



SOUTH ATLANTIC

Living Shorelines



SUMMIT

APRIL 12 & 13, 2016

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On behalf of the Governors' South Atlantic Alliance, I'd like to welcome you to our first regional summit on living shorelines. Our region includes some of the largest and most productive estuaries in the world, with shorelines far more extensive than oceanfront beaches. For example, recent mapping efforts in North Carolina revealed over 12,000 miles of estuarine shorelines that fall into at least four different ecological/physical categories. Still, the ecological impacts of shoreline alterations and the overall integrity of intertidal and transitional habitats along estuarine shorelines often receive less attention than the oceanfront, and we recognize a need to improve our ability to match the most appropriate shoreline stabilization approach to the environmental conditions and human activities unique to each location along our coast.

I believe that all of the meeting participants share similar goals for the future of our estuaries, and that is why this Summit is so important - we need more opportunities to share information on the management, research, regulation, and implementation of living shorelines; to identify common data and research needs; and to leverage that information to make better public and private decisions. We truly appreciate the support of our funding partners, including the Environmental Protection Agency, The Nature Conservancy, Southeast Regional Partnership for Planning and Sustainability, Florida Department of Environmental Protection, Florida Fish and Wildlife Commission, and South Carolina Department of Natural Resources. I'd also like to thank the Summit Steering Committee and our meeting organizers, including the North Carolina Coastal Federation and Moffatt and Nichol, for their leadership in planning this meeting. And finally, a special thanks to our speakers, who bring significant expertise and important perspectives from across the region.

Best wishes for a productive meeting,



Braxton Davis, Director, N.C. Division of Coastal Management

This event was made possible by funding from an EPA Region 4 Wetlands Program Development Grant, in partnership with The Nature Conservancy, the Southeast Partnership for Planning and Sustainability, Florida Department of Environmental Protection, Florida Fish and Wildlife Conservation Commission, and South Carolina Department of Natural Resources.

Special thanks to our generous meeting Sponsors:



Join us at the Poster Reception to learn more from our meeting Exhibitors:



GSAA Summit Steering Committee Members

- Joy Brown, The Nature Conservancy
- Bill Cary, Brooks Pierce
- Kevin Claridge, Florida Department of Environmental Protection
- Mary Conley, The Nature Conservancy
- Dr. Carolyn Currin, National Oceanic and Atmospheric Administration
- Anne Deaton, North Carolina Department of Environmental Quality
- Jan Mackinnon, Georgia Department of Natural Resources
- Kayleigh Michaelides, Florida Department of Environmental Protection
- Dr. Charles (Pete) Peterson, University of North Carolina – Institute of Marine Sciences
- Melody Ray-Culp, United States Fish and Wildlife Service
- Linda Rimer, United States Environmental Protection Agency
- Mark Risse, Georgia Sea Grant
- Bill Ross, Southeast Regional Partnership for Planning and Sustainability

- Dr. Denise Sanger, South Carolina Department of Natural Resources
- Deborah Scerno, United States Army Corps of Engineers
- Lisa Schiavinato, North Carolina Sea Grant
- Suzanne Simon, Restore America's Estuaries
- Kent Smith, Florida Fish and Wildlife Conservation Commission
- Seth Theuerkauf, North Carolina State University, NDSEG Fellow
- Dr. Amber Whittle, Florida Fish and Wildlife Conservation Commission
- Dr. Linda Walters, University of Central Florida
- Henry Wicker, United States Army Corps of Engineers

Thank you to the Summit organizers for their efforts in producing this event.

- Kristine Cherry, Governors' South Atlantic Alliance
- Jason Doll, Moffatt and Nichol
- John Dorney, Moffat and Nichol
- Todd Miller, North Carolina Coastal Federation
- Ana Zivanovic-Nenadovic, North Carolina Coastal Federation

April 12 & 13, 2016

Agenda

Summit Purpose: To share information on the management, research, regulation, and implementation of living shorelines in the South Atlantic region, building knowledge and relationships that expand the use of appropriate stabilization alternatives to traditional shoreline hardening.

APRIL 12, 2016

- 8:00 a.m. Registration and coffee**
- 8:30 a.m. Welcome and Purpose of Meeting**
Kevin Claridge, GSAA Partner and Director, Florida Coastal Office, Florida Department of Environmental Protection
- 8:40 a.m. Keynote Speaker: Living Shorelines: A Vital Management Strategy to Keep Our Estuaries Healthy and Productive for Generations to Come**
Dr. Charles Peterson, Professor of Marine Science, Biology & Ecology, University of North Carolina, Chapel Hill
- 9:00 a.m. Status of Management and Implementation of Living Shorelines in the South Atlantic Region – Panel**
MODERATOR: Melody Ray-Culp, coordinator, US Fish and Wildlife Service, Coastal Program in the Florida Panhandle
Daniel Govoni, policy analyst, North Carolina Department of Environmental Quality, Division of Coastal Management
Dr. Denise Sanger, associate marine scientist South Carolina Department of Natural Resources, Marine Resources Research Institute
Jan MacKinnon, biologist, Georgia Department of Natural Resources, Coastal Resources Division
Kent Smith, biological administrator II, Florida Fish and Wildlife Conservation Commission, Aquatic Habitat Conservation and Restoration Section Marine/Estuarine Subsection
- 10:00 a.m. Break**
- 10:20 a.m. Triaging Estuarine Shorelines: How to Identify and Use the Best Practical Alternatives That Protect the Coastal Environment and Economy?**
Tracy Skrabal, senior scientist, North Carolina Coastal Federation

- 10:45 a.m. Living Shoreline Research – Recent Research and Development**
MODERATOR: Eric Hughes, EPA
Dr. Rachel Gittman, postdoctoral research associate, Northeastern University
Dr. Peter Kinglsey-Smith, associate marine scientist, South Carolina Department of Natural Resources, Marine Resources Research Institute
Tom Bliss, director of shellfish research laboratory, Georgia Sea Grant
Andrea Noel, manager, Florida Department of Environmental Protection, Northeast Florida Aquatic Preserves Guana Tolomato Matanzas National Estuarine Research Reserve
- 11:45 a.m. Networking Lunch**
- 1:00 p.m. Best Practices for Designing and Constructing Living Shorelines and Lessons Learned in the GSAA Region**
MODERATOR: Jason Doll, senior scientist/project manager, Moffat & Nichol
Dr. Lexia Weaver, coastal scientist, North Carolina Coastal Federation
Tom Havens, engineer, Coastal Civil Engineering
Doug Baughman, senior environmental scientist, CH2M Hill
Zachary Schang, assistant manager and living shoreline coordinator, Florida Department of Environmental Protection, Northwest Florida Aquatic Preserves
- 2:00 p.m. Comparing the Costs Among Living Shorelines and to More Traditional Stabilization Methods**
MODERATOR: Dr. Amber Whittle, habitat research administrator, Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute
Ed Hoffman, Greenworks, LLC
Tom Ries, Ecosphere
- 2:45 p.m. Break**

3:15 p.m. **Promoting Living Shoreline Projects: A Recent Report on Overcoming Institutional Barriers**
Bill Cary, Brooks Pierce

3:30 p.m. **Living Shorelines: Federal Agency Initiatives**

MODERATOR: Mary Conley, southeast marine Conservation director, The Nature Conservancy

Dave Evans, deputy director, Office of Wetlands, Oceans and Watersheds, U.S. Environmental Protection Agency

Janine Harris, marine habitat resource specialist (ERT Contractor), National Oceanic and Atmospheric Administration--Office of Habitat Conservation

Henry Wicker, deputy chief, Wilmington District Regulatory Division, U.S. Army Corps of Engineers

Jason Engle, coastal engineer, Jacksonville District Engineering Division, U.S. Army Corps of Engineers

4:30 p.m. **Educational Tools and Practices**

MODERATOR: Suzanne Simon, Restore America's Estuaries strategic project manager

Whitney Jenkins, coastal training coordinator, North Carolina Department of Environmental Quality, National Estuarine Research Reserve

Joy Brown, marine program manager, The Nature Conservancy

Ana Zivanovic-Nenadovic, senior policy analyst, North Carolina Coastal Federation

5:15 p.m. **Wrap-up Adjourn**

5:30–7:30 p.m. **Evening Poster Session and Social Event**

Living Shorelines Academy Workshop

Guana Tolomato Matanzas National Estuarine Research Reserve

APRIL 13, 2016

8 a.m. – 10 a.m.

Field Trip to GTM Research Reserve Living Shorelines Sites

Andrea Small, Northeast Florida Aquatic Preserves Manager

10:15 a.m. – 2 p.m.

Living Shorelines Academy Workshop

A technical training workshop organized by North Carolina Coastal Federation.

This training will test the living shorelines online modules that were designed for the Living Shorelines Academy.

PRESENTED BY:

Tracy Skrabal, Senior Coastal Scientist, North Carolina Coastal Federation

Dr. Lexia Weaver, Coastal Scientist, North Carolina Coastal Federation

Andrea Noel, Tom Ries (Ecosphere), Ed Hoffman (Greenworks, LLC) and Tom Havens (Coastal Civil Engineering)

The Living Shorelines Academy (www.livingshorelinesacademy.org) is an online learning platform featuring scientific, engineering and policy resources, and online training modules. Its goal is to elevate the importance and practice of living shorelines.

The Academy is a partnership between North Carolina Coastal Federation and Restore America's Estuaries made possible by funding from the U.S. Environmental Protection Agency.

North Carolina Coastal Federation

The North Carolina Coastal Federation is a member-supported 501(c)(3) that focuses on protecting and restoring the N.C. coast. For over 34 years, the Coastal Federation has been in the field restoring miles of coastline, training and educating students, adults and communities to take actions that result in cleaner coastal waters and advocating for an accessible, healthy, productive coast.



North Carolina Coastal Federation
Working Together for a Healthy Coast

Guana Tolomato Matanzas National Estuarine Research Reserve

The Guana Tolomato Matanzas National Estuarine Research Reserve (GTM Research Reserve) is dedicated to the conservation of natural biodiversity and cultural resources through research and monitoring to guide science-based stewardship and education strategies.

The Reserve was formed through a collaboration of Florida's Department of Environmental Protection and the National Oceanic and Atmospheric Administration. It covers 74,000 acres of coastal lands in northeast Florida from Ponte Vedra Beach to Palm Coast. The GTM Research Reserve is part of a national system of research reserves that focus on research, education and stewardship.



Kevin Claridge

Florida Coastal Office, Florida Department of Environmental Protection

Kevin Claridge is the director of the Florida Department of Environmental Protection's Florida coastal office. In this position, he oversees the Coastal Management Program, 41 Aquatic Preserves, three National Estuarine Research Reserves, Coral Reef Conservation Program, Offshore Section, co-manages the Florida Keys National Marine Sanctuary with NOAA, and assists with organization and contracting of Deepwater Horizon restoration projects. During his tenure with the State of Florida, he has managed state lands and conservation easements across the state, administered air, waste, water facility, and environmental resource regulatory programs in southeast Florida; led large scale mine reclamation efforts in central Florida; and supervised watershed restoration projects in south Florida. Claridge holds a graduate certificate in public administration from the University of South Florida, a master's degree from the University of Memphis, and a bachelor's degree from the University of North Carolina at Asheville.

Dr. Charles Peterson

Professor of marine science, biology & ecology, University of North Carolina, Chapel Hill

Dr. Charles "Pete" Peterson is an alumni distinguished professor at the University of North Carolina at Chapel Hill. He has a bachelor's degree in biology from Princeton, and master's degree in zoology and Ph.D. in biology from the University of California at Santa Barbara. His research is in the interdisciplinary field of marine conservation ecology. Peterson has served on the N.C. Marine Fisheries Commission, Environmental Management Commission, Sediment Control Commission, and is former chair of the steering committee for the N.C. Coastal Habitat Protection Plan. Peterson has also served on several study panels of the U.S. National Academy of Sciences and was awarded a Pew Fellowship in ecology and environment in 1994.

Melody Ray-Culp

Coordinator, US Fish and Wildlife Service – Coastal Program in the Florida Panhandle

Melody Ray-Culp is a U.S. Fish & Wildlife Service biologist who coordinates the coastal program in the Florida Panhandle, a proactive, nonregulatory approach to fish and wildlife conservation. She has a master's degree in marine sciences from the University of Puerto Rico, a bachelor's degree in biology from Principia College, and is currently based in Panama City.

Daniel Govoni

Policy analyst North Carolina Department of Environmental Quality, Division of Coastal Management

Daniel Govoni is a policy analyst with the North Carolina Division of Coastal Management, which is headquartered in Morehead City, North Carolina. Previously, Daniel served as an assistant major permits coordinator with the Division of Coastal Management where he spent extensive time coordinating development permits including living shorelines. Additionally, he assisted in the development of the Division of Coastal Management's living shoreline strategy.

Dr. Denise Sanger

Associate marine scientist, South Carolina Department of Natural Resources – Marine Resources Research Institute

Dr. Denise Sanger is an associate marine scientist at the South Carolina Department of Natural Resources' Marine Resources Research Institute. She obtained her Ph.D. in marine science from the University of South Carolina and her bachelor's degree in marine biology from the University of California at Santa Cruz. Denise has also worked for the South Carolina Department of Health and Environmental Control's Office of Ocean and Coastal Resource Management and South Carolina Sea Grant Consortium. She has experience in coastal and estuarine ecology and coastal zone management. She is currently working on a living shoreline research project in South Carolina.

Jan MacKinnon

Biologist, Georgia Department of Natural Resources - Coastal Resources Division

Jan MacKinnon is a native of North Carolina, graduating from Meredith College with a bachelor's degree in biology and later from Georgia Southern University with a master's in biology. She has worked as a biologist with the Georgia DNR, Coastal Resources Division since 1999. She currently oversees the Division's Wetlands Program that includes wetland monitoring and assessment, restoration, and living shorelines. Jan is also an adjunct professor at the College of Coastal Georgia where she has taught aquatic biology and ecology as well as marine biology to coastal ecology students since 2003.

Kent Smith

Biological administrator II, Florida Fish and Wildlife Conservation Commission, Aquatic Habitat Conservation and Restoration Section, Marine/Estuarine Subsection

Kent Smith is the biological administrator for the Florida Fish and Wildlife Conservation Commission's (FWC) marine and estuarine habitat conservation program; integrated marine habitat conservation program addressing direct restoration, environmental commenting, partnership coordination and stakeholder outreach. He has worked with the FWC and its forerunner agencies for over 26 years in aquatic habitat conservation programs. He received a bachelor's degree from Duke University's College of Arts and Sciences; a master's degree from Florida State University's department of biological science, studying the behavioral ecology and life history of Caribbean spiny lobsters in Florida Bay marine habitats.

Tracy Skrabal

Senior scientist, North Carolina Coastal Federation

Tracy Skrabal is the regional manager and senior coastal scientist with the North Carolina Coastal Federation, a nonprofit membership organization with over 12,000 members and 3,000 active volunteers working for a healthier N.C. coast. Skrabal oversees the southeast regional office,

and has been with Coastal Federation since 1997. She works in all program areas, including advocacy (as a registered conservation lobbyist), restoration of wetlands, oyster reefs, water quality, and education. Skrabal has a bachelor's degree in geology from the College of William and Mary in Virginia, and a master's degree in geological oceanography from School of Marine Science, College of William and Mary (Virginia Institute of Marine Science). Before working with the Coastal Federation, she spent several years working as an environmental consultant in North Carolina, Virginia, and Maryland, and was with the Delaware Department of Natural Resources and Environmental Control for six years, working as program manager for the marinas, wetlands, and subaqueous lands regulatory programs.

Eric Hughes

U.S. Environmental Protection Agency (EPA) Region 4 (Atlanta) Water Protection Division

Eric Hughes is an ecologist and EPA liaison to the U.S. Army Corps of Engineers, Jacksonville District. He has 38 years of experience with U.S. EPA, wetlands regulatory and everglades restoration/water quality expert.

Hughes main area of involvement is assisting with the Comprehensive Everglades Restoration Plan (CERP), water quality issues and other south Florida NEPA activities. He is also involved with wetland regulatory (Section 10/404) review of all dredge/fill proposals across north/central Florida and is the EPA contact on St. Johns River issues.

Hughes has a bachelor's degree in biology from Emory University and a master's degree in zoology from the University of Georgia, and has completed graduate research on salt marsh ecology at UGA Marine Institute, Sapelo Island, Georgia.

He is the recipient of two EPA bronze medals for commendable service – East Everglades 404c action 1988 and 2000 Everglades Restudy EIS team, as well as the recipient of an EPA silver medal for superior service in 2011 for Everglades phosphorus control associated with EPA's amended determination.

Dr. Rachel Gittman

Postdoctoral research associate, Northeastern University

Dr. Rachel Gittman is a postdoctoral research associate at Northeastern University currently working with Jonathan Grabowski and leading a review and meta-analysis of the ecological effects of shoreline hardening for the Pew Charitable Trusts. Her work with Dr. Grabowski includes coordinating and synthesizing data for a Science for Nature and People (SNAP) working group consisting of federal agencies and NGOs to determine whether current and past federally funded coastal restoration is aligned with social and ecological needs. Gittman received a Ph.D. in ecology from the University of North Carolina at Chapel Hill in December 2014 under the advisement of Charles "Pete" Peterson and John Bruno. Her dissertation research evaluated the ecosystem service provision of different coastal defense strategies (i.e., shoreline hardening versus living shorelines). Before attending UNC, she worked as an environmental consultant for the federal government on environmental policy and management-related issues. She received a bachelor's degree in environmental science from the University of Virginia in 2006, specializing in ecological conservation.

Dr. Peter Kingsley-Smith

Associate marine scientist, South Carolina Department of Natural Resources (SCDNR) – Marine Resources Research Institute

Dr. Peter Kingsley-Smith is associate marine scientist and shellfish research section manager for the South Carolina Department of Natural Resources Marine Resources Research Institute, located in Charleston, South Carolina. He received his bachelor's degree in marine and environmental science from the University of St. Andrews, Scotland (1994-1998) and his Ph.D. from the University College of North Wales-Bangor (1994-1998), studying the natural history of naticid gastropods (moon snails), which initiated his research focus on molluscan ecology. From 2002 to 2008, Kingsley-Smith completed three postdoctoral research fellowships at the Virginia Institute of Marine Science, which included research on the comparative

ecology of native and non-native predatory gastropods and oysters. After spending a summer as marine restoration specialist for The Nature Conservancy's Virginia Coast Reserve, on the Eastern Shore of Virginia, he joined the SCDNR in the fall of 2008. Since 2012, he has served as applied science lead on two research projects funded through the NERRS science collaborative. The first project focused on expanding living shorelines within the ACE Basin NERR through stakeholder engagement in site selection and subsequent implementation of a diversity of reef-building substrates. The second project, which began in the fall of 2015, aims to improve the regulatory framework for living shorelines in South Carolina to help facilitate living shorelines as a viable alternative to bulkheads and seawalls in achieving shoreline protection.

Tom Bliss

Director of shellfish research laboratory, Georgia Sea Grant

Thomas Bliss is the director of the UGA Marine Extension Shellfish Research Laboratory on Skidaway Island, Georgia. He has focused on living shorelines and oyster restoration for over 10 years, working with government and private partners to establish and research living shorelines in coastal Georgia. Other research interest includes shellfish aquaculture, oyster hatchery, and invasive species.

Andrea Noel

Manager, Florida Department of Environmental Protection - Northeast Florida Aquatic Preserves Guana Tolomato Matanzas National Estuarine Research Reserve

Andrea Noel received her bachelor's degree from the University of Southern Maine in natural and applied science and her master's degree from the Edmund S. Muskie School of Public Service in environmental planning. She has lived in Florida for over 20 years and in the Jacksonville area since 1999. Andrea started with the Florida Department of Environmental Protection in 2011, as the watershed coordinator for the National Estuarine Research Reserve and has been the northeast Florida aquatic preserves manager since July 2013.

Jason Doll

Senior scientist/project manager Moffatt & Nichol

After growing up in one of the most remote areas of the northeastern N.C. coast, Jason Doll attended North Carolina State University, where he studied fisheries and wildlife science. After seven years with nonprofit environmental groups, and six years as a water quality modeler with the North Carolina Division of Water Quality, he entered private consulting. Combined, Mr. Doll now has 22 years of experience in the areas of water quality assessment and modeling, watershed planning, and ecological restoration. He is currently a senior scientist and project manager with the engineering firm, Moffatt & Nichol, in Raleigh, North Carolina.

Dr. Lexia Weaver

Coastal scientist, North Carolina Coastal Federation

Dr. Lexia Weaver is a coastal scientist and the central regional manager for the North Carolina Coastal Federation, a member-supported nonprofit organization that focuses on protecting and restoring the N.C. coast. Her background is in estuarine water quality and plant ecology and she has conducted over 12 years of research in Florida, Delaware and North Carolina. Weaver holds a master's degree and a Ph.D. in marine studies from the University of Delaware and a bachelor's degree in biology with a specialization in marine biology from Barry University in Miami Shores, Florida. She has managed and implemented coastal restoration projects within the central region of North Carolina since 2007, including living shoreline, stormwater retrofit, oyster restoration and large-scale wetland restoration projects.

Tom Havens

Engineer, Coastal Civil Engineering

Tom Havens is principal civil engineer and owner of Coastal Civil Engineering, based in the historic district of Savannah, Georgia. Havens has professional registrations in the states of Georgia, South Carolina and California, and has been managing and design civil engineering projects for over 28 years.

He has been involved in the design of environmentally sensitive stream bank stabilizations for over 20 years. Starting in northern California in the mid-nineties, he was an early proponent of combining vegetative elements into traditional reinforcement methods. This introduction of vegetation not only improved the strength and long-term viability of bank repairs, but also had the added benefit of providing natural habitat.

Havens began working with Ed Hoffman on living shorelines in the coastal Georgia area in 2010. Methods were developed to create a bank reinforcement system that blends with the natural environment, maintains a flexibility to conform to a wide range of shoreline geometries, encourages the recruitment of oysters, and enhances habitat opportunities.

Doug Baughman

Senior environmental scientist, CH2M Hill

Doug Baughman is senior scientist with CH2M and currently leads the firm's eastern region water resources and ecosystem management practice. He has worked with the firm for more than 28 years on environmental assessment, planning, and ecosystem management projects across the southeast. He is currently the senior scientist for the on-going collaborative agreement with The Nature Conservancy that focuses on incorporating natural infrastructure alternatives into the traditional engineering evaluations. In this role he is participating in living shoreline design, permitting, and implementation projects in Charleston, South Carolina and East Pensacola Bay, Florida as well as other water resource, water quality, and ecosystem restoration opportunities from the upper Mississippi River basin to the northeast.

Baughman has a bachelor's degree in marine science and a master's degree in environmental health sciences from the University of South Carolina.

Zachary Schang

Assistant manager and living shoreline coordinator, Florida Department of Environmental Protection - Northwest Florida Aquatic Preserves

While studying environmental science in 2006, at the University of West Florida, Zach Schang began his tenure with the Florida Department of Environmental Protection. After assisting with the installation of the award winning Project GreenShores, he focused efforts toward living shorelines throughout the panhandle. As the assistant manager and living shoreline coordinator for the Northwest Florida Aquatic Preserves Office of The Florida Coastal Office, he handles the design, organization, and installation of small and medium scale shoreline restoration projects throughout northwest Florida. He also coordinates volunteer work events, participates in a variety of educational and outreach activities and collects and interprets data associated with the monitoring of installed restoration projects. Schang has been involved with over 40 living shoreline projects to date. His work with navigating the permit process, streamlining installation and design challenges, and coordination with private and public landowners has been instrumental in the area and is sought out for his expertise in all things living shorelines.

Dr. Amber Whittle

Habitat research administrator, Florida Fish and Wildlife Conservation Commission - Fish and Wildlife Research Institute

Dr. Amber Whittle received bachelor's degrees in zoology and English from the University of Florida and her Ph.D. in zoology/ecology, evolution and conservation biology from the University of Hawaii at Manoa. Her research focus was on the abundance, distribution, diversity, and ecology of larval fishes. She has worked as an environmental consultant and is currently the habitat research administrator at the Fish and Wildlife Research Institute. She oversees the coral, seagrass, upland, coastal wetlands, and freshwater plants groups. Dr. Whittle's professional expertise includes watershed restoration, coastal benthic resource assessments and monitoring, habitat/animal interactions, and environmental assessments and mitigation design.

Ed Hoffman

Greenworks, LLC

Ed Hoffman earned his bachelor's degree in natural resource management from Cornell University and in 2005 founded a civil construction firm in coastal Georgia focused on sustainable design. In 2009, he built the first two living shorelines in Georgia on Sapelo Island in coordination with the Georgia Department of Natural Resources, the Nature Conservancy, NOAA and the University of Georgia. Following the success of these installations he helped co-author a living shoreline guidance document for coastal Georgia and has been invited to help design and/or build living shorelines on Little St. Simons Island, Canon's Point, St. Simons Island, Skidaway Island State Park, and Tybee Island. Of particular importance to him, the installation of the living shoreline at LSSI resulted in a 100 percent increase in fish productivity and diversity, according to studies conducted by UGA. Over the past 11 years as an environmental contractor, consultant, and coastal resident he remains passionate about maintaining the beauty and ecology of coastal Georgia. In light of current ecological pressures, he continues to advocate for living shorelines and their ability to increase natural habitat, improve water quality, and protect marsh and upland resources for both human and biotic communities.

Tom Ries

Executive vice president/principal scientist, Scheda Ecological Associates, Inc., and President, Ecosphere Restoration Institute, Inc.

As a scientist, Tom Ries has more than 32 years experience working with Florida ecosystems, specializing in habitat restoration and conducting biological assessments. These efforts have typically involved design and implementation of habitat restoration projects inclusive of living shoreline efforts. He has been involved with the implementation of over 97 habitat restoration projects in this region, including innovative public /private partnerships. Many of these projects have won regional awards for environmental excellence. Ries has a bachelor's degree in biology and a minor in geology from the University of South Florida.

Bill Cary

Attorney, Brooks Pierce

Having previously served as general counsel of the North Carolina Department of Environment and Natural Resources, Bill Cary has extensive experience in compliance planning and litigation, especially CWA issues and emerging coastal management practices. He served on the committee that compiled the Restore America's Estuaries report "Living Shorelines—From Barriers to Opportunities" presented at the 2014 RAE/The Coastal Society summit, and acted as primary scrivener of that report.

Mary Conley

Southeast marine director, The Nature Conservancy

For the past 10 years, Mary Conley has served as The Nature Conservancy's director of marine conservation for the southeast United States. In this role she leads regional coastal and marine conservation initiatives focused around oyster and coral reef restoration, coastal resilience, ocean planning and sustainable fisheries. Recent regional activities include mapping nearshore and offshore natural resources as part of the South Atlantic Bight Marine Assessment, fish monitoring around restored oyster reefs, and tools and training related to the role of natural infrastructure in coastal resilience. In addition, she coordinates marine conservation efforts across four state chapters (NC, SC, GA and FL) working to increase regional marine capacity, promote cross-program learning, and expanding efforts to scale-up activities to a regional level. Before joining the Conservancy, she worked with the Maryland Coastal Zone Management Program and the Chesapeake Bay Program. Conley holds a master's degree in marine science, with an emphasis in benthic ecology from the University of Texas at Austin and a bachelor's degree in marine biology, with a geology minor, from the College of Charleston.

Dave Evans

Deputy director, Office of Wetlands, Oceans and Watersheds, U.S. Environmental Protection Agency

Dave Evans is deputy director of EPA's Office of Wetlands, Oceans and Watersheds (OWOW), a position he has held since 2013. As deputy, he focuses on strengthening internal workings and performance of OWOW's multifaceted program efforts. Previously, Dave served as director of OWOW's Wetlands Division from 2005-13 leading EPA's Section 404 regulatory program and the agency's efforts to build wetland partnerships and enhance state/tribal wetlands programs. While wetlands division director, Evans formed and led an interagency coastal wetlands working group of six federal agencies, which served to increase attention on the challenges and opportunities of creating more living shorelines. He has been with the EPA since 1983, when he moved from his initial presidential management internship program assignment. After staff work in this program and as the agency's water quality budget analyst, he moved to the Superfund program in 1989 and held a series of leadership positions until his move to the Wetlands Division. Evans holds degrees in geography from SUNY-Oswego and urban planning from the University of Arizona.

Janine Harris

Marine habitat resource specialist (ERT Contractor), NOAA Fisheries- Office of Habitat Conservation National Oceanic and Atmospheric Administration

Janine Harris is a marine habitat resource specialist working on contract with ERT to NOAA fisheries office of habitat conservation. Since 2013, she has been leading the NOAA living shorelines workgroup, an effort within NOAA to coordinate the many roles NOAA plays in living shoreline research and implementation. Harris' work also involves national essential fish habitat reviews and working with other federal agencies and partners on coastal blue carbon implementation and other strategies to curb coastal wetland loss. Before NOAA, she worked with the New York City Department of Parks and Recreation, Natural Resources Group where she managed a community based oyster restoration project in the Bronx River.

Henry Wicker

Deputy chief, Wilmington District Regulatory Division, U.S. Army Corps of Engineers

Henry Wicker is the deputy regulatory chief of the Wilmington District Regulatory Division, a position he has held since 2013. As chief, he assists in administering the laws, regulations and policies of the department of the Army regulatory program under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. He directly supervises technical and professional staff, and assists in supervision and oversight of employees located in four regional regulatory field offices in North Carolina. Before that Henry worked as a special project manager in the Wilmington district regulatory division on a variety of projects and permits, including environmental impact statements; reissuance of the regional conditions for the nationwide permits (2007 and 2012); reissuance for the Wilmington districts regional general permits, water supply reservoirs; cement mining facilities and coastal permits for a variety of projects, including beach nourishment and living shorelines. Wicker has a bachelor's degree in biology from University of North Carolina at Pembroke.

Jason Engle

Coastal engineer, Jacksonville District Engineering Division, U.S. Army Corps of Engineers

Jason Engle is chief of the water resources engineering branch, Jacksonville District, U.S. Army Corps of Engineers. The branch consists of a staff of approximately 35 engineers and scientists who perform a wide variety of hydraulic, hydrodynamic and coastal engineering analyses supporting the design and construction of federal civil works projects that provide coastal storm risk management, inland flood risk management, ecosystem restoration and navigation benefits. This work is performed over a region that includes Florida, Puerto Rico and the U.S. Virgin Islands. Engle holds a bachelor's degree in civil engineering and a master's degree in coastal and

oceanographic engineering from the University of Florida, and is a registered professional engineer in the state of Florida.

Suzanne Simon

Restore America's Estuaries strategic projects manager

Suzanne Giles-Simon is the strategic projects manager for Restore America's Estuaries (RAE). She has spent more than 20 years working on coastal, marine, and estuarine issues in the private, public, and nonprofit sectors. An estuarine scientist by training, she started her career at an oceanographic consulting firm in the Pacific Northwest. From 2000 to 2004 she worked in DC's nonprofit sector, including a two-year period as RAE's national policy and science director. A move to Florida prompted a switch back to the private sector, where she once again joined a consulting firm and developed expertise in Florida's ecosystems and drinking water issues. She rejoined RAE in 2009. She has a bachelor's degree in biology from Bates College and a master's degree in environmental science with a concentration in marine and estuarine science from Western Washington University.

Whitney Jenkins

Coastal training coordinator, North Carolina Department of Environmental Quality – National Estuarine Research Reserve

Whitney has been the coordinator of the North Carolina Coastal Training Program since 2002. The goal of the program is to promote informed coastal decisions through science-based training for professionals. Training programs focus on sustainable development, water quality protection, and coastal hazards. She is also responsible for developing and facilitating collaborative learning processes for groups such as the North Carolina Sentinel Site Cooperative. Jenkins has a master's degree in environmental management from Duke University and a bachelor's degree from the University of Florida. She is based at the Coastal Reserve's headquarters in Beaufort, but coordinates training across North Carolina's 20 coastal counties.

Joy Brown

Marine program manager The Nature Conservancy

Joy Brown, the marine program manager for The Nature Conservancy, is a native of the Florida Panhandle and previously worked with a small nonprofit group, the Choctawhatchee Basin Alliance, where she helped grow the organization and implement many of their marine and stormwater programs. She also held a position with the city of Fort Walton Beach where she began an oyster restoration program that utilized local volunteers for oyster gardening and included a science teacher-mentoring element. Brown earned a bachelor's degree in biological sciences from Florida State University and a master's degree in biology and coastal zone studies from The University of West Florida.

Ana Zivanovic-Nenadovic

Senior policy analyst North Carolina Coastal Federation

Ana Zivanovic-Nenadovic is a senior policy analyst with the North Carolina Coastal Federation, a state-based nonprofit organization. Ana leads the Coastal Federation's effort on protecting oceanfront and inlet beaches for public uses and maintaining the inlets' natural functions. She assists the executive director on devising and evaluating policies. She also manages graduate level policy internship program. Ana has a master's degree in business administration for sustainable business from the University of Maine. She received her bachelor's degree from Universidad Rey Juan Carlos in Madrid, Spain.

22 years of worldwide reef ball coastal restoration

Larry Beggs¹, Todd Barber², James (Jim) McFarlane³

¹ Reef Innovations

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As a result of natural disasters and human impact, coral reefs, marshes, oyster beds, mangroves and other marine habitats are in need of preservation and restoration. Worldwide there has been a significant loss of marine ecosystems.

Research has shown a need to: increase juvenile fish habitats, increase oysters in estuaries, protect shoreline, increase sediments in marshes. Reef Balls® were selected for the projects because: the design and testing of the product demonstrated the quality and characteristics to meet project needs. Reef Balls utilize pH balanced, marine-grade concrete, with a textured surface and without environmental toxins. Reef Balls were designed to mimic natural ecosystems. Reef Balls have a history of staying where they are placed.

The process involved a site survey, permitting, deployment and monitoring of the modules. Reef Balls have been placed in various ecosystems around the world. The success of Reef Balls has been demonstrated over the past 22 years with projects in over 60 different countries. Studies and analysis of data collected from numerous sites have shown Reef Balls to be an excellent material for: fish habitat, mangrove restoration, breakwater for beach stabilization and nourishment, oyster bed development, coral transplanting and preservation, as well as the reestablishment of living shorelines.

Reef Balls have been successful in meeting the objectives of marine restoration projects around the world.

Blue carbon potential of living shorelines

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The value of living shorelines for providing erosion control and habitat has been documented, but their capacity for carbon storage has not. We measured carbon storage rates in living shorelines and transplanted *Spartina* marshes in the Newport River Estuary, North Carolina. Carbon storage decreased with marsh age to an equilibrium value of 75 g m⁻² yr⁻¹. The pattern of lower rates in older marshes is likely the result of a relative enrichment of labile organic matter in younger sites. These data suggest that wide-scale use of living shorelines will have a measurable 'blue carbon' benefit.

Jacksonville Zoo living shoreline project

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The purpose of the Jacksonville Zoo Living Shoreline Project is to feature alternative shoreline stabilization practices, promote nature habitats, and educate the public about the importance of living shorelines. Armored shorelines, like bulkheads or seawalls, are traditional in Florida but cause a net loss of aquatic habitat. This project is a green infrastructure alternative that will enhance aquatic habitat and productivity. The City of Jacksonville City Council previously approved 2012076E, a resolution supporting the Jacksonville Zoo Living Shoreline Project.

This project will be an active research site monitored for three years by the students of Jacksonville University and Terry Parker High School, as well as by community volunteers. The proposed activities include the following: (1) vegetate approximately 0.21 acres of eroding shoreline with emergent and wetland plants, (2) install +/-200 linear foot wave attenuation devices offshore, (3) construct a +/-425 foot elevated boardwalk to enhance educational opportunities, and (4) implementation of a broad education plan.

The fully implemented project will: (1) create an intertidal habitat including salt marsh and oyster bars, (2) prevent shoreline erosion by installing native aquatic plants to stabilize the shoreline, as well as attenuate the wave energy, (3) provide guidance for future installations of this approach from monitoring results, and (4) educate the public on living shorelines as an alternative to bulkheads.

Estuarine shoreline research and monitoring to inform coastal management in North Carolina

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The North Carolina Division of Coastal Management (DCM) and the North Carolina Coastal Reserve and National Estuarine Research Reserve (NCNERR) are focused on exploring the use of living shorelines for erosion control through research, monitoring, and mapping initiatives that provide information about the design and benefits of living shorelines along the coast of North Carolina. These initiatives include digitally mapping North Carolina's shoreline and related structures, evaluating the impacts of bulkheads on ecosystem services, and studying the protection provided by various stabilization methods. Results are communicated to coastal communities through education and stewardship initiatives that promote the use of living shorelines based on specific site conditions.

Monitoring trends in erosion, accretion, and shoreline change at a living shoreline reef: Oak Point, Wadmalaw Island, South Carolina

Katie Luciano¹, Joy Brown², Melissa Strickland²

¹ South Carolina Geological Survey, ² The Nature Conservancy

This research presents the results of a yearlong elevation monitoring effort conducted adjacent to a living shoreline project installed by The Nature Conservancy (TNC) at Oak Point, Wadmalaw Island, South Carolina on Aug. 9, 2014. Funding for monitoring research has been provided by the Wildlife Conservation Society's Climate Adaptation Fund. Post-installation monitoring involved collecting measurements at a series of elevation monitoring rods installed in a grid behind and adjacent to the living shoreline reef. Measurements were taken bi-monthly to calculate the distance between the top of each monitoring rod and the marsh surface. Sediment plates were also deployed adjacent to each transect and collected every three months to determine the composition of deposited materials. For samples that yielded 20 grams or more of material - primarily samples from the plates deployed directly behind the reef - grain size analyses were conducted using a modification of the Plumb (1981) pipette method to determine percentage sand, silt, and clay in each sample based on settling velocities. Linear regressions run on vertical measurements indicate little correlation between elevation change and time. Vertical elevation measurements show that the highest amount of accretion behind the reef occurred between September and November, 2014, and that trends in erosion and accretion tend to level out after this time period. Elevation monitoring at the edges of the reef indicate some periods of erosion, with monitoring showing a net overall loss at the edges of the reef. Sediment analyses for plates installed directly behind the reef show that the clay and silt content for each sample was higher several months following installation (November, 2014) than when samples were collected in March and July 2015. Shoreline change analyses were also conducted by TNC using AMBUR (Analyzing Moving Boundaries Using R) and a GIS-based Near tool to better understand shoreline variability along Church Creek from 1994 to present-day. Results of this monitoring project suggest that the emplacement of the living shoreline structure encouraged accretion behind the reef that was most dramatic within the first three months of sampling (September - November 2014). Fine-grained silts and clays initially deposited post-installation were later replaced by an increasing amount of sand-sized sediment. Shoreline change analyses indicate that estuarine shoreline along Church Creek has experienced variable patterns of erosion and accretion depending on the specific location, and the hotspots of erosion do exist, particularly on the shoreline opposite the living shoreline installation. The monitoring methodology used for this project will be replicated for another TNC living shoreline installation at Goldbug Island, South Carolina that will be constructed in late April 2016.

Development of CoastalResilience.org, a tool to support living shorelines implementation

Caitlin Lustic¹

¹The Nature Conservancy

The Southeast Florida Regional Climate Change Compact's Shoreline Resilience Working Group is working to identify and promote natural systems, living shorelines and grey-green approaches to increase coastal resilience. With support from TNC, the group has developed products, including CoastalResilience.org, a website and set of applications that allow users to view the potential impacts of sea level rise and the importance of natural systems and living shorelines for addressing some impacts.

Living Shorelines in Georgia

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In Georgia, large tidal amplitude and anthropogenic influences exacerbate riverine and tidal creek erosion. In 2006, a new technique to combat erosion referred to as living shorelines began was developed. Living shorelines are novel engineering approaches which provide alternatives to conventional armored shorelines that are constructed to protect lands lying adjacent to estuarine waters from erosion. These living shorelines form into reef and vegetated communities that function similarly to a natural habitat, and in 2010, the first living shorelines were built on Sapelo Island, Georgia. To date, six living shorelines have been constructed along the Georgia coast and have utilized oyster cultch material and native vegetation plantings. To further encourage development and outreach opportunities for living shorelines, a multi-agency workgroup was formed. This workgroup is comprised of government, academia, conservation organizations, and landowners that serve as the leading experts for all living shoreline projects in Georgia.

Evaluating living shorelines to inform regulatory decision-making in South Carolina

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Living shorelines show great promise in coastal South Carolina as a tool to control erosion, increase habitat, and protect coastal areas from hazards both short-term (e.g., storms) and long-term (e.g., sea level rise). The South Carolina Department of Natural Resources and ACE Basin NERR have constructed oyster-reef based living shorelines on public land for 15 years and private property owners are also showing interest in using living shorelines to prevent erosion. Current South Carolina permitting processes, however, do not address this emerging strategy and serves as a barrier for private property owners wishing to pursue this approach.

In response to the state's desire to develop a comprehensive, science-based regulatory process to address the design and permitting of living shorelines, this research will comprehensively analyze the suite of living shoreline possibilities specifically suited to South Carolina and their performance under varying physical and environmental conditions. Using a stakeholder-driven process, case study assessments, experimental research sites and monitoring will generate the information needed by the state to develop statewide living shoreline policy. Ultimately, this project will help to remove a critical barrier to living shoreline implementation.

A GIS-based decision support tool for oyster reef habitat restoration

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The global decline of many recreationally- and commercially-important marine species has prompted the use of habitat restoration, such as the construction of oyster reefs, as a management tool to combat population declines. Inadequate scientific information to guide site selection is one of the most common causes of unsuccessful habitat restoration. In this study, we developed a hierarchical, GIS-based optimization approach to selecting the most suitable sites for oyster reef habitat restoration in Pamlico Sound, North Carolina, USA. Our novel approach linked relevant biological, physical, and socioeconomic information within a unifying GIS-based decision support tool framework to guide habitat restoration prioritization using oyster reef habitat restoration in Pamlico Sound, North Carolina, USA as a model system. The underlying framework of this decision support tool is adaptable to inform habitat restoration in other systems.

This presentation will focus on the GIS-based decision support tool that we have generated for oyster sanctuary site selection in Pamlico Sound, North Carolina, USA, and will focus on our approach, including the: 1) selection of relevant biological, physical, ecosystem services, and socioeconomic spatial layers, 2) convening of an expert panel (including academia, nonprofits, and government agencies) to assess underlying model weightings within the tool, 3) development of the tool framework, 4) validation of tool output, and 5) translation of the tool output into meaningful information for decision-makers tasked with oyster reef habitat restoration. The presentation will also introduce ongoing updates to the tool to inform intertidal oyster reef habitat restoration and incorporate ecosystem services (i.e., oyster filtration and finfish habitat enhancement).

Microplastics in southeastern coastal / marine US national parks

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¹ National Park Service, Southeastern Region

The annual global demand for plastics has consistently increased and is now estimated at approximately 245 million tons. A particular concern is the occurrence of smaller pieces of plastic debris including those not visible to the naked eye, referred to as microplastics, that are found in coastal ecosystems. Ingestion of microplastics by microbiota, presents a very real problem. The concern is their potential for delivery of concentrated persistent organic pollutants (POPs), mainly those picked up from sea water. These dissolved POPs, along with the plastics themselves, are toxic. We are quantifying the amount of microplastics in beach habitat across multiple marine park units; sites range from remote to highly-urbanized and represents one of the broadest geographic sampling efforts to date. This study provides much-needed data to identify management actions to address microplastic input, protect species susceptible to effects of microplastics (e.g., oysters, shorebirds), and develop education materials. Results demonstrate the quantities found in NPS shoreline sediments and explain distribution and abundance based on ocean currents, land use, and geography.

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