



Introduction to the next edition of the Blueprint

Erin Fleckenstein, NC Coastal Federation

NC Oyster Restoration Efforts

- ➤ 1915: NC DMF started cultch plantings
 - 1915-2020 ~22 million bushels of cultch material planted
- ➤ 1947: Shellfish Rehabilitation Program began
- ➤ 1995: Blue Ribbon Advisory Council on Oysters
- > 1996: Oyster sanctuary program initiated
- ➤ 1997: Fisheries Reform Act
- ≥2001: Oyster Fishery Management Plan
- ≥2003: NGOs & research institutions ramp up efforts
- ≥2004: Coastal Habitat Protection Plan



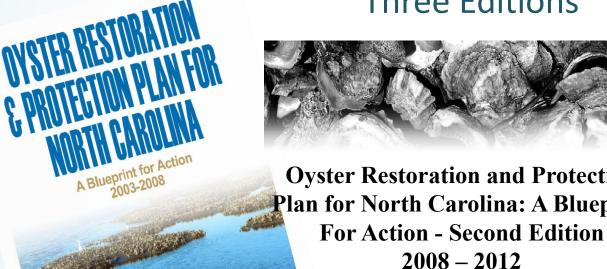
Oyster Restoration and Protection Plan for North Carolina: A Blueprint For Action

- >2003 Oyster Forum yielded compilation of suggested actions
- ➤ Incorporated recommendations from:
 - Blue Ribbon Advisory Council on Oysters
 - Fisheries Reform Act
 - Oyster Fishery Management Plan
 - Coastal Habitat Protection Plan
 - Basinwide Water Quality Plans
- ➤ Drafted into comprehensive, concerted & bold effort to take place over five years
 - **2**003-2008; 2008-2012; 2015-2020
- ➤ Steering Committee and Regional Workgroups engaged

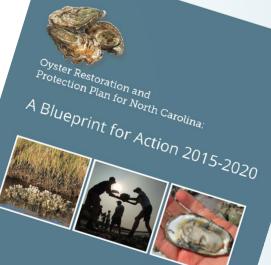


Oyster Restoration and Protection Plan for North Carolina:

A Blueprint for Action Three Editions



Oyster Restoration and Protection Plan for North Carolina: A Blueprint



Prepared by: N.C. Coastal Federation

Partnerships and Collaborations are Key to Success







































US Army Corps of Engineers®



























NC Restaurant & Lodging Association

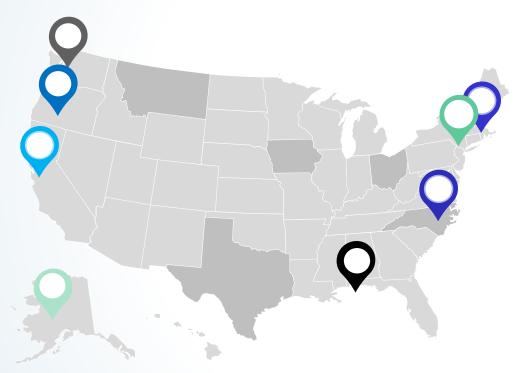


Major Accomplishments 2003-2013

- Government, private agencies and other shellfish stakeholders coordinated habitat, water quality and fisheries management activities.
- Funding for oyster related programs increase by a factor of ten from 2003-2013.
- Nearly 200 acres of oyster habitat were enhanced and restored, annual oyster harvests increased during this time, and a greater number of watershed restoration projects along the coast were implemented.



Major Accomplishments 2015-2020



Oyster Restoration and Growing are good for both the economy and environment

North Carolina joined NOAA's National Shellfish Initiative

Developed Strategic Mariculture Plan

Shellfish aquaculture grew from \$1 million to nearly \$5 million industry

Built ~50 acres of reef through oyster sanctuaries, living shorelines and patch reefs

Built ~200 acres of harvestable reef

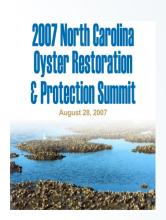
Water quality degradation continues to be a concern but some localized improvements were observed

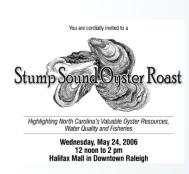
Researchers developed and refined tools to guide restoration, growing and enhancement efforts



Blueprint Summits, Roasts & Forums

- ► 2003 Oyster Forum, Ocean
- ➤ 2004 Encore for Oysters Summit, Morehead City
- ➤ 2005 Oyster Summit & Legislative Reception, Raleigh
- ➤ 2006 Regional Public Oyster Forums, Wilmington, Beaufort & Manteo
- ➤ 2006 Legislative Oyster Roast, Raleigh
- ➤ 2007 Legislative Oyster Roast, Raleigh
- ➤ 2007 Oyster Summit, Pine Knoll Shores
- ➤ 2014 Oyster Restoration Workshop, Beaufort
- ➤ 2015 Oyster Summit & Legislative Reception, Raleigh
- ► 2017 Oyster Summit & Legislative Reception, Raleigh
- ➤ 2019 Oyster Summit & Legislative Reception, Raleigh







Annual State of the Oyster Report



STATE OF THE OYSTER: 2015 Progress Report

on the OYSTER RESTORATION AND PROTECTION P



STATE OF THE OYSTER: 2016 Progress Report



on the Oyster restoration and protection plan for North Carolina

Prepared by the North Carolina Coastal Federation

STATE OF THE OYSTER: Progress Report

on the Oyster restoration and protection plan for North Carolina

Prepared by the North Carolina Coastal Federation Published September 2019





WHO WE ARE ABOUT OYSTERS THE BLUEPRINT NEWS & RESOURCES PROGRESS EVENTS Q



Since 2003, a diverse group of stakeholders involved in growing, harvesting, studying, educating, managing and eating oysters have voluntarily and productively worked together to protect and restore North Carolina's oyster habitats and fisheries. This website links their efforts to present a holistic approach to advancing the vision of North Carolina becoming "the Napa Valley of Oysters."

NCOysters.org is North Carolina's clearinghouse for oyster habitat restoration, planning, education/outreach and research. It is designed to:

News

Grower Profile: Ryan Bethea

Grower Profile: Katherine McGlade

Senate Mulls Fisheries, Shellfish Overhauls

Coastal Review Online

Genetic impacts of a commercial

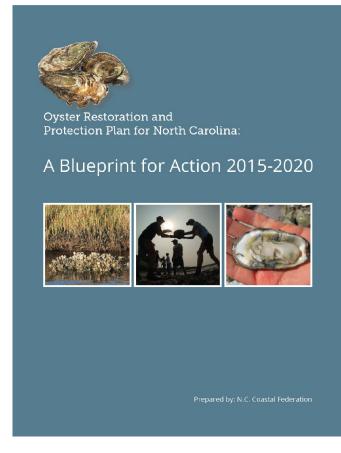
aquaculture lease

2019 Oyster Summit Held in Raleigh

SUBSCRIBE FOR UPDATES HERE



@NcOysters @NorthCarolinaOysters www.ncoysters.org



Third Edition

Seven Goals of the Blueprint

Link Restoration of Oysters and Water Quality to an Economic Development Strategy

Establish 500 acres of Oyster Sanctuaries

Plant Cultch to Provide for Ample Sustainable Wild Oyster Harvest

Build the Mariculture Oyster Industry to Meet or Exceed
Wild Harvest Limits

Sustainably Manage Oyster Harvest on Public Bottom

Protect and Improve Water Quality in Priority Shellfish Growing Areas

Document Oyster Status and Trends Resulting from Successful Implementation of the *Blueprint*

Vision for 4th Edition of the Oyster Blueprint

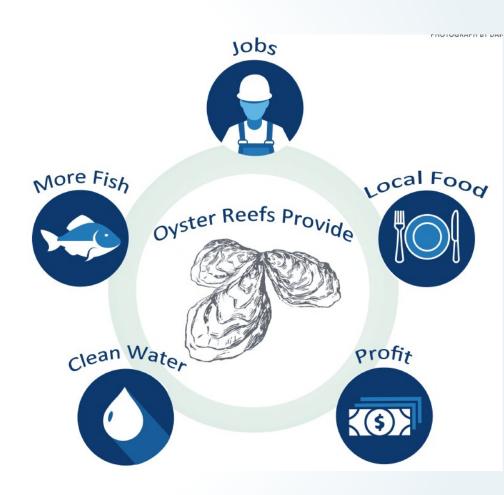


The vision of the Blueprint is to foster collaboration among partners, ensuring oysters in N.C. perpetuate a healthy and robust environment and economy.

To What End?

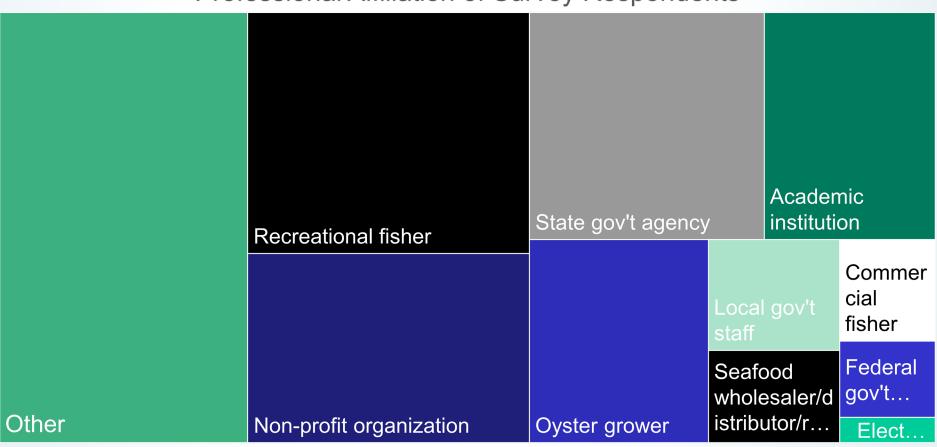
Setting goals based on Ecosystem Services.

Ecosystem Services defined as Benefits people gain from thriving coastal habitats and clean waters.



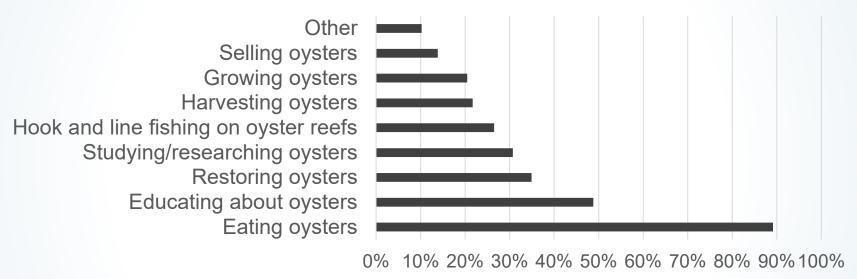
Results of Stakeholder Survey

Professional Affiliation of Survey Respondents



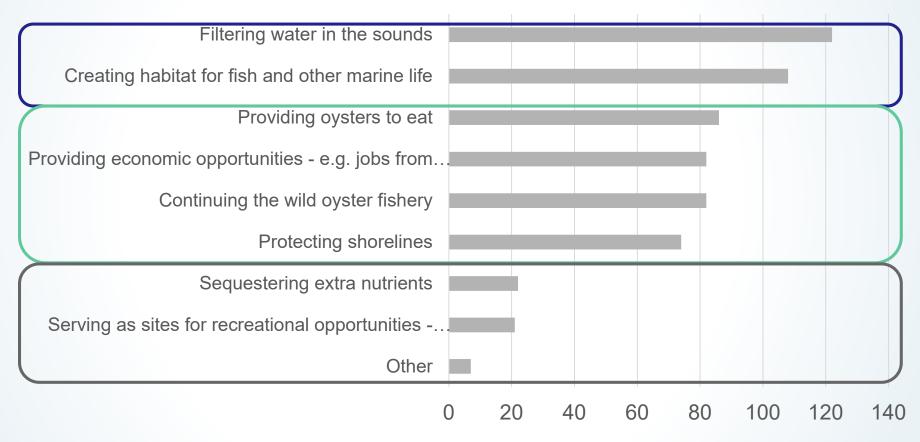
166 Respondents

Survey Respondents' Oyster Related Activities



Survey respondents' participation in oyster related activities as a percent of all respondents

Survey Respondents Selected the Benefits of Oysters that were Most Important to Them



Number of Times an Oyster Benefit was Selected by Survey Respondents

Direct Threats to Oysters Most to Least Concerning

Physical Destruction to Reefs from Human Related Activities (other than harvest)

Overharvest of Resource

Siltation/Burying of Reefs

Incompatible Fishing Practices (e.g. dredging)

Low Dissolved Oxygen

Lack of Spawning due to Low Oyster Population

Shellfish Diseases

Salinity Changes (too high/too low)

Lack of Settlement due to Low Substrate Availability

Introduced Invasive Species

Ocean Acidification

Physical Destruction to Reefs from Storms or Natural Causes

Predation

Lack of Sufficient Food for Oysters

What do you consider to be the single greatest threat to oysters in North Carolina in the next 5-10 years and why?

Threat	# of Times
	Selected
Water Quality	11
Incompatible Fishing Practices	8
Overharvest of Resource	5
Land-based Development	4
Storms	4
Ocean Acidification	3
Shellfish Diseases	3
Physical Destruction to Reefs	3
Management	3
Lack of Spawning	2
Lack of Substrate	2
Siltation	2
Swings in Salinity	1
Lack of Awareness	1
Multiple Threats/Interactions	66

Respondents provided 241 actions to be considered for Oysters

Action Related to:	Number of Times Made
Habitat Enhancement	85
Water Quality Improvements	52
Shellfish Aquaculture	52
Fisheries Management	38
Education/Awareness	6
Other	8

Build Habitat (25) Recycle Shell for Habitat (11) Habitat Enhancement **Increase Funding** Siting of Reefs (4) Living Shorelines Management (3)





www.nccoast.org www.ncoysters.org

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The North Carolina Living Shoreline Strategy



Dr. Rachel K. Gittman East Carolina University

Oyster Restoration Toolbox: Living Shorelines

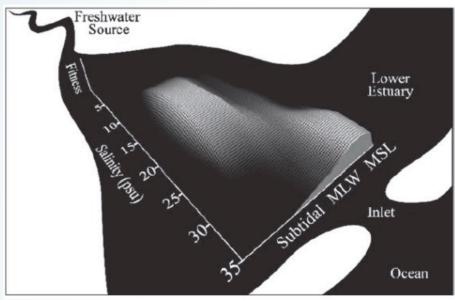


Photo credit: R. Gittman

- Living shorelines can be viable method for oyster restoration, if designed and sited correctly
- Use of alternative substrates can reduce demand on cultch shell for restoration
- Co-benefits of shore protection and sediment stabilization can increase public and private support for oyster restoration

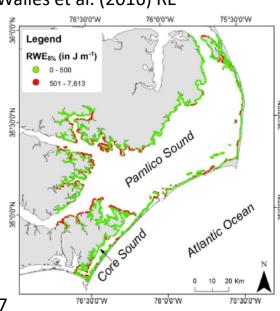


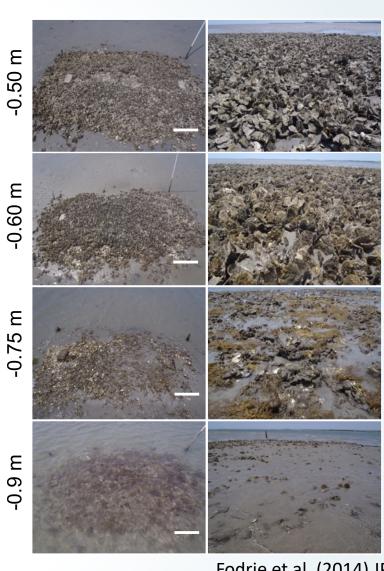
Intertidal Oyster Restoration: What We Know

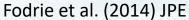


Baggett et al. (2015) & Walles et al. (2016) RE

- Larval supply
- Salinity
- Depth
- Wave exposure









Theuekauf et al. (EC) 2017

Oyster Recruitment and Growth on Living Shoreline Substrates







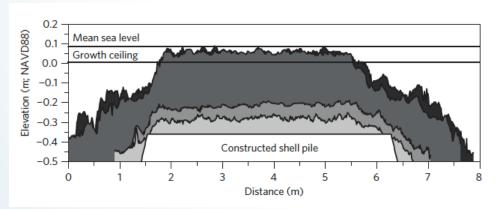


Photo credits: R. Gittman



Ecosystem Services Supported by Living Shorelines

- Wave attenuation
- Sediment stabilization
- Habitat provisioning
- Water quality improvements
- Carbon sequestration
- Resilience to climate change?



Rodriguez et al. (2014) NCC













Living Shoreline Strategy

Accomplishments and Lessons Learned

April 29, 2020 Tracy Skrabal Coastal Scientist and Southeast Regional Manager

North Carolina Living Shorelines



Accomplishments

- ✓ Increased #s of living shoreline projects
- ✓ Increased # of trained professionals
- ✓ Improved regulatory process
- ✓ Increased scientific literature
- ✓ Increased state/national promotion
- ✓ Increased grant funding





Lessons Learned

- Permits equity matters
- Proper designs are site specific, but follow sound design principles
- Various materials are viable for LS project success
- Technical training critical to widescale adoption of LS measures
- Adaptive management improves design, success
- LS projects perform well in higher energy







Shoreline Stabilization Permitting

Categories:

- -General Permits (GPs): issued by DCM field staff and are streamlined major permits for routine projects (permit issuance averages 5-14 days)
- -Major permits: reviewed by 10 state & 4 federal agencies and are issued at the Division headquarters (permit issuance averages 75-90 days)
- -Minor permits/Exemptions: Special circumstances such as maintenance/post- storm repairs, etc.

Credit: N.C. Division of Coastal Management



Living Shorelines General Permits

SECTION .2700 - GENERAL PERMIT FOR THE CONSTRUCTION OF RIPRAP SILLS FOR WETLAND ENHANCEMENT IN ESTUARINE AND PUBLIC TRUST WATERS

15A NCAC 7H .2701 PURPOSE

A general permit pursuant to this Section shall allow for the construction of riprap sills for wetland enhancement in estuarine and public trust waters as set out in Subchapter 7J.1100 and according to the rules in this Section.

History Note: Authority G.S. 113A-107; 113A-118.1; Temporary Eff. June 15, 2004;

Eff. April 1, 2005.

15A NCAC 07H .2702 APPROVAL PROCEDURES

(a) An applicant for a General Permit under this Subchapter shall contact the Division of Coastal Management and request approval for development. The applicant shall provide information on site location, dimensions of the project area, and applicant name and address.

(b) The applicant shall provide:

- confirmation that a written statement has been obtained signed by the adjacent riparian property owners indicating that they have no objections to the proposed work; or
- (2) confirmation that the adjacent riparian property owners have been notified by certified mail of the proposed work. The notice shall instruct adjacent property owners to provide any comments on the proposed development in writing for consideration by permitting officials to the Division of Coastal

SECTION .2400 – GENERAL PERMIT FOR PLACEMENT OF RIPRAP REVETMENTS FOR WETLAND PROTECTION IN ESTUARINE AND PUBLIC TRUST WATERS

15A NCAC 07H .2401 PURPOSE

The general permit for placement of riprap revetments for wetland protection in estuarine and public trust waters shall allow the placement of riprap revetments immediately adjacent to and waterward of the wetland toe. This permit shall only be applicable in public trust areas and estuarine waters according to authority provided in 15A NCAC 07J.1100 and according to the rules in this Section. This permit shall not apply to occanfront shorelines or to waters and shorelines adjacent to the Ocean Hazard AEC with the exception of those portions of shoreline that feature characteristics of Estuarine Shorelines. Such features include the presence of wetland vegetation, lower wave energy, and lower erosion rates than in the adjoining Ocean Erodible Area.

History Note: Authority G.S. 113A-107; 113A-118.1;

Eff. August 1, 2000;

Amended Eff. February 1, 2009; April 1, 2003.

15A NCAC 07H .2402 APPROVAL PROCEDURES

(a) An applicant for a General Permit under this Subchapter shall contact the Division of Coastal Management and request approval for development. The applicant shall provide information on site location, dimensions of the project area, and the

(c) DCM staff sha proposed project, if

SECTION .2100 - GENERAL PERMIT FOR CONSTRUCTION OF SHEETPILE SILL FOR SHORELINE PROTECTION IN ESTUARINE AND PUBLIC TRUST WATERS AND OCEAN HAZARD AREAS

t riparian property owners

rtified mail of the proposed omments on the proposed on of Coastal Management shall be interpreted as no

15A NCAC 07H .2101 PURPOSE

A general permit pursuant to this Section shall allow the construction of offshore parallel sheetpile sills, constructed from timber, vinyl, or steel sheetpiles for shoreline protection in conjunction with existing or created coastal wetlands. This permit shall only be applicable in public trust areas and estuarine waters according to authority provided in 15A NCAC 07J .1100 and according to the procedures and conditions outlined in this subchapter. This permit shall not apply to oceanfront shorelines or to waters and shorelines adjacent to the Ocean Hazard AEC with the exception of those shorelines that feature characteristics of Estuarine Shorelines. Such features include the presence of wetland vegetation, lower wave energy, and lower erosion rates than in adjoining Ocean Erodible Area.

History Note: Authority G.S. 113A-107; 113A-118.1;

Eff. June 1, 1994;

Amended Eff. February 1, 2009; April 1, 2003; August 1, 2000.

15A NCAC 07H .2102 APPROVAL PROCEDURES

(a) An applicant for a General Permit under this Subchapter shall contact the Division of Coastal Management and request



Federal Permit 2019- 2024 RGP for Marsh Sills

DEPARTMENT OF THE ARMY Wilmington District, Corps of Engineers 69 Darlington Avenue

Wilmington, North Carolina 28403-1343

http://www.saw.usace.army.mil/Missions/RegulatoryPermitProgram.aspx

General Permit No. 201801536
Name of Permittee: General Public
Effective Date: March 22, 2019
Expiration Date: March 21, 2024

DEPARTMENT OF THE ARMY GENERAL (REGIONAL) PERMIT

A general permit to perform work in or affecting navigable waters of the United States and waters of the United States, upon recommendation of the Chief of Engineers, pursuant to Section 10 of the Rivers and Harbors Act of March 3, 1899 (33 U.S.C. 403), and Section 404 of the Clean Water Act (33 U.S.C. 1344), is hereby issued by authority of the Secretary of the Army by the

District Engineer U.S. Army Engineer District, Wilmington Corps of Engineers 69 Darlington Avenue Wilmington, North Carolina 28403-1343

TO MAINTAIN, REPAIR AND CONSTRUCT MARSH SILLS FOR SHORELINE STABILIZATION ALONG ERODING SHORELINES IN NAVIGABLE WATERS AND WATERS OF THE UNITED STATES WITHIN THE 20 COASTAL COUNTIES IN THE STATE OF NORTH CAROLINA.

The following definitions should be used for purposes of this regional general permit (RGP):

a. <u>Marsh Sill</u>: Marsh sills are low-profile structures that are generally constructed parallel to shorelines with the objective of reducing wave action and providing protection for existing coastal marshes and shorelines. Marsh sills can maintain the natural continuity of the land-water interface and retain or enhance shoreline ecological processes.



CAMA General Permit (.2700) for Living Shorelines

- Limited to 30' past normal high water or 5' past existing wetlands, whichever is greater
- Cannot exceed 1' above normal high water
- Slope cannot exceed 1.5' horizontal distance over a 1' vertical rise
- Max length 500' with a 5' openings every 100', max base width of 12'
- Must be marked for navigational purposes
- Cannot construct over existing SAV or oyster beds
- No associated backfill



Wetland Riprap Revetment Erosion Escarpment Marsh Normal High Water Filter Cloth Normal Low Water Sill VIEW FROM SIDE Marsh Planting Appropriate Normal Low Water Sill Material Fill Material Normal High Water Erosion Escarpment

General Permits for Oyster Projects

Riprap revetment for Wetland Protection GP (.2400)

Riprap Sill for Wetland Enhancement GP (.2700) –

AKA Living Shoreline GP



Oyster Shell Patch Reefs/ Sills









Rip-Rap (Marsh Toe) Revetments With Oysters/Stone



Living Shorelines By the Numbers

	Major Permits (Living Shorelines)	GP .2400 (Marsh Toe Revetment)	GP .2700 (SILL)
2018	10	5	
2019	4	19	11
2020	2	1 (Jan-Feb)	4 (Jan-Feb)

Credit: N.C. Division of Coastal Management



General Permit for Living Shorelines

Where Do I Submit My Application?

Contact the DCM district office that serves your area with the requested information. A list of district offices is available on DCM's Web site located at the following link:

http://deq.nc.gov/about/divisions/coastal-management/about-coastal-management/staff-listing.

GP application

- ✓ Drawing
- ✓ Adjacent Neighbor notifications
- ✓ Permit fee (\$200)



SAMPLE SITE PLAN: Oyster Shell Bag Marsh Sill

Applicant: Address:

Work Plat Drawing 1 of 2: Design - Plan View

Date:

The location of the proposed oyster shell bag marsh sill is shown (yellow line). The structure will span approximately ___ linear feet of shoreline with a 5 ft. gap every 100 ft. to allow water circulation and fish passage.



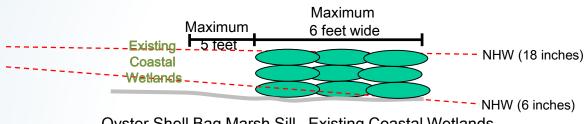
SAMPLE PLAN: Oyster Shell Bag Marsh Sill

Applicant: Address:

Work Plat Drawing 2 of 2: Design - Cross-Section View

Date:

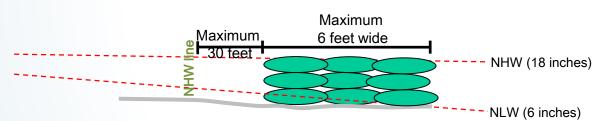
The oyster shell bag marsh sill will consist of layers of oyster shell bags placed parallel to the shoreline no higher than 12 inches above normal high water (NHW) or the elevation of the existing marsh substrate, whichever is higher. The landward edge of the marsh sill will be constructed no more than 30 feet waterward of NHW or five feet waterward of existing coastal wetlands, whichever distance is greater. The width of the sill will extend no more than 6 feet. Each oyster shell bag is approximately 2 feet long, 6 inches wide and 6 inches high.



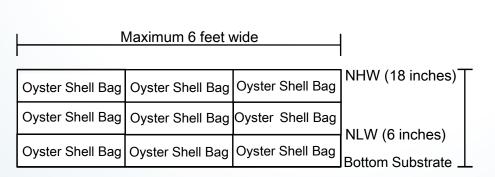
Oyster Shell Bag Marsh Sill –Existing Coastal Wetlands



Example of Oyster Shell Bag Marsh Sill – Existing Coastal Wetlands



Oyster Shell Bag Marsh Sill – 30 Feet Waterward of NHW





Example of Oyster Shell Bag Marsh Sill – 30 Feet Waterward of NHW





Living Shoreline Strategy

Draft Actions and Benchmarks for the 2021-2025 Oyster Blueprint Update

April 29, 2020 Lexia M. Weaver, Ph.D. Coastal Scientist and Central Regional Manager

Living Shoreline Strategy Committee Members

- Jacob Boyd, N.C. DMF
- Bill Cary, Brooke Pierce
- Carolyn Currin, NOAA
- Jenny Davis, NOAA
- Anne Deaton, N.C. DMF
- Rebecca Ellin, N.C. NERR
- Devon Eulie, UNCW
- Erin Fleckenstein, NC Coastal Federation
- Rachel Gittman, ECU
- Niels Lindquist, UNC-IMS, Sandbar Oyster Company
- Todd Miller, NC Coastal Federation

- Trish Murphey, APNEP
- Martin Posey, UNCW
- Brandon Puckett, N.C. NERR
- Tony Rodriguez, UNC-IMS
- Brian Silliman, DUML
- Carter Smith, DUML
- Seth Theuerkauf, TNC
- Leslie Vegas, NC Coastal Federation
- Lexia Weaver, NC Coastal Federation
- Curt Weychert, N.C. DMF
- Ted Wilgis, NC Coastal Federation

Living Shoreline Strategy Overarching Goal

 Expand the use of living shorelines to become the most commonly used stabilization method in estuaries that support oyster habitats.







Action 1: Collaborate through the Living Shoreline Steering Committee

- Identify and bring together the multiple efforts focused on promoting the use of living shorelines.
- Provide the leadership necessary to reach the goal for living shorelines within this blueprint.





Action 2: Implement living shorelines to continue to demonstrate their benefits to oysters and soundfront property owners.

- Build at least three miles of living shorelines on public and private lands where oysters grow by 2025.
- Continue to site and design living shorelines based on research to date and lessons learned from decades of intertidal oyster restoration in North Carolina and elsewhere to promote oyster growth and development, as well as support other ecosystem functions and services.
- Devise and implement a communication and education strategy around each project to publicize benefits to gain more public and agency demand for these projects.
- Engage volunteers and contractors in building living shorelines to help increase public awareness of their benefits.
- Document the success of living shoreline projects each year (new and old) including their oyster recruitment potential, cost-benefits and resilience compared to other types of shoreline stabilization.

Action 3: Increase the use of living shorelines instead of bulkheads.

- Quantify the extent of living shorelines implemented to date that also serve as oyster habitat.
- Increase the percentage of living shorelines permitted for shoreline stabilization along shorelines that support oyster growth by 15 percent a year. The more living shorelines, the more oysters in the water.
- Track the number and type of shoreline stabilization projects authorized each year.
- Educate marine contractors, engineers, consultants and regulators through technical trainings to encourage the use of living shorelines. Conduct three regional 2-day trainings for marine contractors, consultants, engineers, agency staff, beginning in Wilmington in February 2021.
- Conduct living shoreline consultations with five marine contractors per year.





Action 4: Create and promote consumer demand for living shorelines by property owners with a special focus on shorelines that support oyster growth.

- Educate waterfront property owners, realtors, homeowners associations (Community Association Management Services), local governments and the general public on the value and benefits of living shorelines.
- Develop educational outreach materials (electronic and printed) to be distributed to these audiences.
- Conduct one on one living shoreline consultations with 50 waterfront property owners per year.
- Market the use of living shorelines by property managers and owners at three outreach events in three regions of the coast.



Action 5: Protect regulated and permitted living shorelines that grow harvestable oysters.

- Explore the protection of oyster shell bag and Oyster CatcherTM living shorelines in the next update to the N.C. Coastal Habitat Protection Plan (CHPP).
- Experiment with the use of stronger bags or other sill materials that would not be damaged if oysters are harvested from them.











Action 6: Test alternative living shoreline construction materials and methods that increase oyster recruitment.

- Test non-plastic, alternative materials for living shoreline construction at five demonstration project sites.
- Monitor and report the performance of alternative materials.











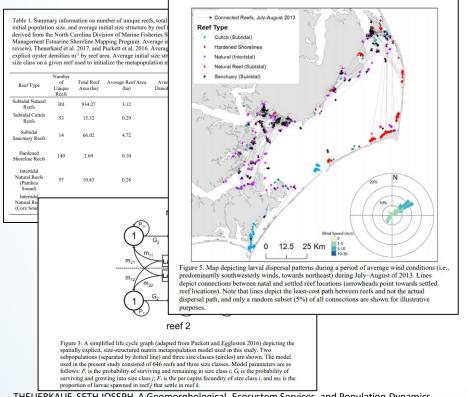






Action 7: Summarize living shoreline research accomplishments and major findings to date related to oysters.

 Provide information on how to site and design living shorelines to promote oysters based on research to date.



Article | Open Access | Published: 07 October 2015

Maximizing oyster-reef growth supports green infrastructure with accelerating sea-level rise

Justin T. Ridge, Antonio B. Rodriguez, F. Joel Fodrie, Niels L. Lindquist, Michelle C. Brodeur, Sara E. Coleman, Jonathan H. Grabowski & Ethan J. Theuerkauf

Scientific Reports 5, Article number: 14785 (2015) | Cite this article

The Potential for Created Oyster Shell Reefs as a Sustainable Shoreline Protection Strategy in Louisiana

August 2005 - Restoration Ecology, 13(3):499 - 506

DOI: 10.1111/j.1526-100X.2005.00062.x

Bryan P. Piazza . Patrick D. Banks . Megan K. La Peyre

ublished: 29 August 2016

Wave Exposure Structures Oyster Distribution on Natural Intertidal Reefs, But Not on Hardened Shorelines

<u>Seth J. Theuerkauf</u> [™], <u>David B. Eggleston</u>, <u>Brandon J. Puckett</u> & <u>Kathrynlynn W. Theuerkauf</u>

Estuaries and Coasts 40, 376–386(2017) | Cite this article

Oyster Density and Demographic Rates on Natural Intertidal Reefs and Hardened Shoreline Structures

Seth J. Theuerkauf, David B. Eggleston. Kathrynlynn W. Theuerkauf. Brandon J. Puckett

Author Affiliations +

J. of Shellfish Research, 36(1):87-100 (2017). https://doi.org/10.2983/035.036.0111



PUBLISHED ONLINE: 28 APRIL 2014 | DOI: 10.1038/NCLIMATE2216

Oyster reefs can outpace sea-level rise

Antonio B. Rodriguez^{1*}, F. Joel Fodrie¹, Justin T. Ridge¹, Niels L. Lindquist¹, Ethan J. Theuerkauf¹, Sara E. Coleman¹, Jonathan H. Grabowski², Michelle C. Brodeur¹, Rachel K. Gittman¹, Danielle A. Keller¹ and Matthew D. Kenworthy¹



THEUERKAUF, SETH JOSEPH. A Geomorphological, Ecosystem Services, and Population Dynamics Approach to Oyster Restoration and Management. (Under the direction of Dr. David Eggleston).

Action 8: Identify and answer living shoreline research questions and gaps as they pertain to oysters.

- Continue quantifying the role of living shorelines in supporting oyster populations.
- Document the degree to which living shorelines using oysters can adjust to sea level rise.
- Research the nutrient (nitrogen, phosphorus) reduction benefits provided by living shorelines and use that information to provide incentives for living shoreline projects if warranted.
- Determine why is oyster recruitment on living shoreline materials more abundant on the seaward edge of the sill. How can they be designed differently to increase oyster recruitment?
- On average, how many oysters per ft. can be generated from a living shoreline? On average, how much water can be filtered by oysters on a living shoreline per ft. or other unit?

Action 9: Qualify living shorelines for mitigation credits.

- Determine if living shoreline projects can be built to qualify for salt marsh (\$560,000 an acre value) or nutrient mitigation credits.
- Issue formal policy recommendations.
- Inform mitigation bankers about this opportunity.

tatewide Stream & Wetland ILF Program Rates for Standard Service Areas			
Service Area	Mitigation Type	DMS Rate Per Credit (Effective through 6/30/2020)	
Statewide Standard	Stream	\$525.65	
Statewide Standard	Freshwater Wetlands (Riparian and Non Riparian)	\$52,273.99	
Statewide Standard	Coastal Wetlands	\$560,000.00	











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Wrap up and Next Steps

Erin Fleckenstein, NC Coastal Federation

Process of Updating the Blueprint



Assessing

Blueprint Stakeholder Survey Strategy Workgroup Recommendations

Planning

- Public Review of Draft Plan
- Oyster Steering Committee Review
- Virtual Meeting Input
- Workgroup Recommendations



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