or 843-904-9026).

Program Notes
Stewardship

Add seven more to the growing list of alumni of the Winyah Master Naturalist course. The Winyah Master Naturalist program is facilitated by the Reserve each spring to develop a pool of local community members with the skills necessary to participate in Reserve and local stewardship and citizen science projects. Since its start in 2007, 120 people have completed the 12-week Winyah course.

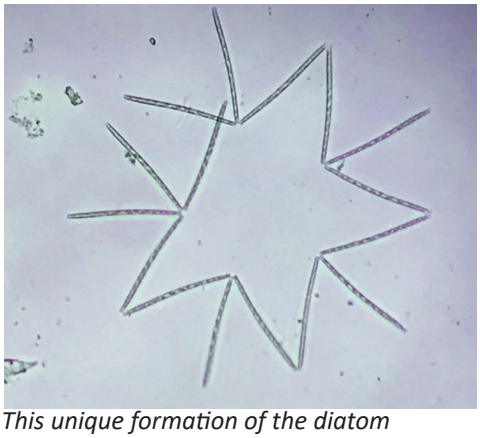
Congratulations to this year's graduates of the Winyah Master Naturalist class!

We continue to watch out for our feathered friends at the Reserve. Five surveys by boat were conducted this spring for shorebirds around North Inlet. Forty-three bird species were recorded, including American Oystercatchers and Red Knot, two species listed as extremely high priority for conservation in the U.S. Shorebird conservation plan. Wilsons plover, whimbrel and short-billed dowitcher were also seen and are listed as species of high priority.

Painted bunting surveys were conducted by volunteers in May and June this spring. Volunteers listened for calling birds over a five-minute period at marked stations that were 0.3 miles apart along Crabhaul, Marsh and Clambank roads at the Reserve. Buntings were heard calling on all survey dates, with a maximum of 14 birds observed on June 30. Buntings were most consistently heard at a station which is a forested area on Marsh Road, and were heard least often at a station that is an open area adjacent to the saltmarsh near the end of Clambank Causeway. Further analysis will be done to determine if there are relationships between habitat characteristics, such as vegetation type and density, and the observed presence of painted buntings.

> ***Volunteers are monitoring our water quality, watching out for harmful algal blooms, and counting shorebirds. We hope to engage even more community members in joining our citizen science marsh monitoring network.***

Five volunteer teams are now monitoring water quality in our local watershed, contributing to both the local understanding of environmental conditions in our coastal marshes, and also to a statewide effort to collect baseline data on the health of our waters. Three teams at Pawley's Island, and teams in Murrells Inlet and at Winyah Bay have been completing monthly measurements of pH, dissolved oxygen, air and water temperature, salinity, transparency, and habitat conditions following protocols established by the South Carolina Adopt-a-Stream Program. The Murrells Inlet team has also been participating in the Phytoplankton Monitoing Network, and in July a training was held to generate further interest in the progam. The Reserve hopes to establish a network of volunteer monitors throughout the coastal watershed who will contribute to our understanding of environmental conditions in the tidal creeks and marshes. The Reserve conducts trainings and provides equipment and support for volunteers interested in being a part of the network. For futher information, please visit http://northinlet.sc.edu/volunteer/ or contact jen@baruch.sc.edu.



This unique formation of the diatom Thalassionema *was spotted by volunteer Rosanne Maraziti.*

Program Notes
Education

Our long-standing partnerships with the Georgetown County Library System branches really kicked into high gear this spring and summer. In May, Reserve's Margaret A. Davidson Fellow, Johanna L'Heureux, explained sediment coring during a 'Magical Microbes' event. June's library theme brought 'Oceans of Possibilities' for topics to share and included our most popular ocean-themed programs, 'Beach Night Life' and 'Sea Turtles 101'. Education staff were also invited to visit the nearby McClellanville library (part of the Charleston County Public Library System), as well as the ten Horry County branches throughout the summer. These have been a great way to connect with audiences that may not have opportunities to come to us.

K12 and public programming that acknowledges the needs of autistic children has been evolving through interactions with recent program participants. On and off site activities have been modified to engage students in formats that help address their unique learning challenges. We are very excited to host the Plantersville STEM Summer Academy again this summer, with forty 6th and 7th grade students participating in a salt marsh field experience and lab tour, and meeting researchers in the field.

Our summer education intern, Liv Carey, led the Reserve's first ever Swamp Yoga

> ***The Reserve was excited to host our first-ever education intern for the summer season, Liv Carey, from Florence, SC! She focused on Diversity, Equity, Inclusion, Justice & Accessibility (DEIJA) efforts and has helped us to increase program capacity, raise awareness of NERR activities in local communities, and design new programming to increase audience diversity.***

The Family Fishing Clinics at North Inlet with the South Carolina Department of Natural Resources (SCDNR) have been well attended and the fishing has been productive! A new Bilingual clinic was held in spring and staff from SCDNR's Aquatic Division in Charleston provided interpretation for the event. We are also assisting SCDNR with educational "pier outreach" walks on public fishing piers in Georgetown and Horry Counties featuring fishing information and sea turtle and shorebird conservation education.

Another exciting community event Reserve staff joined this summer was a 'Pride Pizza Party' hosted by Parents, Families & Friends of Lesbians & Gays (PFLAG) at the Carolina Human Reinvestment Community Garden. The gardens and greenhouse were filled with community supporters and friends of the Pawleys Island PFLAG chapter, and included educational booths, voter registration, and free pizza and donuts donated by our local Domino's and Parlor Donuts. The Reserve hosted a tent at the event with marine and rainbow-themed arts and crafts including fish printing and face painting, and even a bubble machine!

SC DNR, in partnership with North Inlet-Winyah Bay Reserve, is offering a free opportunity for Georgetown area schools this fall. The Educational Vessel (E/V) Discovery is a 45 foot catamaran outfitted as an outdoor classroom used to educate students about our marine resources, and will be docked at North Inlet-WinyahBay NERR (Hobcaw Barony). The boat will be available on November 15-18. It holds 35 passengers per trip, with two trips per day and is for 5th grade and older only, with scheduling prefrence given to Georgetown County students. Please contact Erica Connery for more information. ConneryE@dnr.sc.gov

TRAINING

Instructors from SCDNR and the Army Corps of Engineers showed the key characteristics that define wetlands

This spring, NERR training program participants got their boots muddy with trainings focused on wetland identification. ***Freshwater Wetland Identification Basics*** was a field-based training series hosted in May 2022. This training taught how to recognize wetlands on a property of interest, a necessary skill for anyone who makes decisions about purchasing or developing properties, conservation easements, or land use in coastal South Carolina, an area with high wetland density. Instructors from SCDNR and the Army Corps of Engineers showed the key characteristics that define wetlands, which are hydrology, hydric soils, and hydrophytic (aka water loving) vegetation.

Partnering with the ACE Basin NERR, this course was offered in the Lowcountry, Charleston area, and locally at Hobcaw Barony. While Hobcaw Barony is home to spectacular salt marsh creeks and stately cypress trees in black water swamps, this training focused on the less obvious wetlands of Hobcaw. Small, depressional wetlands are typically fed by rainwater (instead of tides or overflow from rivers). The amount of water in such wetlands varies daily, seasonally, or yearly, and they may be completely dry for long stretches of time. Training participants learned how to recognize the signs, such as a line of moss on tree trunks from when standing water was present, that point to their hidden identity as wetlands.

Identifying wetlands is an important first step in protecting the important ecosystem services they provide. Wetlands play an important role in managing stormwater runoff, improving water quality and mitigating floods. Policy tools can be used to protect wetland services at the local government level. Wetland buffers- a requirement to maintain an area of undisturbed vegetation around wetland boundaries- provide breathing room for wetlands so they can continue to provide valuable services. The Coastal Training Program was featured in a local news article on these topics.

> ***The Coastal Training Program continues to connect decision-makers to the science, tools, and training they need to protect coastal resources.***

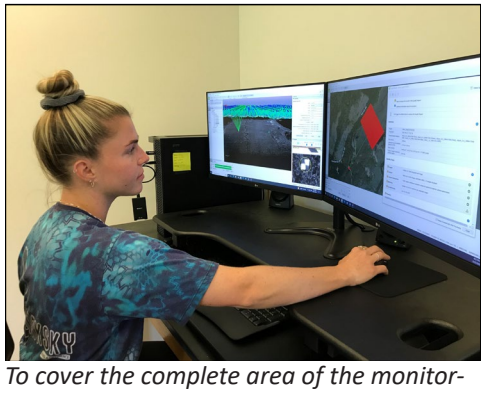
We were also excited to welcome our first Coastal Training Program (CTP) intern for the summer. Bailie Willis is a sustainability and coastal resilience major at Coastal Carolina University. She worked on a survey of coastal residents who live in communities with stormwater ponds. The goal of the survey is to understand barriers to applying landscaping best management practices, such as vegetated shoreline buffers. Her project will help to improve future stormwater pond education for the Grand Strand.

Other CTP activities have included trainings focused on salt marsh ecosystems. CTP continues to partner with the ACE Basin NERR on the South Carolina Marsh Stakeholder Collaborative. Marshfront management is becoming increasingly recognized as a crucial need for coastal communities. For more information contact Maeve Snyder, msnyder@baruch.sc.edu or visit the Training Program web page.

Watching Grass Grow (high-tech)

Monitoring salt marsh vegetation at scales not previously possible

Widely recognized as some of the most productive areas in the world, salt marshes provide a wide range of valuable ecosystem services, such as protecting shoreline from storm surges, providing critical fish and shellfish habitat, intercepting and filtering land-derived runoff, and supporting every increasing coastal tourism and recreation economies. The ability of salt marshes to provide such services depends, in very large part, on the healthy growth of the plants that make up the marsh.



To cover the complete area of the monitoring site, the sUAS flies a grid pattern over the area while the multispectral sensor on the sUAS (top panel) collects over 950 overlapping pictures in each of 5 different portions of the visible and infrared light spectrum. Sophisticated computer software (lower panel) then 'stiches' all the individual photos together to create a high-resolution map that is precisely scaled in all dimensions so that the map can be used to precisely locate features of interest and make accurate measurements of distance and size.

Tracking changes in the condition of salt marsh plant communities due to increasing sea level rise, storm events, or other environmental changes, has been a priority of the National Estuarine Research Reserve System for over a decade. To date, this has been done by reserve staff going out into the marsh to manual identify the number and species of plants in a series of long-term monitoring plots. This is labor intensive, can only be done in a relatively few number of small plots, and necessarily relies on relatively simple measurements. The use of small Uncrewed Aerial Systems (sUAS) has the potential to not only make it easier to collect this information but also greatly expand the quantity and type of information collected.

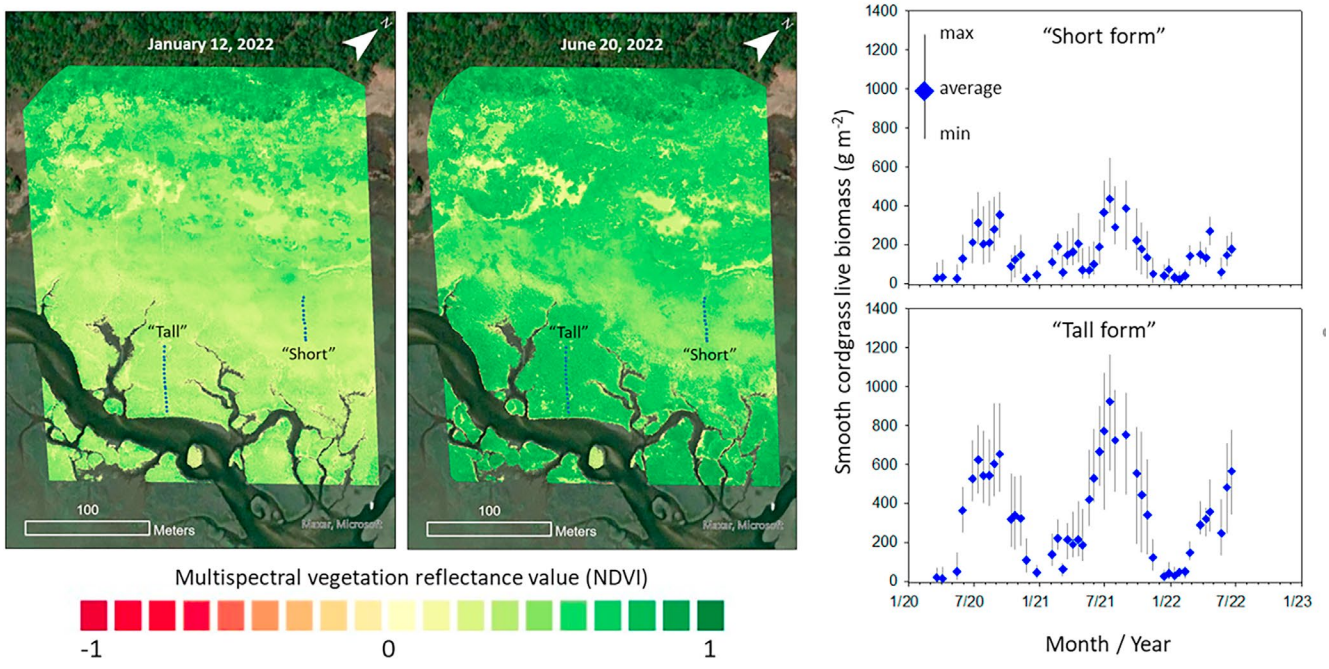
Starting in 2020, with funding from NOAA, the NI-WB NERR collaborated with other Reserves in the Southeastern U.S. as well as research partners at Duke University and NOAA's National Centers for Coastal Ocean Science, to test and develop protocols for incorporating the use of sUAS into standardized marsh monitoring programs. This involved a series of systematic assessments of different aircraft platforms, cameras and multispectral sensors, image collection and processing techniques, and methods of interpreting the data. This was done across multiple Reserves in the Southeast, from North Carolina to Florida and Puerto Rico. The result is a series of protocols detailing best practices, operational standards, and data collection techniques for use in marsh monitoring programs.

Based on the results of these efforts, the NI-WB NERR has operationalized the use of sUAS and multispectral image collection in our routine marsh monitoring efforts in North Inlet's Crab Haul Creek basin. We are creating high resolution vegetation maps across the marsh platform, from creek bank to upland forest edge, on an annual basis. Previously our monitoring efforts in this regard were limited to manual measurements in 53 discrete survey plots, each measuring 1 meter (about 3 ft) on a side. Thanks to

> *With state-of-the-art multispectral sensors flown on drones (more properly known as small Uncrewed Aerial Systems, or sUAS for short) the North Inlet – Winyah Bay Reserve is at the forefront of monitoring salt marsh vegetation at scales not previously possible.*

the sUAS we have increased the scale of those measurements over 2000 times, measuring plant community distribution in an area of marsh just over 115,000 square meters (or about 29 acres of marsh area). This greatly improves our ability to quantify fine-scale changes in plant community distribution across the entire marsh platform and thus determine the rate at which the plant communities migrate in response to increasing tidal flooding.

What is perhaps most exciting is the ability to use data collected by the sUAS's multispectral sensor to derive robust estimates of the amount and distribution of living plant matter (biomass) for smooth cordgrass (Spartina alterniflora, recently reclassified as Sporobolus alterniflorus). Smooth cordgrass is the dominant marsh grass species in Southeastern salt marshes, forming a monoculture everywhere below the mean high-water mark. Understanding its dynamics is key to understanding the condition of the marsh and how the marsh will respond to sea level rise. By flying the sensor monthly, and every two weeks during the peak growing season of May – August, we can track plant growth over the seasons. Doing this over the years will allow us to understand how marsh growth, or productivity, varies in response to a changing climate. Not just on average across the marsh, but on smaller scales to reveal specifically where plants are growing well and where they are under stress due to sea level rise or other environmental conditions. Continued collection of these sUAS derived measurements over time will greatly improve the ability of NERR scientists and coastal resource managers to better understand and predict how the salt marshes of North Inlet are changing as the climate changes. This information is a critical component of effectively preserving and adaptively managing these salt marsh ecosystems to maintain the essential ecological and economic functions they provide.



Multispectral images are used to create vegetation reflectance maps of the area (left panels), which correlate to the amount of living plant matter and thus provide high resolution maps of vegetation distribution over the area. Repeated flights allow us to track how much living marsh grass is present in various areas over time. The right panel shows the annual growth curves of two areas of cordgrass (Spartina alterniflora), one in the short form of the grass, higher up on the marsh platform, and one in the tall form of the grass, closer to the creek bank.

Erik Smith, erik@baruch.sc.edu

Breathing Room for Wetlands

Buffers Protect Wetland Benefits

Wetlands are a prominent feature on the South Carolina coastal landscape. Wetland is an umbrella term and encompasses many different types of habitat. A tour of local wetland ecosystems might include drifting past cypress-tupelo swamps in black water rivers, stomping through dense pocosin shrubs in a Carolina Bay, or pulling your boots out of pluff mud in a salt marsh.



What do the above habitats have in common? They are all wetlands. The cypress/tupelo swamp forest at left is obviously a flooded forest habitat, but wetland forests may not always be flooded, as shown in the middle picture. Some wetlands may even appear as shrubby or grass meadows, like the Carolina bay pictured at right.



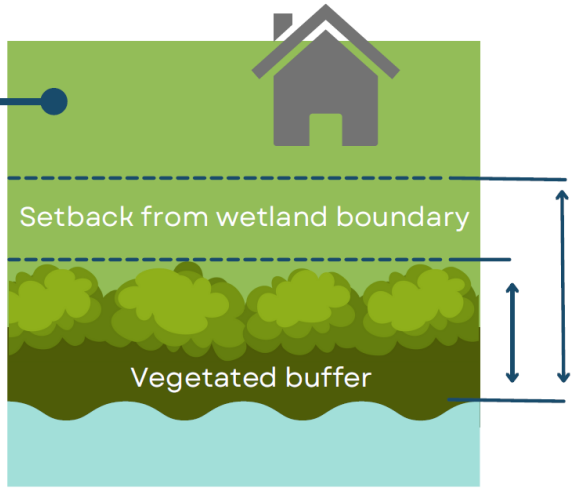
Wetlands can also be transitional habitats. The swamp forest at left is slowly changing to an herbaceous brackish wetland due to changes in the hydrology of the watershed. Sea level rise is also driving changes in tidal wetlands, such as the salt marsh in the center picture. In the absence of standing water, wetlands can be identified by vegetation types and soil conditions. The Coastal Training Program at the Reserve offers wetland identification classess, pictured at right.

Wetlands provide benefits including flood mitigation, wildlife habitat, nutrient cycling, water quality improvements, carbon storage, groundwater recharge, and more. These valuable services are important to local communities, leading to interest in policies that would ensure these benefits are maintained or enhanced. In particular, state and local governments have the ability to go above and beyond the baseline of existing wetland protections. At the federal level, wetlands are protected under Section 404 of the Clean Water Act. The boundaries that determine jurisdictional limits may not be sufficient to maintain desired levels of wetland benefits. For example, construction, mining, or industrial activities may not have direct impacts within wetland boundaries, but can indirectly affect these ecosystems. Common impacts from human activities include altered hydrology, influxes of eroded sediments, or excessive nutrients.

So how can wetlands be protected from these impacts? One of the best ways to do this is to give them some breathing room! Wetland buffers add a layer of protection around wetlands, shielding them from adjacent impacts. For example, imagine the noise of a neighbor's leaf blower spilling over into your backyard, even if they are not working directly in your space. Having a border of plants can help to muffle that outside noise, acting as a buffer. Buffers are non-disturbance areas where natural vegetation is maintained. This differs from setbacks, which define a distance from a boundary where certain activities are prohibited. Vegetated buffers provide similar functions to wetlands (filtering runoff, providing habitat), which reduces the intensity of impacts to the core wetland. Wetland ecosystems can only provide services up to a certain point before they themselves become degraded and their functions are impaired.

Buffers vs Setbacks

Both are regulated areas where certain activities may be limited. A **setback** defines a distance from a boundary where certain building activities are prohibited. **Buffers** are non-disturbance areas where natural vegetation must be maintained. Leaving existing native plants is the best choice for ease of maintenance and benefits provided.



To put buffers into practice, local governments may enact ordinances requiring buffer zones where development borders wetlands. Wetland buffers can come in different shapes and sizes. Determining the appropriate width for a buffer depends on many factors, including the desired wetland benefits, the intensity of the nearby activity, the characteristics of the site, or the sensitivity of the habitat. For example, wider buffers (50 feet or more) are needed to maintain wetlands as wildlife habitat. A smaller buffer may still provide some benefit for filtering sediment and pollution before it enters the wetland, but it wouldn't provide habitat connectivity. As a general rule, the wider the better for maintaining wetland benefits!

To provide science-based information on buffers for coastal decision-makers, the NERR Coastal Training Program developed a Fact Sheet on Wetland Buffers. Additional resources for learning more about wetlands and buffers are below:

- An Introduction to Wetlands of South Carolina
  https://lgpress.clemson.edu/publication/an-introduction-to-wetlands-of-south-carolina/
- What is a Wetland? Video
  https://www.youtube.com/watch?v=L_yNOlvlRzE&feature=youtu.be
- Wetland Habitats of Coastal SC Video
  https://www.youtube.com/watch?v=tEOMsljYv6E
- Planner's Guide to Wetland Buffers for Local Governments
  https://www.eli.org/research-report/planners-guide-wetland-buffers-local-governments

Maeve Snyder, msnyder@baruch.sc.edu

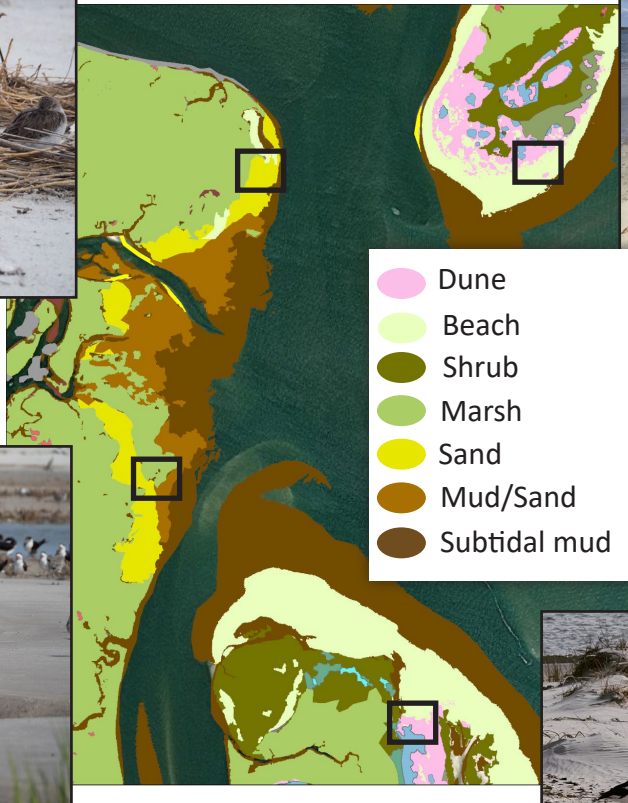
Birds-eye view

Counting birds and mapping habitat to promote conservation

Shorebird populations have shrunk by an estimated 70% across North America since 1973. Habitat loss is considered a key driver of population declines in shorebirds, but the term 'habitat loss' encompasses many types and sources of impacts. Coastline development, recreational use, overfishing, upland freshwater usage (which impacts discharge to estuaries), and marine debris all contribute to habitat loss. Coastal habitats may also be eroded and degraded by the projected effects of climate change that include sea-level rise and increased intensity and frequency of storms. Effective shorebird conservation requires not only monitoring population trends, but also developing an understanding of the specific habitat needs of species for feeding, roosting and nesting.

Shorebird counts have been conducted in the North Inlet estuary during most spring and fall migrations since 2016. Within North Inlet, four sub-habitat areas have been selected to compare species use with habitat characteristics. Within a given general habitat type, such as 'beach', there are many 'micro-habitats' created by slight changes in elevation and the accumulation of vegetation debris (wrack). These micro-habitats may provide shelter from winds, sun, and predators, and there is also evidence that birds may select areas of dry sand, wet sand or wrack to help with thermoregulation. With increasing ambient temperatures due to climate change, the availability of cooling microhabitats such as pools and wrack may become vital for species to manage heat stress. Continued species monitoring combined with the study of micro-habitat distribution at these sites will inform future conservation and restoration.

Habitat features that are temporary, such as piles of wrack, may not be apparent in large scale habitat mapping, but provide shelter and feeding areas.



A North Inlet base habitat map was created by NOAA's Office for Coastal Management using 2017 NAIP imagery, which has a 1- meter resolution.

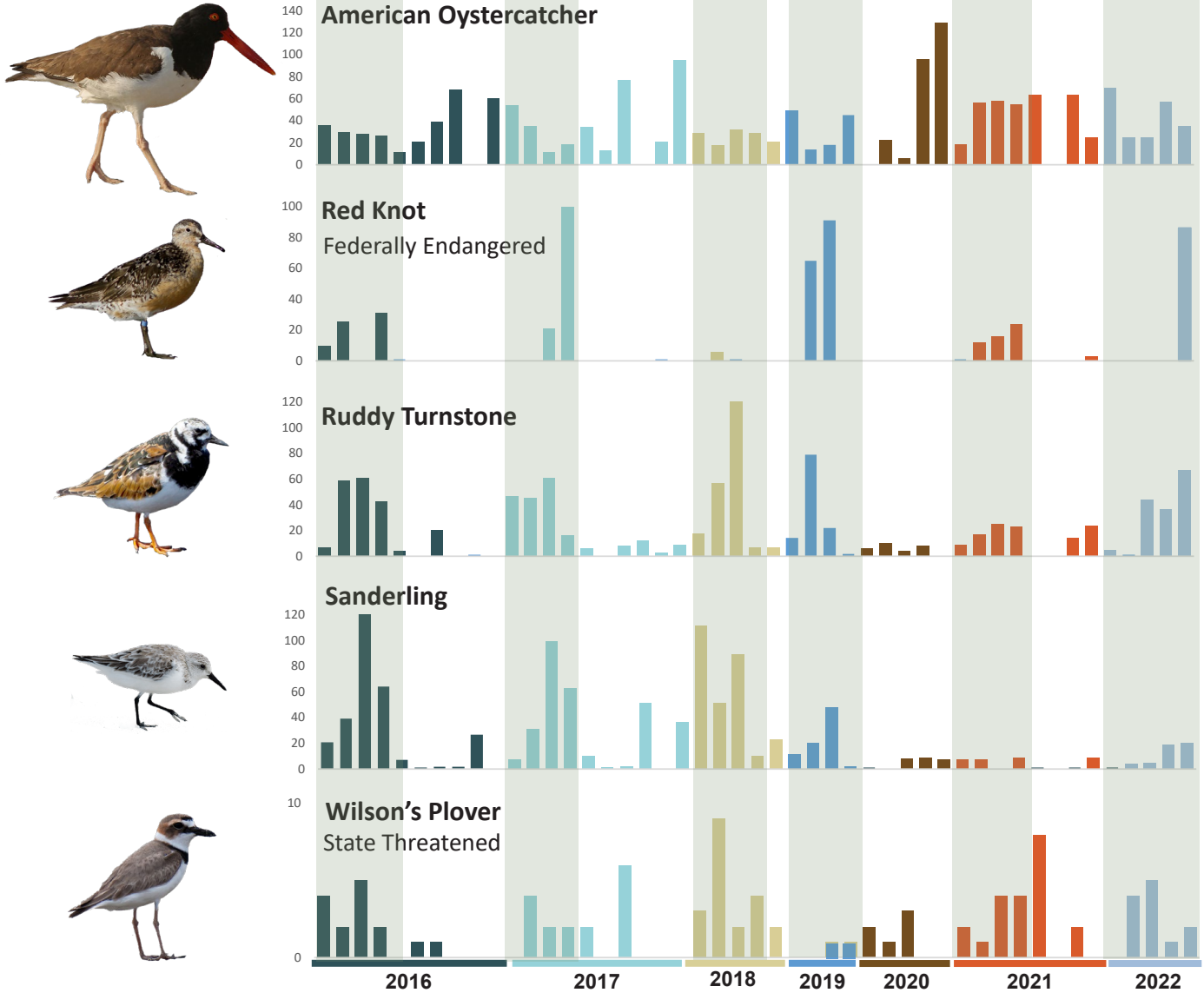
Many estuarine habitats experience rapid changes, both year to year and sometime even month to month.

Within a general habitat area, there may be many smaller "micro-habitats" such as pools and mud flats. A diveristy of micro-habitats may be important for some species.

Dune areas are used by species such as American Oystercatchers for nesting.

Our understanding of overall population trends and habitat usage is complicated by significant variability in counts year to year, and even week to week. On a given day, the number of birds seen can be affected by the time of tide, the weather, and even the presence of boats and birds of prey nearby. To illustrate, counts for all sample days since 2016 are shown for five species below (all are species listed as highest priority in the South Carolina State Wildlife Action Plan). Counts are typically highest during the spring migration (March to June, indicated by the light green boxes below). American Oystercatchers are fairly consistently seen across seasons and years. In contrast, Red Knots have been seen infrequently across years. Red Knots have experienced an approximate 85% decline in population since 1970 and are a Federally Endangered species. The good news is that some populations of coastal birds, such as Brown Pelicans and American Oystercatchers, have rebounded with stewardship interventions, such as fencing, signage and education. But not all beaches are the same, and each site will need its own set of strategies to promote conservation. Further research and monitoring will help to inform future conservation.

*No surveys were conducted in the spring of 2020.



Jennifer Plunket, jen@baruch.sc.edu

Who's In the Marsh?

Interns at the Reserve: Summer 2022

Lillian Doll

University of South Carolina

Lily is a rising Senior in UofSC's Honors College studying environmental science and biology, originally from Wilmington, NC. Lily participated in the Baruch Marine Lab's Semester @ the Coast program, where she began working on her Honors Thesis research. Lily is interested in landscape ecology and how physical environmental characteristics influence organism's habitat utilization. Her thesis is investigating the abundance, sex ratio, and body size of two key crab species on oyster reefs over a landscape gradient, but her favorite marsh creature so far is the diamondback terrapin.

Willa Lane

University of Delaware

Willa is a NOAA Hollings Scholar majoring in marine science at the University of Delaware and interning at the North Inlet-Winyah Bay NERR during summer 2022. Her research explores how organismal density and salinity of the water affect growth and mortality rates for white and brown shrimp, two species that support a key fishery stock in the South Atlantic Bight. Willa will also be taking a fisheries management course at Rutgers University this summer as an extension of her project. She is currently applying to fellowships for graduate school where she wants to continue research on marine invertebrates.

Isabel Hubbard

University of South Carolina

Isabel is a rising senior at U of SC majoring in Environmental Science. From Sullivan's Island SC, she has worked previous summers with SCDNR, SCORE and Charleston Waterkeeper. Her interests include oyster health and restoration in the SC Lowcountry, and the effects of climate change on marine ecosystems. During summer and fall 2022 she will be contributing to many of the ongoing projects conducted by the NI-WB NERR Research & Monitoring program, with a specific focus on crabs in both our salt marshes and tidal creeks.

Bailie Willis

Coastal Carolina University

Bailie Willis is a sustainability and coastal resilience major at Coastal Carolina University. She will be working on a survey of coastal residents who live in communities with stormwater ponds. The goal of the survey is to understand barriers to applying landscaping best management practices, such as vegetated shoreline buffers. Her project will help to improve future stormwater pond education for the Grand Strand.

Sarah 'Liv' Carey

Francis Marion University

Liv Carey graduated from Florence-Darlington Technical College with an Associate of Science Degree and is a sophomore at Francis Marion University majoring in Biology with Certification in Secondary Education. She is working with the education staff on public and K12 outreach and will help assess current programming and design new activities and support materials, as well as assist in social media outreach and exhibit presentation updates in support of 30th anniversary events this year. Her career interests are in-school psychology and teaching high school biology. Based on her animal yoga posing skills, her favorite marsh creature is the osprey!

We would also like to welcome our new Margaret Davidson Graduate Fellow

Gwen Hopper

University of South Carolina

Gwen is a Ph.D. student in analytical environmental chemistry, who spent her summer collecting, testing and analyzing water samples from rivers, wetlands, creeks and stormwater retention ponds in the Winyah Bay watershed near Georgetown. She is investigating how land use and development practices influence the type of dissolved organic matter exported to local waterways.

For more information on the Margaret Davidson Fellowship, visit:
https://coast.noaa.gov/nerrs/research/davidson-fellowship.html
For more information on the NOAA Hollings Scholarship, visit:
https://www.noaa.gov/office-education/hollings-scholarship

The Coastal Zone Managment Act

50 years addressing the challenges of protecting our nation's coasts.

1972

The crew of the Apollo named their command module Casper after the popular friendly ghost to appeal to children's imaginations (Image from John Sisson, dreamsofspace. blogspot.com). Video games looked very different, but Georgetown's Front Street looks more familiar, although the 700 block was destroyed by fire in 2013 (Bodian's Department Store, 721 Front Street. Image courtesy of Georgetown County). The population of Georgetown County was 35,360. A song about nostalgia for youthful innocence topped the pop charts, while the EPA's Documentaria program to photographically document subjects of environmental concern in America began. Approximately 70 well-known photographers were contracted to document scenes such as this one of litter on Isle of Palms.

In 1972 NASA's Space Shuttle Program was officially launched, Atari kicked off the first generation of video games with the release of PONG, the cost of a gallon of gas was 55 cents, and Don McLean's "American Pie" topped the pop music charts. With 43% of the US population living in coastal shoreline counties, it was also a time of intense pressure to develop the nation's shores for potentially conflicting uses, including industrial, residential, recreation, and tourism. Without some kind of legal framework to guide development, the nation's wild beaches and the public's ability to access the shore could be lost. As early as 1955, a report for the National Park Service had issued a dire warning, "Almost every attractive seashore area on our Atlantic and Gulf coasts has been preempted for commercial or private development. Only a fraction of our long seacoast is left for public use, and much of this small portion is rapidly disappearing before our eyes." So in 1972, Congress took action to protect our nation's ocean and coasts. The Clean Water Act, the Coastal Zone Management Act, the Marine Mammal Protection Act, and the National Marine Sanctuaries Act were passed, forming a powerful set of laws to lay the foundation for coastal and marine stewardship.

> *To preserve, protect, develop, enhance, and restore where possible, coastal resources.*

As we celebrate 30 years since our designation as a National Estuarine Research Reserve at North Inlet-Winyah Bay, we are also commemorating the 50th anniversary of the act of congress that established the Reserve system- the Coastal Zone Management Act (CZMA). This legislation provides for the management of the nation's coastal resources with a goal to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone." The CZMA authorizes the Secretary of Commerce to provide grants related to program administration, coastal resource improvement, coastal and estuarine land conservation, coastal enhancement objectives, technical assistance, and coastal nonpoint pollution control. The CZMA is administered by NOAA's Office for Coastal Management, and implemented through four programs: the National Coastal Zone Management Program, the National Estuarine Research Reserve System, the Coral Reef Conservation Program, and the Digital Coast. Since 1972, NOAA has allocated over $2 billion in coastal zone management-related grants to eligible coastal states.

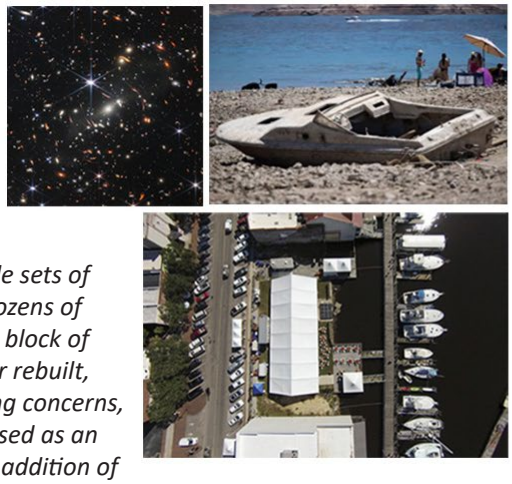
The strength in the CZMA is that it encourages coastal states and territories to work in partnership with the federal government to design and enforce local programs that best address each state's unique coastal challenges. Participation by states in the program is voluntary, and currently 34 of the 35 eligible states

participate. (Alaska, if you were wondering). While a set of National policies guide the program, the state approach is flexible. Ways in which each state may apply the program include directly protecting natural resources, managing development in high hazard areas, giving priority to development for coastal-dependent uses, providing public access for recreation, improving coastal water quality, coordinating federal and state actions, and involving the public in state and community-based decisions. Participation in the program also gives states the right to review federal actions that affect coastal uses or resources, for example actions involving dredging, renewable and non-renewable energy, and aquaculture.

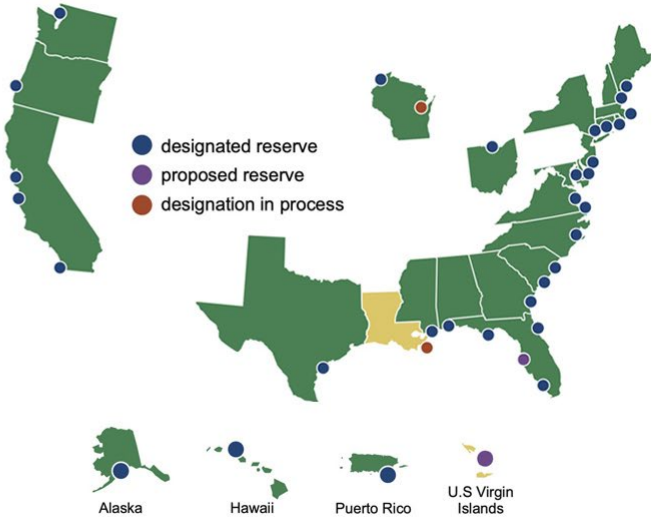
South Carolina's Coastal Management Program was adopted by the S.C. General Assembly in 1977 under the Coastal Tidelands and Wetlands Act. As a local example of the CZMA at work, the North Inlet-Winyah Bay and ACE Basin National Estuarine Research Reserves recently worked with South Carolina's Department of Natural Resources and Office of Ocean and Coastal Resource Management to address a local coastal management need for strategies to minimize shoreline erosion while conserving coastal habitat. Living shoreline techniques utilize natural structures such as oyster shells, plantings, logs or rocks to reduce erosion and allow marsh grasses to grow. However, South Carolina lacked science-based information on how different living shoreline approaches performed under various conditions, and an easy pathway to permit living shoreline projects adjacent to private land. The project team analyzed data and case studies to compile detailed information about the performance of different living shoreline treatments over time and under a range of conditions, and from that information developed a technical report to guide living shoreline regulation, an extensive monitoring dataset, and a decision tree for property owners considering living shorelines. This information is expected to enable agencies to streamline the review of living shoreline permit applications and to develop new living shoreline regulatory standards. This project was funded by NOAA though the NERRS Science Collaborative, which is a primary mechanism that supports competitive, user-focused research in the Reserve System.

Of the total population of approximately 4.8 million in South Carolina, over 1.3 million people live in coastal portions of the state. With the potential future effects of climate change, including sea level rise and increased storm intensity, and 2,876 miles of shoreline, strategic coastal zone management will continue to be needed to prevent our coastal resources from, "rapidly disappearing before our eyes."

2022



NASA's James Webb Space Telescope let us see the distant universe as never before, while the record drop in water level at Lake Mead revealed multiple sets of human remains and dozens of sunken boats. The 700 block of Georgetown was never rebuilt, partially due to flooding concerns, but the space is now used as an event venue. With the addition of Connecticut, the NERR system has reached 30 Reserves.



Jennifer Plunket, jen@baruch.sc.edu

Friends

Across the coastal states, community members are actively supporting the mission and work of their local National Estuarine Research Reserve, through activities including:

- *Fund raising for community education and research*
- *Trail and infrastructure fundraising and development*
- *Maintaining interpretive centers and kiosks*
- *Assisting with education programs such as guided walks and k-12 classes*
- *Hosting special events*
- *Participating in stewardship activities such as clean-ups and invasive species removal*
- *Assisting with field research activities*

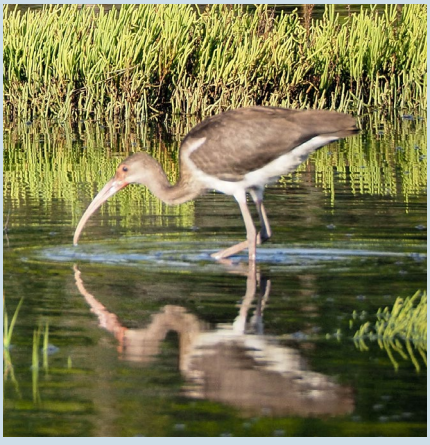
And of course organizing fun and educational field trips for their members. The National Estuarine Research Reserve Association (NERRA) teams up with Reserve friends groups to form the NERRS Friends and Foundations Network, a national community of practice that works together to protect Reserves for future generations. NERRA provides resources and connectivity among the friends groups and guidance for members to help support the National Estuarine Research Reserve System through letter writing and advocacy. In this way, members can be friends not only to their local Reserve, but to Reserves across the country.

About two years ago, a small group of dedicated volunteers began to form a friends group for the North Inlet-Winyah Bay NERR, called the Inlet & Bay Stewards (IBIS). The mission of IBIS is to connect people with the dynamic coastal environment of North Inlet and Winyah Bay estuaries in South Carolina, supporting the North Inlet-Winyah Bay NERR. The last couple of years have presented some difficulties for getting a new organization started, but IBIS was still able to move forward on the initial steps of creating bylaws, forming a board, and obtaining designation as a SC Non-Profit organization. Charter members of IBIS have run fishing clinics for the Reserve and have helped with stewardship monitoring programs. But in order to grow the organization, members, ideas and energy are needed.

In order to 'reboot' IBIS as a Friends Group to the NERR, the board is holding an open workshop to engage new members and establish a path forward. We would love to hear your thoughts about what you would like to see for IBIS activities and events, and how you might like to help support our local NERR. **Please join us at the Discovery Center on Monday, August 29th from 5 to 7 pm. Learn more about the Reserve, potential opportunities for IBIS, and also to meet fellow estuary enthusiasts.**

Please RSVP to inletandbaystewards@gmail.com

Events



IBIS Friends Group Meeting

Monday, August 29th, 5 to 7 PM

Members, ideas and energy are needed to grow the friends group of the Reserve, Inlet & Bay Stewards. Please join us at the Discovery Center to learn more about the mission of IBIS and opportunities to participate in the education, research and stewardship activities at the Reserve, and to share your ideas about how you can help to support the NERR and protect our estuaries.

Please RSVP to inletandbaystewards@gmail.com

Myrtle Beach Green Drinks

Tuesday, August 23rd, 5:30 to 7:30, Hosted by Friends of Lewis Ocean Bay at Handley's Pub and Grill

Each month, a different local environmental organization will share how they are serving the Grand Strand through education, advocacy, and community outreach. Join a lively mixture of people from NGOs, academia, government and business for an informal evening of catching up and making new contacts in the green community.

https://www.facebook.com/myrtlebeachgreendrinks

Trash Free Estuary! Roadside Cleanup

Sunday, September 18th, 8 to 10 AM

Celebrate our beautiful estuaries and coast by pitching in and helping to pick-up litter before it makes its way into our watershed. Join the North Inlet-Winyah Bay NERR, Keep It Green, and Georgetown County to clean up litter from our local roadways on Sunday, September 18th.

Register at northinlet.sc.edu/events/cleanup

Then Now Future

30 Years of Research and Conservation at North Inlet & Winyah Bay

Special guest speakers at Kimbel Lodge at Hobcaw Barony will reflect on long-term changes in the salt-marsh habitats of North Inlet.

Wednesday, September 7, 6:00 PM

The salt marsh, rapid climate change, sea-level rise, and human impacts

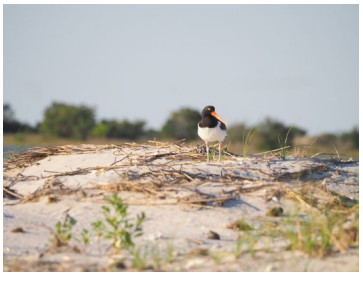
Dr. James Morris, Distinguished Research Professor, Baruch Institute for Marine & Coastal Sciences University of South Carolina

Thursday, September 15, 6:00 PM

Cool Planktonic Critters in Warming Estuarine Waters

Dr. Dennis Allen, Distinguished Research Professor Emeritus Resident Director, Baruch Marine Field Lab. University of South Carolina

Wednesday, September 21, 6:00 PM



Space for Seabirds and Shorebirds in North Inlet

Mary-Catherine Martin, Wildlife Biologist, South Carolina Department of Natural Resources

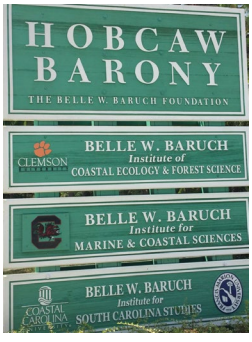
See all 30th Celebration Events @

northinlet.sc.edu/30years

North Inlet – Winyah Bay 30 Years National Estuarine Research Reserve

Events

North Inlet-Winyah Bay
NATIONAL ESTUARINE RESEARCH RESERVE



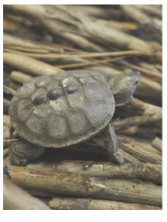
Have you ever wondered

What goes on behind the Hobcaw signs?
What is a National Estuarine Research Reserve?
What types of research go on in North Inlet?
Can I visit the North Inlet NERR?

Know the NERR

Join Reserve staff to learn more about the research, education and stewardship at the Reserve since its designation in 1992.

Georgetown County Museum *Tuesday* **September 6** 5:30 PM
Waccamaw Library *Thursday* **September 8** 10:00 AM
Andrews Library *Saturday* **September 10** 11:00 AM
Georgetown Library *Tuesday* **September 13** 11:00 AM
Southern Georgetown Library *Thursday* **September 15** 3:00 PM
Carvers Bay Library *Saturday* **September 17** 10:00 AM



Events

Party

The North Inlet-Winyah Bay National Estuarine Research Reserve is Celebrating 30 Years of Research, Education and Stewardship

Join Us at the

Hobcaw Barony Discovery Center

Saturday, September 24

9 am to 2 pm

Free Events

See all 30th Celebration Events @

northinlet.sc.edu/30years

Reserve Report
Estuary Trends

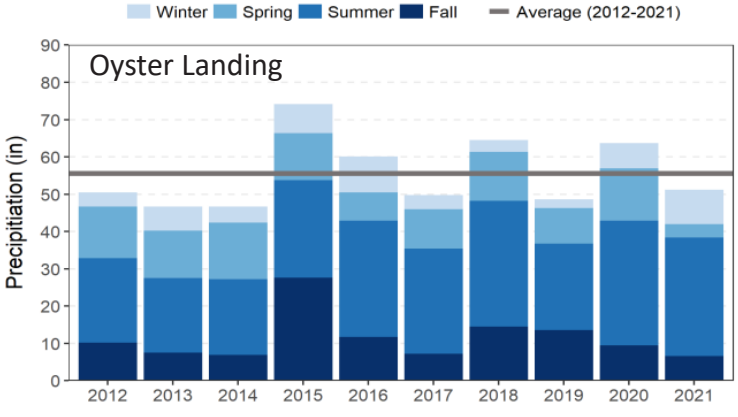
Weather & Water Quality Highlights from 2021

The health of every National Estuarine Research Reserve is continuously monitored by the System Wide Monitoring Program (SWMP). This program is designed to measure changes in estuarine water quality, habitat and land use and provide information on environmental trends. Reserve generated data and information are available to local citizens and decision makers. For more information, go to: https://coast.noaa.gov/nerrs/

The NIWB Reserve has five sampling sites, two in Winyah Bay and three in North Inlet. From left to right: Winyah Bay, Thousand Acre, Debidue Creek, Oyster Landing and Clambank Landing.

Analysis of 2021 data showed that...

- **Rainfall in 2021 was just below the long term historical average.**
- **Air and water temperatures in 2021 were right at their long term historical averages.**
- **Chlorophyll-a concentrations are increasing in North Inlet.**
- **Salinity is decreasing at all monitoring stations.**



Trends in weather and water quality from 2012 to 2021...

Location ID	Location Name	Air Temperature	Precipitation
OL	Oyster Landing	↑	—

Location ID	Location Name	Water Temperature	Salinity	Dissolved Oxygen	pH	Turbidity
CB	Clambank	↑	↓	↓	—	—
DC	Debidue Creek	↑	↓	↓	↓	—
OL	Oyster Landing	—	↓	—	↓	—
TA	Thousand Acre	↑	↓	—	↓	↓

Location ID	Location Name	Ortho-phosphate	Ammonium	Nitrite	Nitrate	Chlorophyll -a
CB	Clambank	—	↑	↓	—	↑
DC	Debidue Creek	—	↑	—	—	↑
OL	Oyster Landing	—	↑	—	—	↑
TA	Thousand Acre	—	—	—	↑	—

**Based on data collected from 2012-2021*

X Insufficient Data ↑ Increasing — Not Changing ↓ Decreasing

= Precipitation is not changing.

⬆Air and water temperature are increasing.

= Phosphorous is not changing

⬇Salinity is decreasing.

= Turbidity is not changing.

Did you Know?

You can see real-time data from any of the NERRS around the country at www.nerrsdata.org/mobile

Our Staff

Erik Smith
Manager

Beth Thomas
Education Coordinator

Hayley Fournier
Education Specialist

Maeve Snyder
Coastal Training Program
Coordinator

Jennifer Plunket
Stewardship Coordinator

Julie Krask
Research Specialist

Baker Stevens
Research Specialist

Brittany Morse
Research Specialist

Robert Dunn
Research Coordinator

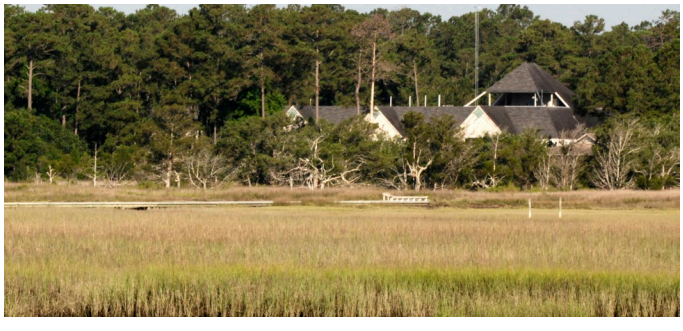
http://northinlet.sc.edu/contact-us/

North Inlet-Winyah Bay
National Estuarine Research Reserve

The **North Inlet-Winyah Bay National Estuarine Research Reserve** includes North Inlet and lower Winyah Bay and encompasses tidal marshes, oyster reefs, beaches, coastal forest, and open water. This reserve provides habitat for many species, including federally threatened and endangered sea turtles, sturgeon, red knots, and wood storks.

The reserve conducts research and provides education programs needed by communities to conserve and manage coastal resources. Primary focus areas include impacts of urbanization and stormwater management on coastal water quality, effects of climate variability on natural and human coastal communities, and monitoring and actions to protect biodiversity.

The reserve headquarters is located at the Baruch Marine Field Laboratory on Hobcaw Barony. Daily oversight is provided by the Belle W. Baruch Institute for Marine and Coastal Sciences, University of South Carolina. NOAA's Office for Coastal Management provides funding, national guidance, and technical assistance.



The nation's 30 research reserves protect over 1.4 million acres and provide habitat where plants and wildlife thrive. Community benefits include recreation, flood protection, and water filtration.

North Inlet-Winyah Bay National Estuarine Research Reserve

www.northinlet.sc.edu