NORTH CAROLINA OYSTER BLUEPRINT

An Action Plan for Restoration and Protection



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

NORTH CAROLINA OYSTER BLUEPRINT
An Action Plan for Restoration and Protection

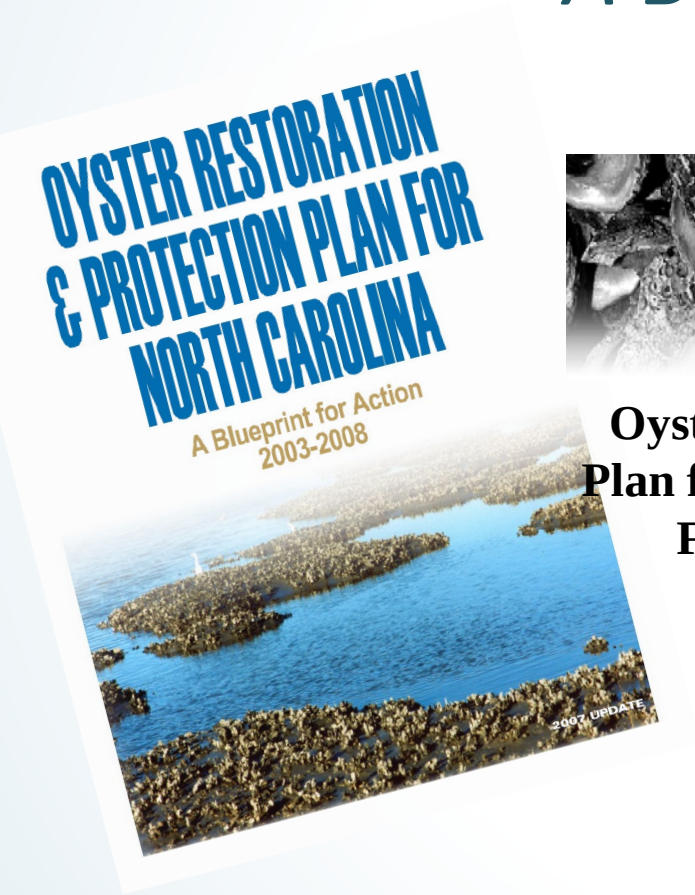
Oyster Restoration and Protection Plan for North Carolina: A Blueprint For Action

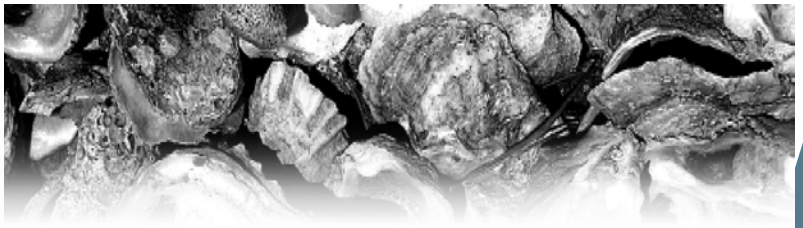
- 2003 Oyster Forum yielded compilation of suggested actions
- Incorporated recommendations from:
  - Blue Ribbon Advisory Council on Oysters
  - Fisheries Reform Act
  - Oyster Fishery Management Plan
  - Coastal Habitat Protection Plan
  - Basinwide Water Quality Plans
- Drafted into comprehensive,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

NORTH CAROLINA OYSTER BLUEPRINT
An Action Plan for Restoration and Protection

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

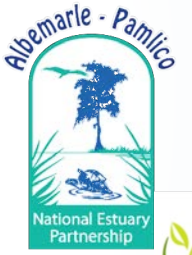
Three Editions

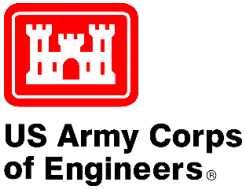




Oyster Restoration and Protection Plan for North Carolina: A Blueprint For Action - Second Edition 2008 – 2012

Partnerships and Collaborations are Key to Success

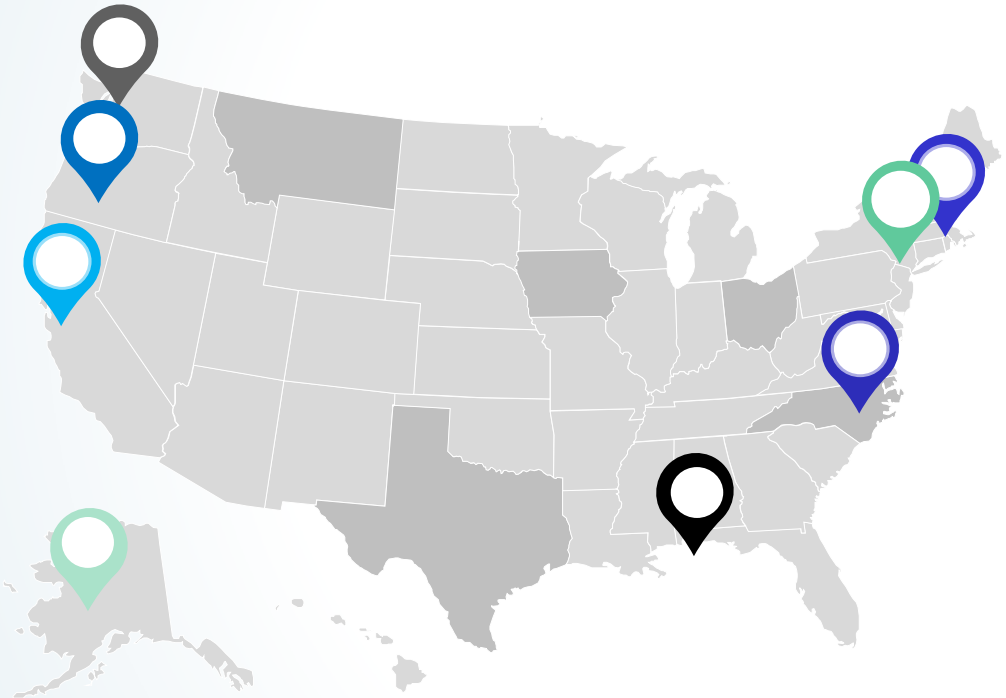




Major Accomplishments 2003-2013

- Government, private agencies and other shellfish stakeholders coordinated habitat, water quality and fisheries management activities.
- Funding for oyster related programs increased 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 were implemented along the coast.

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
- Seven new coastal watershed restoration plans written
- Researchers developed and refined tools to guide restoration, growing and enhancement efforts

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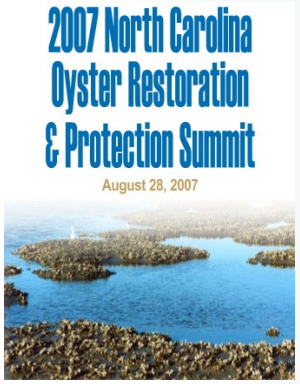
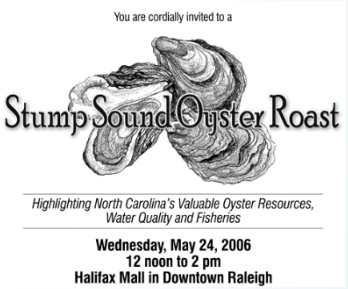
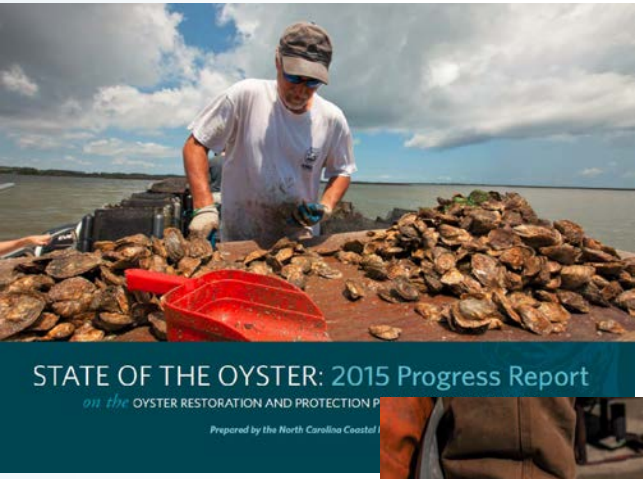
Blueprint Summits, Roasts & Forums

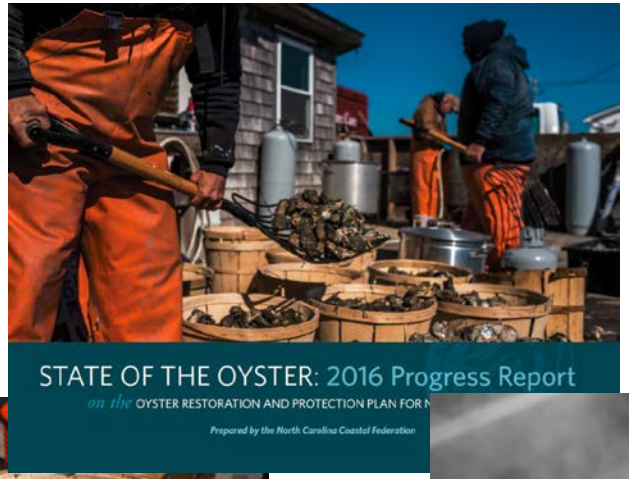
- 2003 Oyster Forum, Ocean
- 2004 Encore for Oysters Summit, Morehead City
- 2005 Oyster Summit & Legislative Reception, Raleigh
- 2006 Regional Public Oyster Forums, Wilmington, Beaufort & Manteo
- 2006 Legislative Oyster Roast, Raleigh
- 2007 Legislative Oyster Roast, Raleigh
- 2007 Oyster Summit, 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

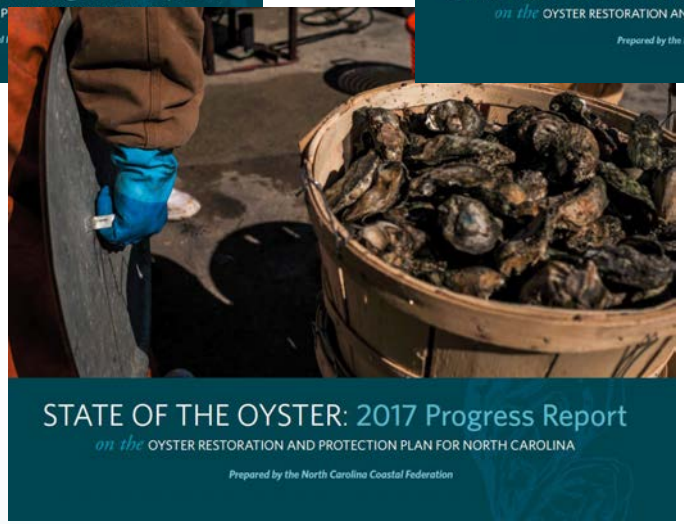


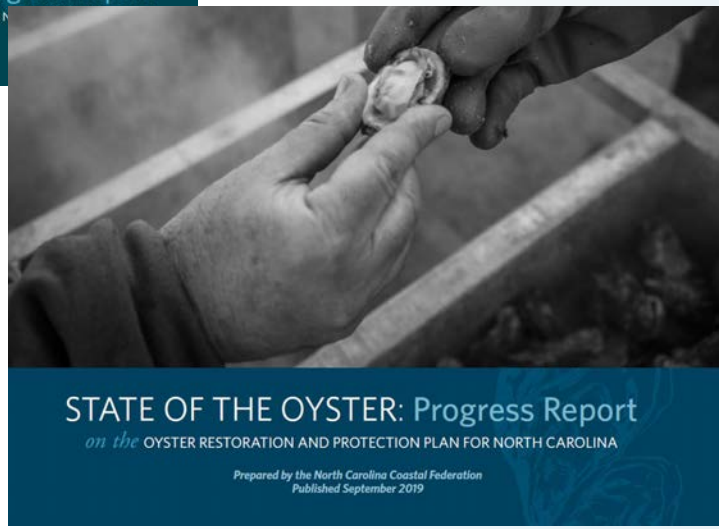


Annual State of the Oyster Report









NORTH CAROLINA OYSTER BLUEPRINT

An Action Plan for Restoration and Protection

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

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

NC OYSTERS

@NcOysters
@NorthCarolinaOysters
www.ncoysters.org

Blueprint Focus Areas

- Education and Outreach
- Research
- Fishery & Shellfish Aquaculture Development
- Oyster Habitat Protection & Restoration
- Water Quality Protection & Restoration
- Link to Ongoing Planning Efforts

North Carolina Oyster Shell Recycling

Freshness from North Carolina Waters

Living Shorelines

Education & Outreach

Oyster Sanctuaries

Wild Harvest

Cultch Planting

Shellfish Aquaculture

Protect Shellfish Waters

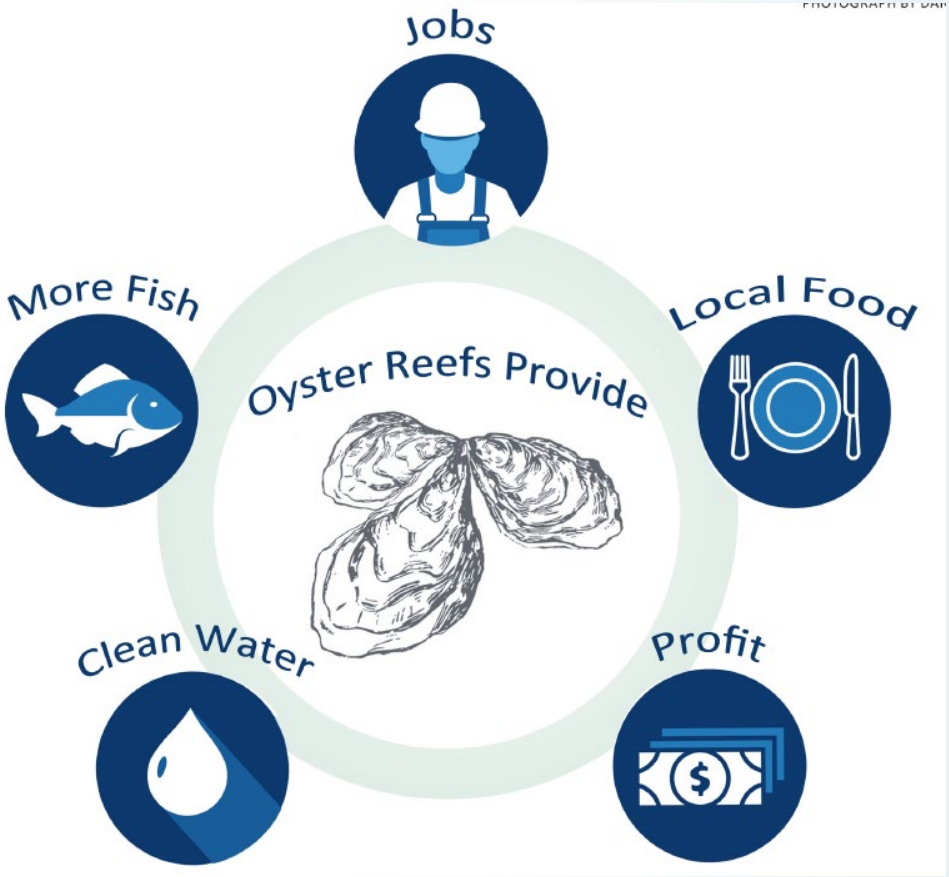
Vision for 4th Edition of the Oyster Blueprint

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

Ecosystem Services

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

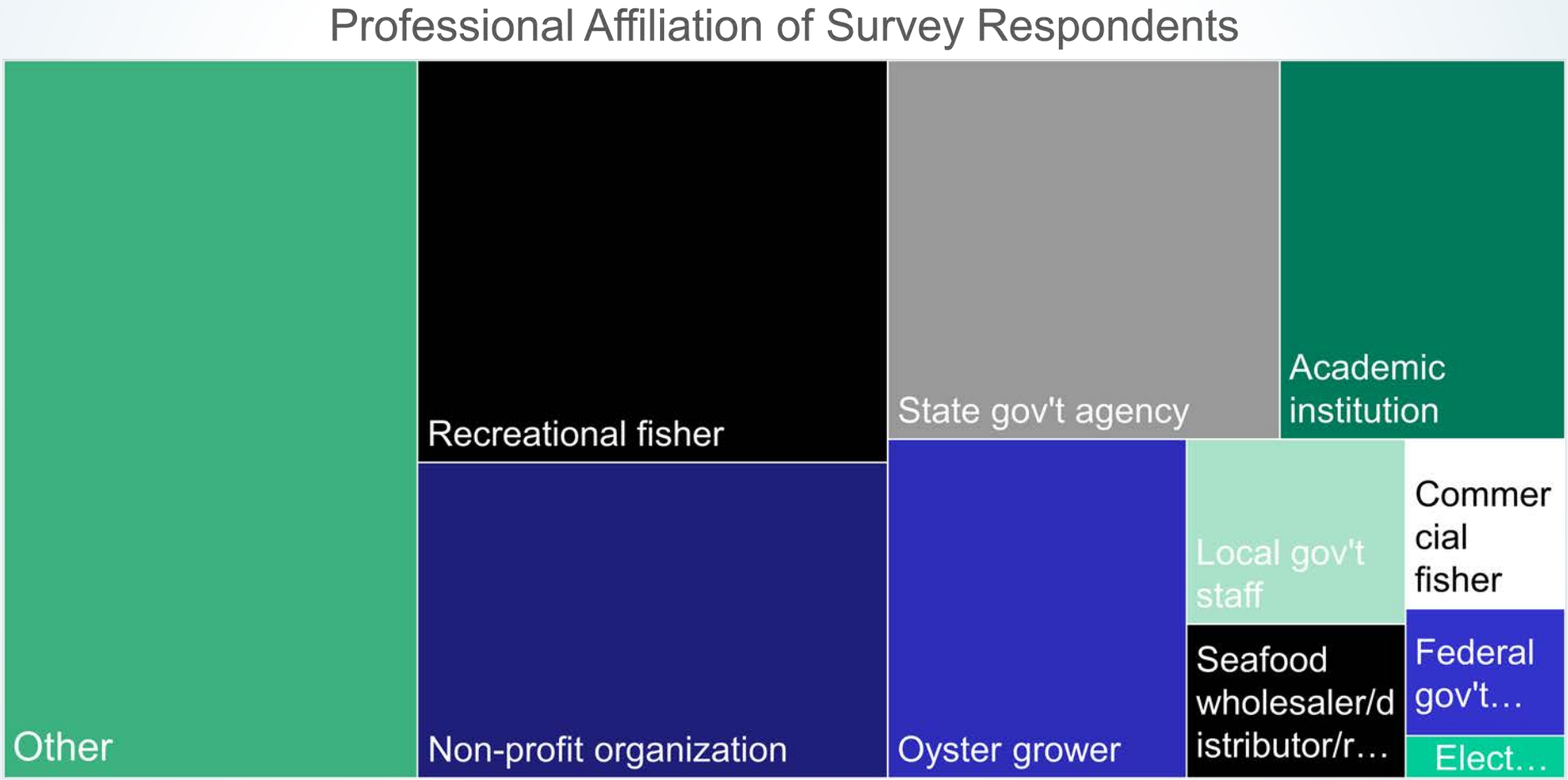
Setting goals based on Ecosystem Services.



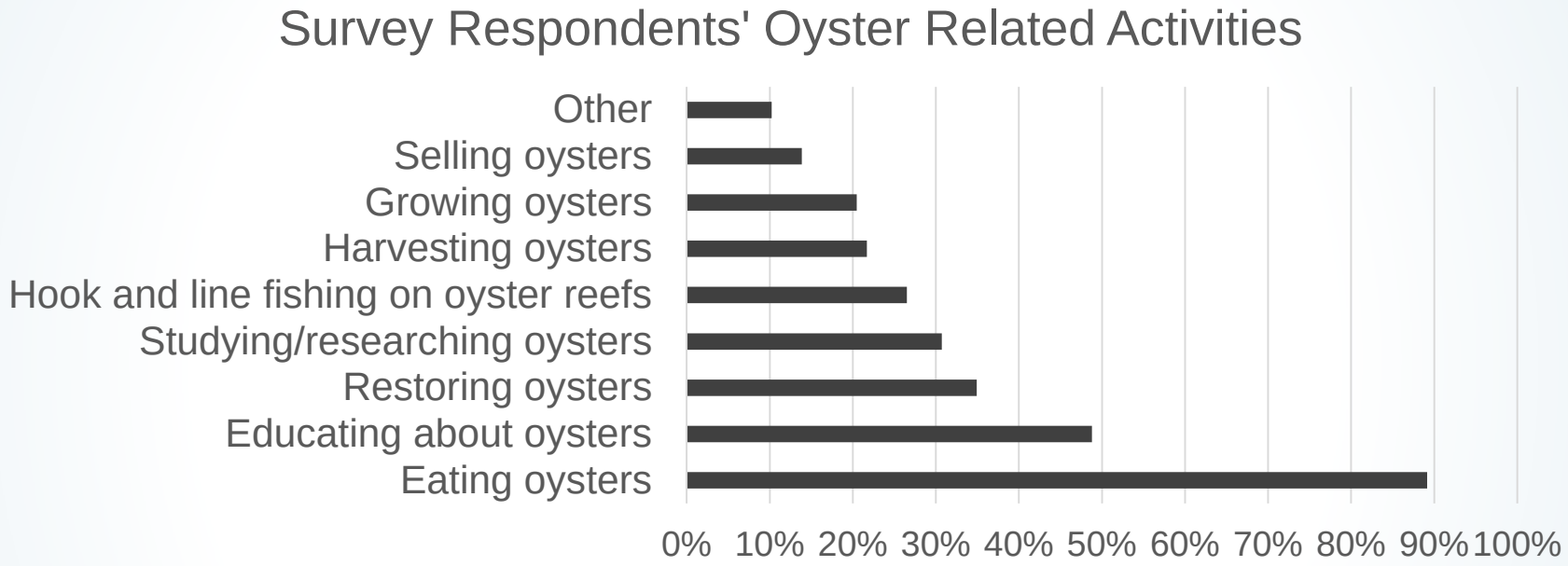
Stakeholder Survey

- Benefits
- Threats
- Actions

Results of Stakeholder Survey

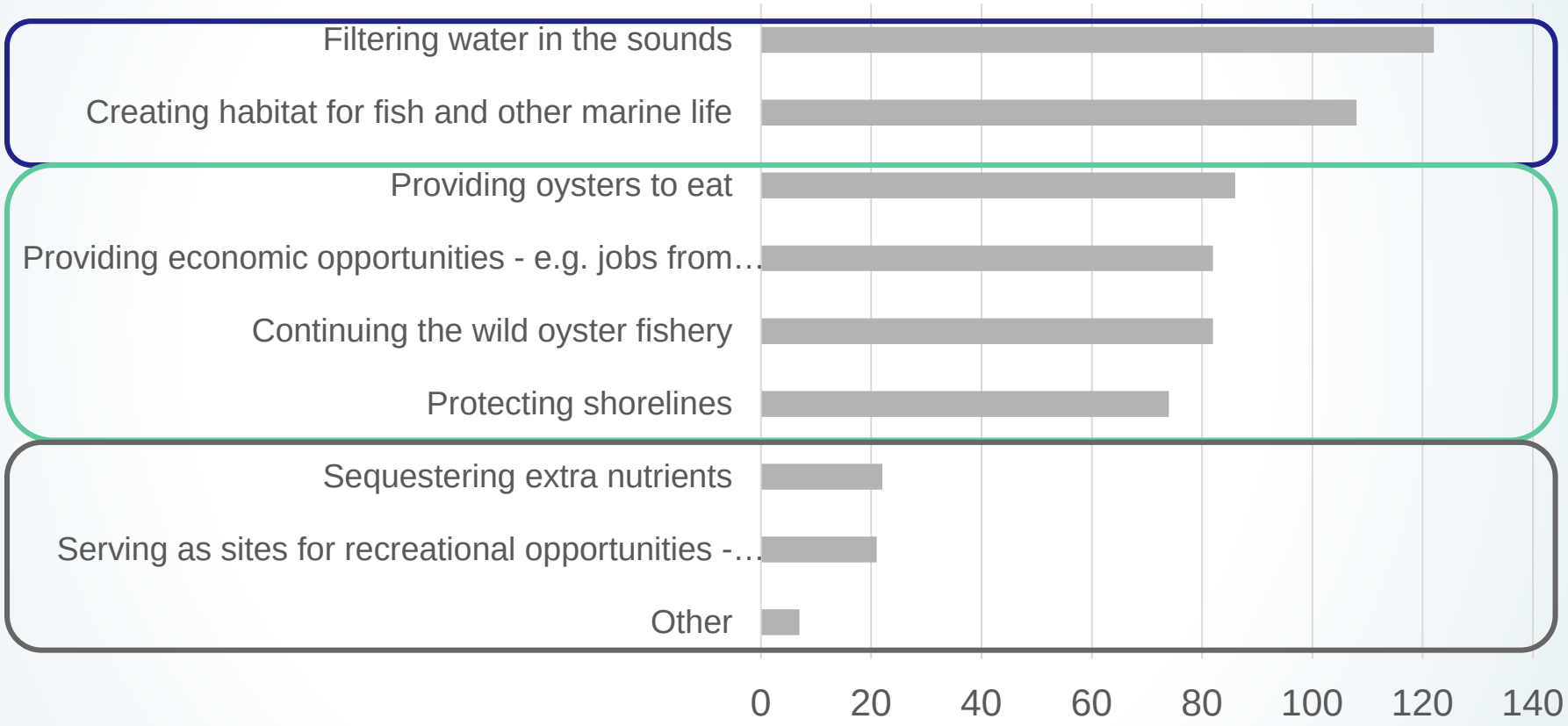


166 Respondents



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



Direct Threats to Oysters

Most to Least Concerning

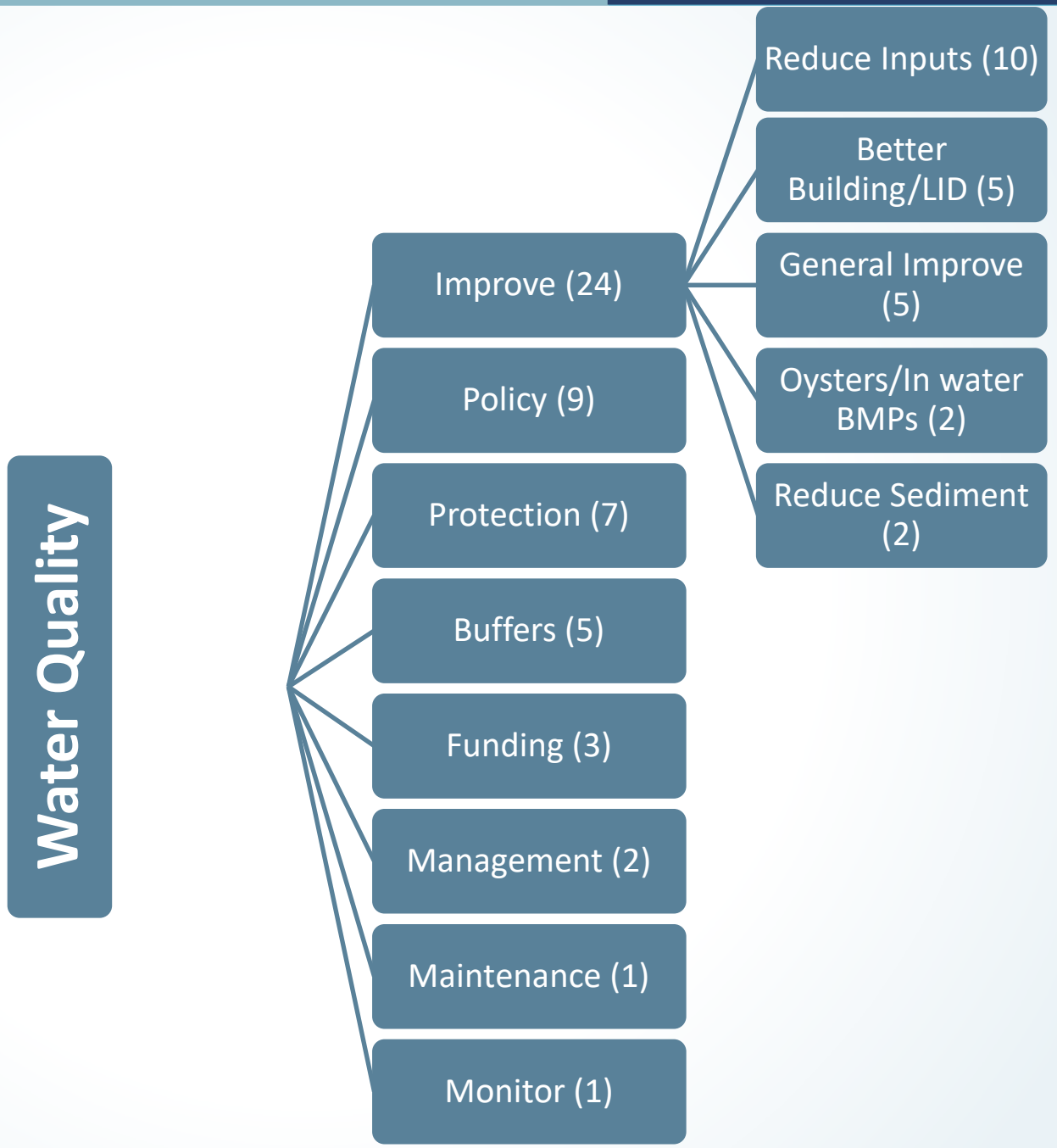
Physical Destruction to Reefs from Human Related Activities (other than harvest)
Overharvest of Resource
Siltation/Burying of Reefs
Incompatible Fishing Practices (e.g. dredging)
Low Dissolved Oxygen
Lack of Spawning due to Low Oyster Population
Shellfish Diseases
Salinity Changes (too high/too low)
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


Water Quality
Improve (24)
Policy (9)
Protection (7)
Buffers (5)
Funding (3)
Management (2)
Maintenance (1)
Monitor (1)
Reduce Inputs (10)
Better Building/LID (5)
General Improve (5)
Oysters/In water BMPs (2)
Reduce Sediment (2)

WATER QUALITY

North Carolina
Coastal Federation

Working Together for a Healthy Coast

www.nccoast.org

www.ncoysters.org

637 Harbor Road Wanchese, NC 27981

(252) 473 1607

erinf@nccoast.org

NC Oyster Blueprint - Water Quality Workshop

DEPARTMENT OF ENVIRONMENTAL QUALITY

Marine Fisheries

Shannon Jenkins | May 5, 2020

Water Quality

- Why is water quality important related to oysters?
  - Environment / Growth
  - Economy
  - Public Health

Department of Environmental Quality

Oysters

- Bivalve mollusks such as oysters, clams and mussels are filter feeders
- Can process up to 50 gallons of water per day, and can concentrate pathogens and toxins up to 100 times the ambient levels that are in the water
- Shellfish are commonly eaten alive and raw or undercooked
- ~70% of seafood related illnesses in the United States are tied to consumption of raw shellfish

Shellfish Growing Area Program

- Classify coastal waters for safe shellfish harvesting for human consumption

- Waters classified using Sanitary Surveys

- An evaluation of the environmental factors that affect water quality in shellfish growing areas:
  - Bacteriological water quality survey
  - Shoreline survey of pollution sources
  - Hydrographic survey (dye studies)
  - Meteorological survey
  - Sanitary Survey Report

Bacteriological Sampling

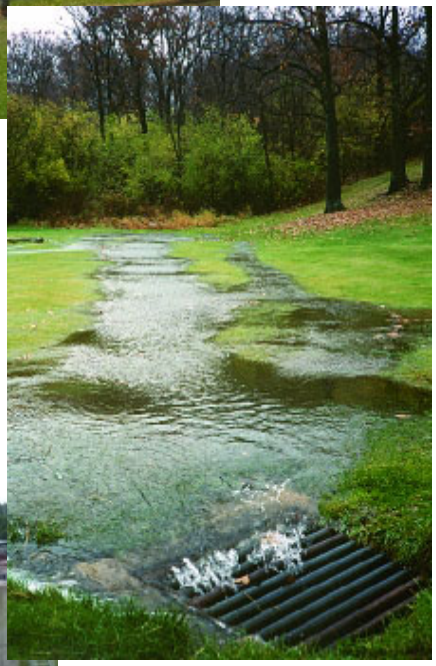
- 1,000 stations coast wide sampled randomly a minimum of six times per year
- All samples are planted, cultured, and analyzed using division laboratories
- Sample results used to classify shellfish growing areas and to reopen temporarily closed areas

Laboratory

- Morehead City and Wilmington
- U.S. Food and Drug Administration / State certified and inspected
- Fecal coliform indicator organism- Indicates potential presence of pathogens such as viruses, bacteria, protozoa that are harmful to humans
- Multiple tube fermentation method

Shoreline Surveys

- Evaluation of all existing or potential sources of pollution that can affect shellfish growing waters
- Staff evaluate wastewater treatment plants, onsite septic systems, marinas, stormwater conveyances, animals and other areas of concern
- Work with appropriate agencies such as the local Health Departments to resolve issues where possible



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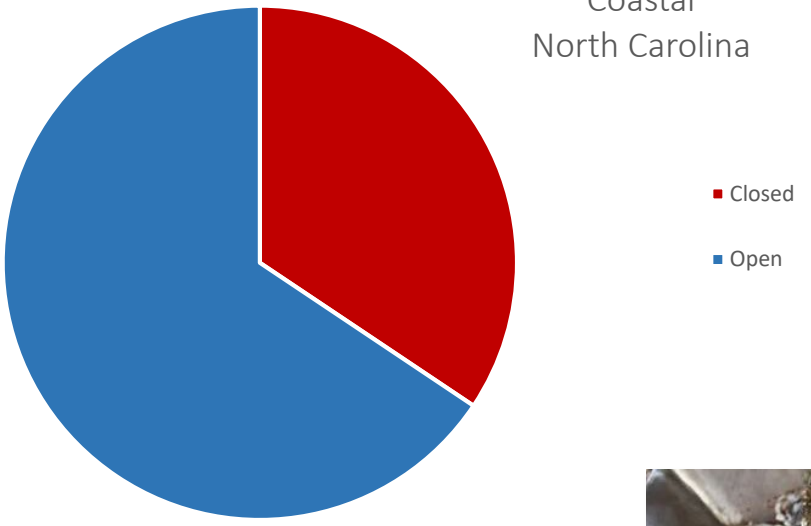
Meteorological Factors- Stormwater Runoff

- Can result in “Permanent” shellfish closures
- Rainfall elevates bacterial loading through runoff and results in temporary closures
- Temporary closures reopened with satisfactory water samples

Shellfish Classification - Status



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Shellfish Classification- Status and Trends (Acres)

Year	Open	Closed	Approved	Conditionally Approved Open	Conditionally Approved Closed	Restricted	Prohibited
3/30/2007	1777768	441250	1732069	45699	11775	NA	429475
1/1/2008	1777523	441478	1734339	43184	12793	NA	428685
1/15/2009	1777473	441527	1734192	43281	12788	NA	428739
9/9/2010	1777992	440966	1734938	43054	12552	NA	428414
5/25/2011	1777992	440966	1734938	43054	12552	NA	428414
1/13/2012	1777487	441543	1732888	44599	12708	NA	428835
3/18/2013	1777718	441365	1733069	44649	11834	NA	429531
2/5/2014	1777416	441623	1733155	44261	11827	NA	429796
2/4/2015*	1462222	756908	1418373	43849	11739	NA	745169
4/19/2016	1461745	757605	1416960	44785	12008	NA	745597
3/1/2017	1459134	759968	1414709	44425	12209	NA	747759
1/25/2018	1458551	760637	1414625	43926	12031	NA	748606
12/6/2018**	1458647	760552	1414525	44122	11859	18933	729761
3/15/2019	1458119	763510	1414971	43148	12836	20245	730429
10/3/2019	1458094	763531	1414877	43217	12721	20260	730550
2/17/2020	1459036	764587	1416179	42857	10138	18658	735791

*314,710 acres administratively closed on 2/4/15 due to budget cuts and office closures

**Added the "Restricted" classification to our set of classification types. Previously these waters were included in the Prohibited classification.

Total Change Closed 2007 to 2020:	+323337
Total Change Closed (Non-Admin):	**+8627**

Shellfish Classification- Status and Trends (Acres)

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5/25/2011	1777992	440966
1/13/2012	1777487	441543
3/18/2013	1777718	441365
2/5/2014	1777416	441623
2/4/2015*	1462222	756908
4/19/2016	1461745	757605
3/1/2017	1459134	759968
1/25/2018	1458551	760637
12/6/2018**	1458647	760552
3/15/2019	1458119	763510
10/3/2019	1458094	763531
2/17/2020	1459036	764587

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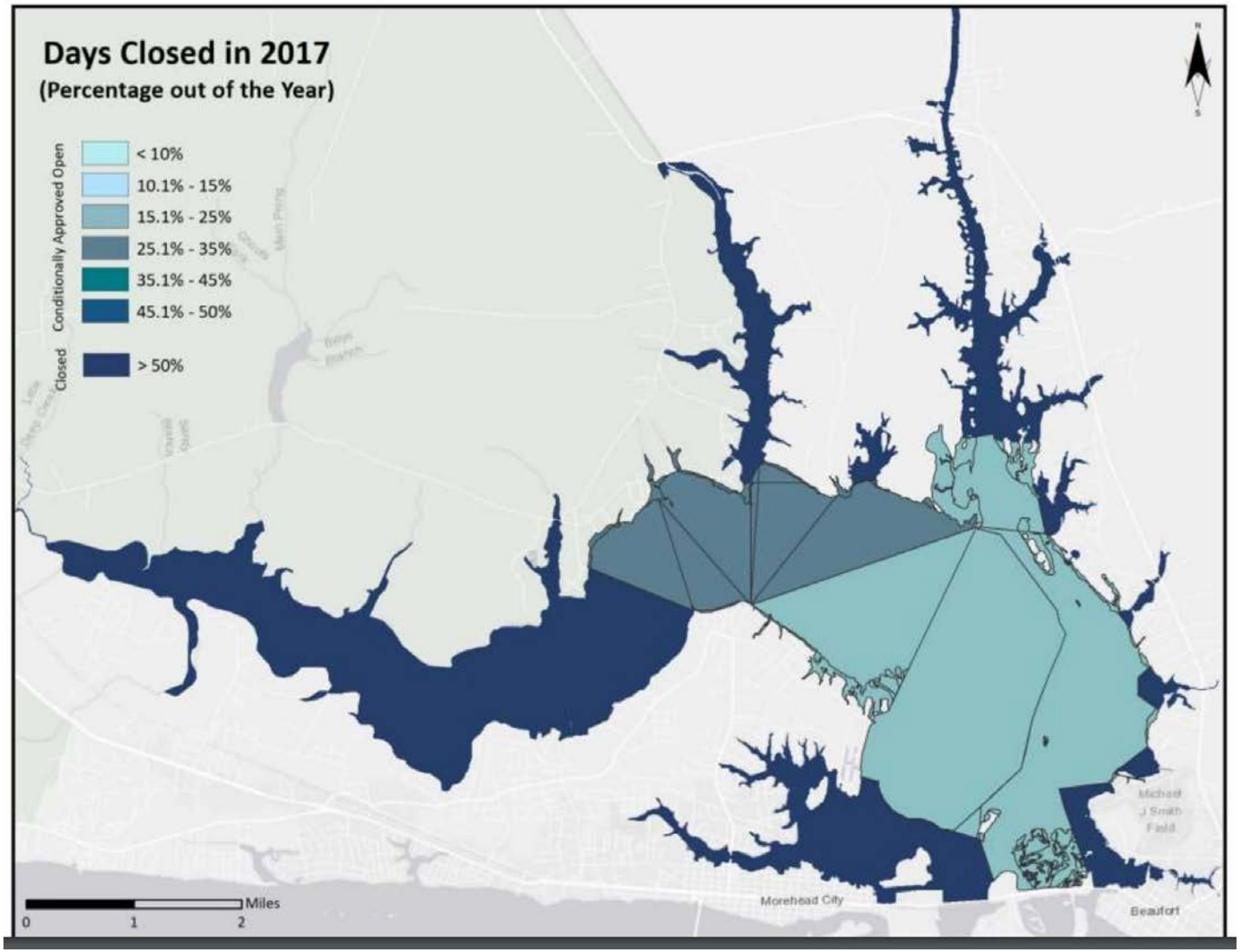
Temporary Closures

Temporary Closures



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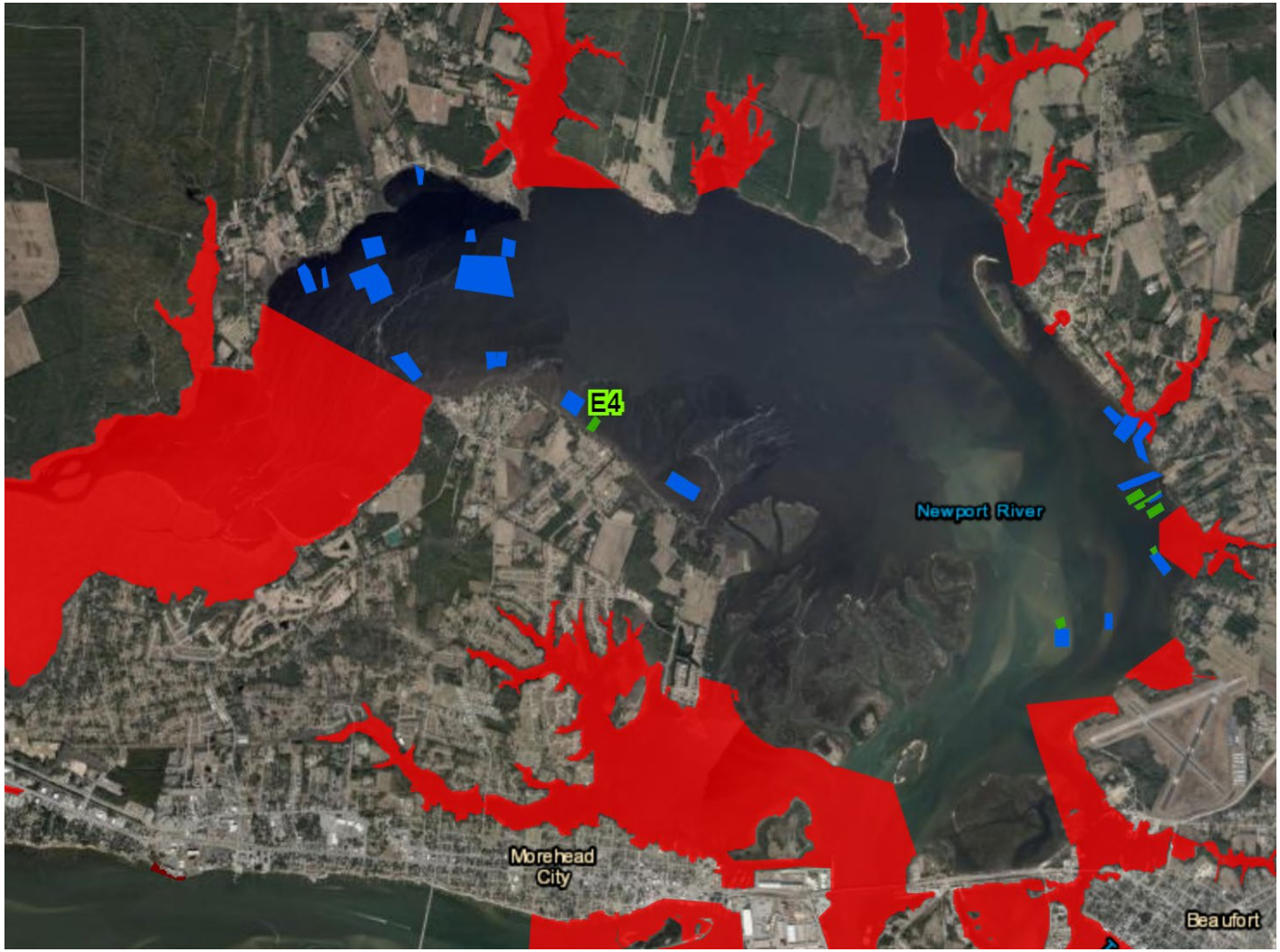
Temporary Closures – Wild Harvest & Aquaculture



Department of Environmental Quality

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Protecting and Restoring Water Quality in High Priority Shellfish Growing Areas:

Lessons Learned and Accomplishments

Todd Miller
North Carolina Coastal Federation

May 7, 2020

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An Action Plan for Restoration and Protection

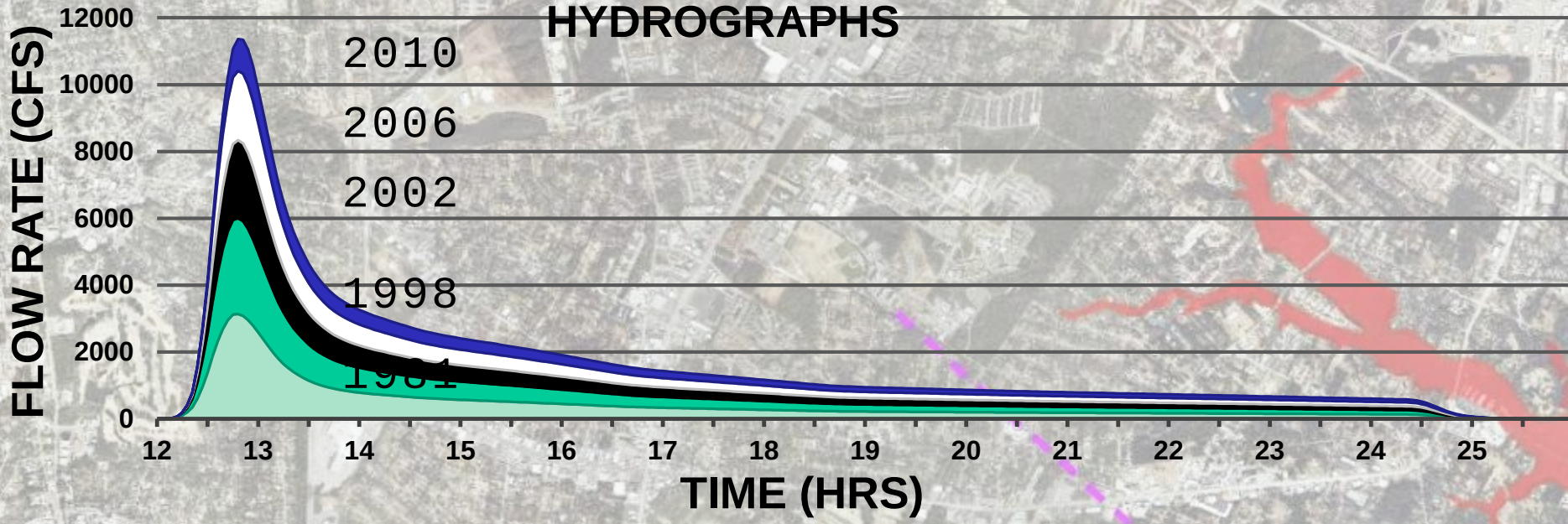
Protecting and Restoring Water Quality in Shellfish Growing Areas: Lessons Learned

- **Bacteria closes shellfish waters to harvest**
- **Bacteria is abundant in nature (it's everywhere and comes from wildlife as well as humans and pets)**
- **Hydrologic modifications to the landscape increase the volume and rate of runoff**
- **Increased volumes and rates of stormwater carry bacteria from the land to downstream surface waters**

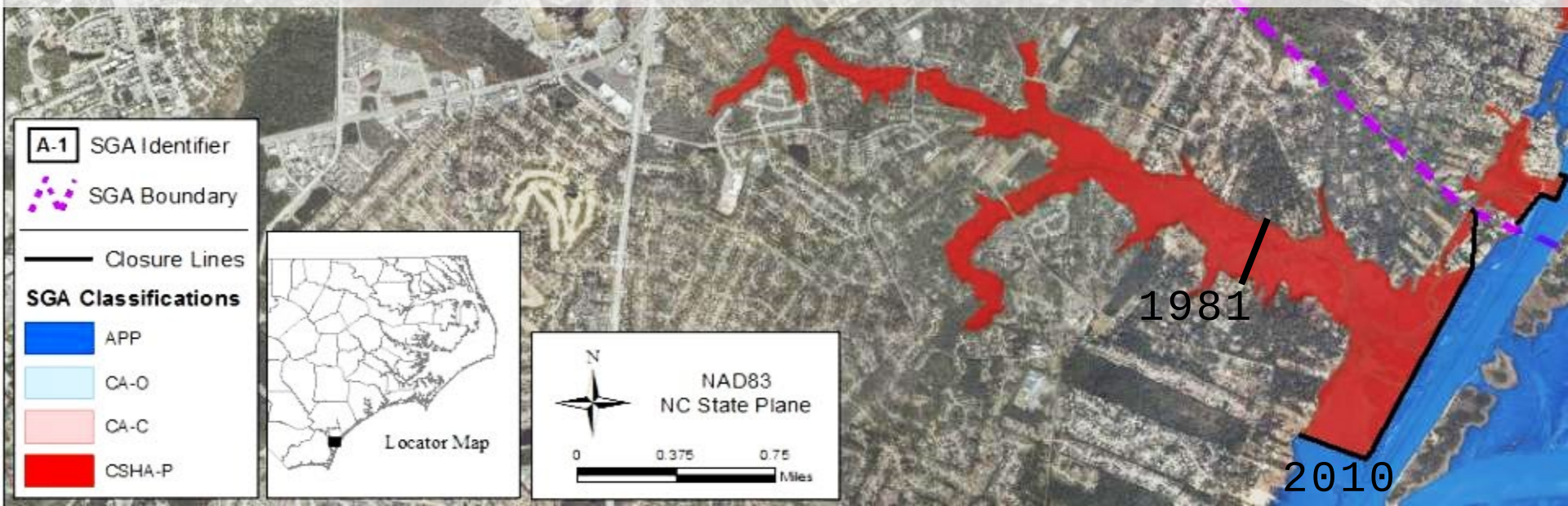
Protecting and Restoring Water Quality in Shellfish Growing Areas: Lessons Learned

- **Sources of runoff that transport bacteria that pollute shellfish growing waters are geographically close to growing areas**
- **Runoff is contaminated by bacteria after just short distances flowing over the landscape**
- **Attempts to control sources and treat bacteria are mostly futile when it comes to a large percentage of runoff in a watershed**
- **Intensity and frequency of storms magnifying problems**

HEWLETTS CREEK WATERSHED 1-YR STORM HYDROGRAPHS



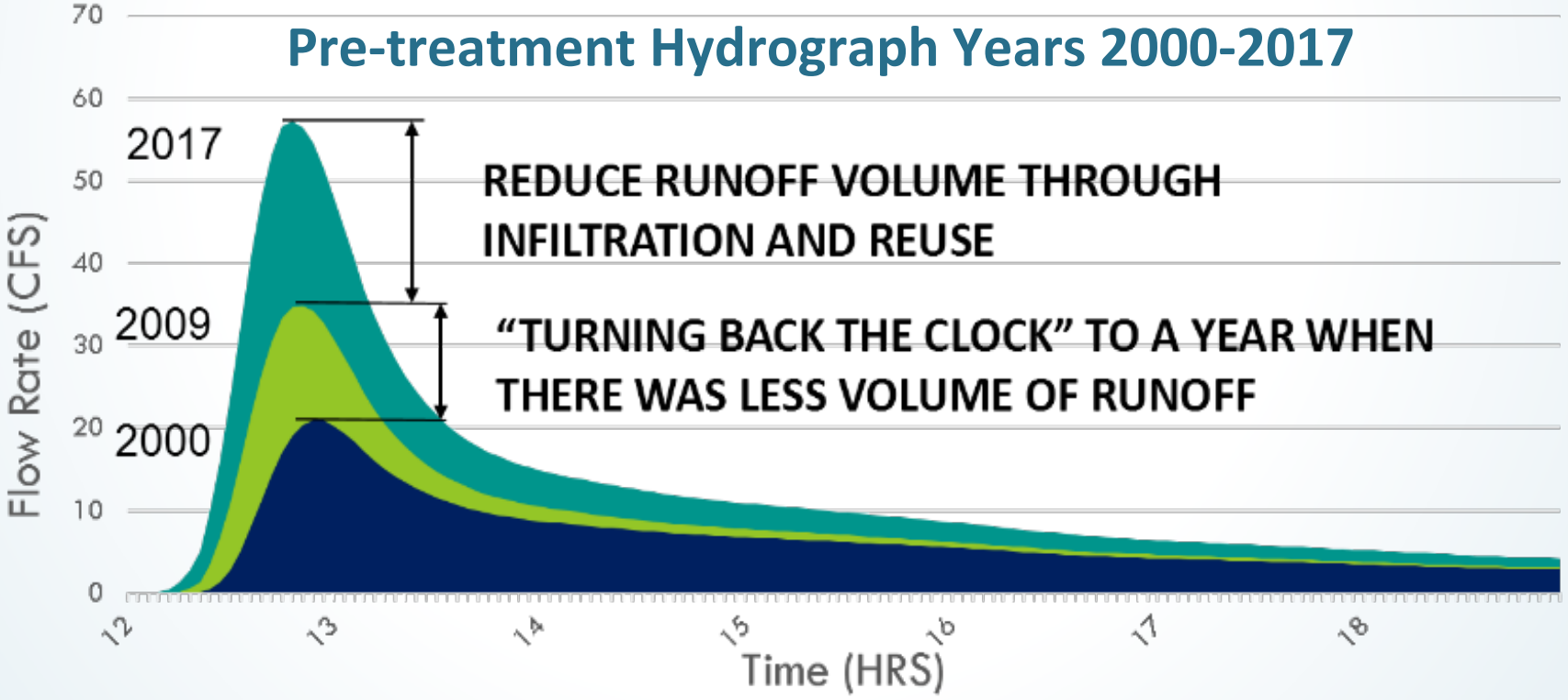
CHANGES IN SHELLFISH CLOSURE BOUNDARIES



Protecting and Restoring Water Quality in Shellfish Growing Areas

Watershed Strategy

Replicate natural hydrology by focusing on the watershed as a whole



Protecting and Restoring Water Quality in Shellfish Growing Areas: What's Been Accomplished

- **Some communities and landowners near growing areas are attempting to manage watersheds**
- **The toolbox of retrofit practices that mimic natural hydrology is growing more complete**
- **These practices have proven to provide multiple benefits in addition to water quality including reduce flooding and more resilient communities**

NORTH CAROLINA OYSTER BLUEPRINT
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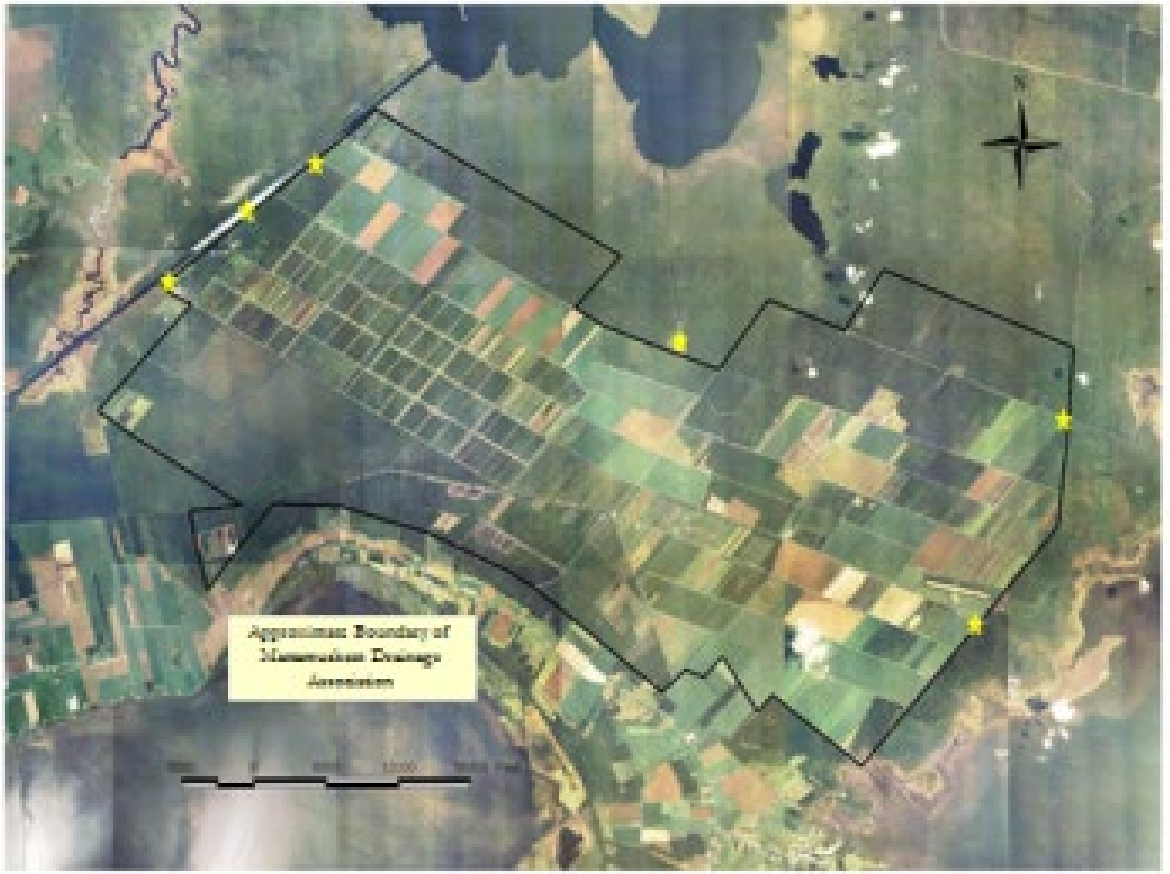
Protecting and Restoring Water Quality in Shellfish Growing Areas: What's Been Accomplished

Watershed Plans Completed and Approved:

- **Mattamuskeet Drainage Association**
- **Lake Mattamuskeet**
- **Beaufort**
- **Pine Knoll Shores**
- **Cedar Point**
- **Swansboro**
- **Bradley and Hewletts Creeks**
- **Lockwood's Folly**

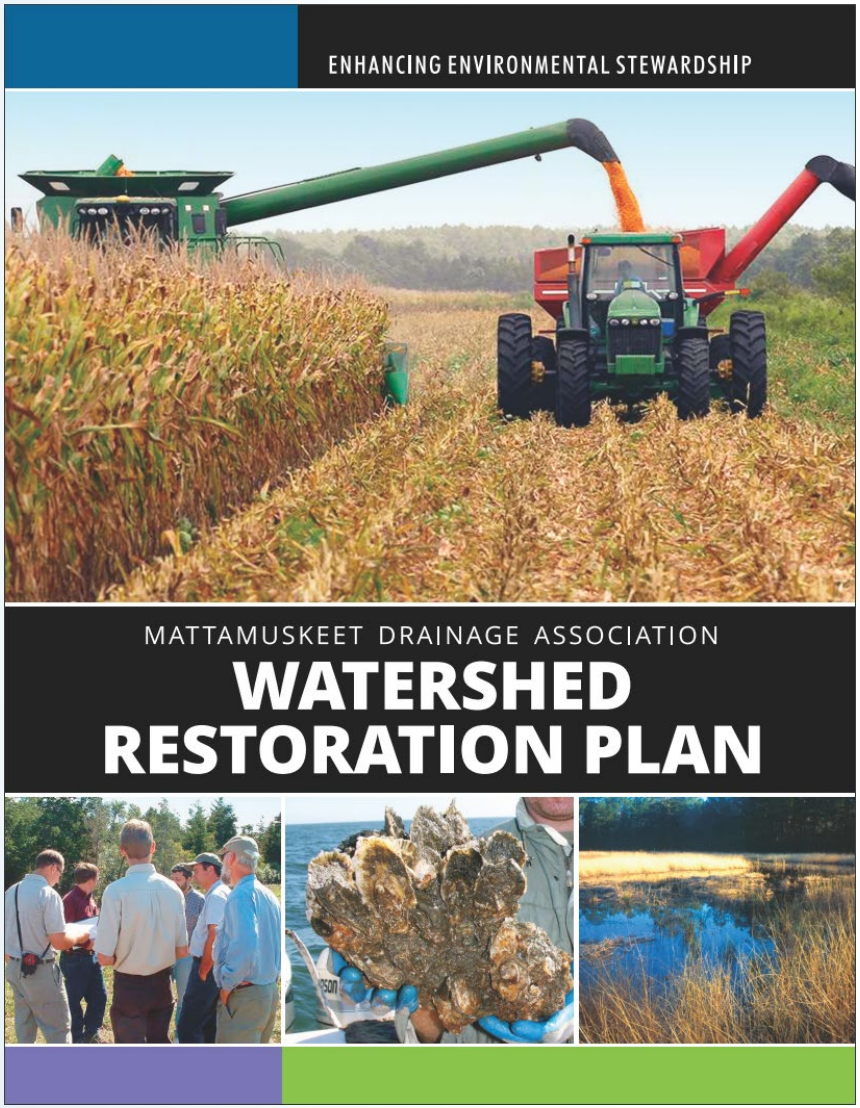
Snapshots of Nature-based Stormwater Strategies

Nature-based Stormwater Strategies for Working Lands



The 42,500-acre Mattamuskeet Drainage District (approximately 64 square miles) in Hyde County is one of the largest drainage districts in North Carolina. It has been the focus of wetland and hydrologic restoration efforts since 2003.

Nature-based Watershed Strategies for Priority Shellfish Growing Areas



- Developed a watershed restoration plan to evaluate cost-effective strategies to protect or replicate natural hydrology using new infrastructure, strategic land and easement purchases, restored wetlands, and other proven retrofit measures.
- Designed new drainage infrastructure to replicate natural movement and rates of runoff.
- Formulated set of consensus recommendations that advance needs of landowners, communities, government agencies and the environment.

Nature-based Watershed Strategies for Priority Shellfish Growing Areas – North River

Questions

Oyster Restoration and Protection Plan for North Carolina

Water Quality Recommendations for Inclusion in the 2021-2025 Update

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Oyster Restoration and Protection Plan for North Carolina

Water Quality Recommendations for Inclusion in the 2021-2025 Update

2020 Water Quality Committee Members

- Shannon Jenkins -Shellfish Sanitation - NC DMF
- Anne Deaton and Casey Knight – NC DMF
- Andy McDaniel - NC DOT
- Keith Walls - Falling Tide Oyster Co.
- James Hargrove - Middle Sound Mariculture
- Matthew Stuart – Onslow County Planning
- Natalie Nelson - NC State University
- Jonathan Hinkle -LDSI, Inc.
- Frank Lopez – NC Sea Grant
- Todd Miller, Ted Wilgis, Erin Fleckenstein, Lauren Kolodij – North Carolina Coastal Federation

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Draft Recommendations for Water Quality

1. Demonstrate Success in protecting and Restoring Two of the State's Most Important and Endangered Shellfish Growing Waters (Newport River and Stump Sound).
2. Create and Heavily Publicize a Prioritized List of Additional Endangered Shellfish Growing Waters For Targeted Management and Restoration Planning. (compile list in Year 1 of Blueprint).
3. Secure Formal Recognition and Commitment to Shellfish Growing Water Quality Strategy.
4. Adopt State Policy for Application of Stormwater Volume Matching Criteria (LID) (when feasible and practical) for State Funded Construction Projects and Showcase Projects Located in Priority Shellfish Growing Waters.
5. Integrate Protection and Restoration Strategies into Multiple State Programs.
6. Revise Scoring Criteria for State-administered Grant Funding Programs.

Oyster Restoration and Protection Plan for North Carolina

Water Quality Recommendations for Inclusion in the 2021-2025 Update

Recommendation 1:

Demonstrate Success in Protecting and Restoring Two of the State's Most Important and Endangered Shellfish Growing Waters (Newport River and Stump Sound).

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Recommendation 2:

Create and Heavily Publicize a Prioritized List of Additional Endangered Shellfish Growing Waters For Targeted Management and Restoration Planning. (compile list in Year 1 of Blueprint).

NORTH CAROLINA OYSTER BLUEPRINT
An Action Plan for Restoration and Protection

Oyster Restoration and Protection Plan for North Carolina

Water Quality Recommendations for Inclusion in the 2021-2025 Update

Recommendation 3:

Secure Formal Recognition and Commitment to Shellfish Growing Water Quality Strategy.

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Water Quality Recommendations for Inclusion in the 2021-2025 Update

Recommendation 4 :

Adopt State Policy for Application of Stormwater Volume Matching Criteria (LID) (when feasible and practical) for State Funded Construction Projects and Showcase Projects Located in Priority Shellfish Growing Waters

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Recommendation 5 :

Integrate Protection and Restoration Strategies into Multiple State Programs.

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Recommendation 6 :

Revise Scoring Criteria for State-administered Grant Funding Programs.

NORTH CAROLINA **OYSTER**

BLUEPRINT

An Action Plan for Restoration and Protection

Wrap up and Next Steps

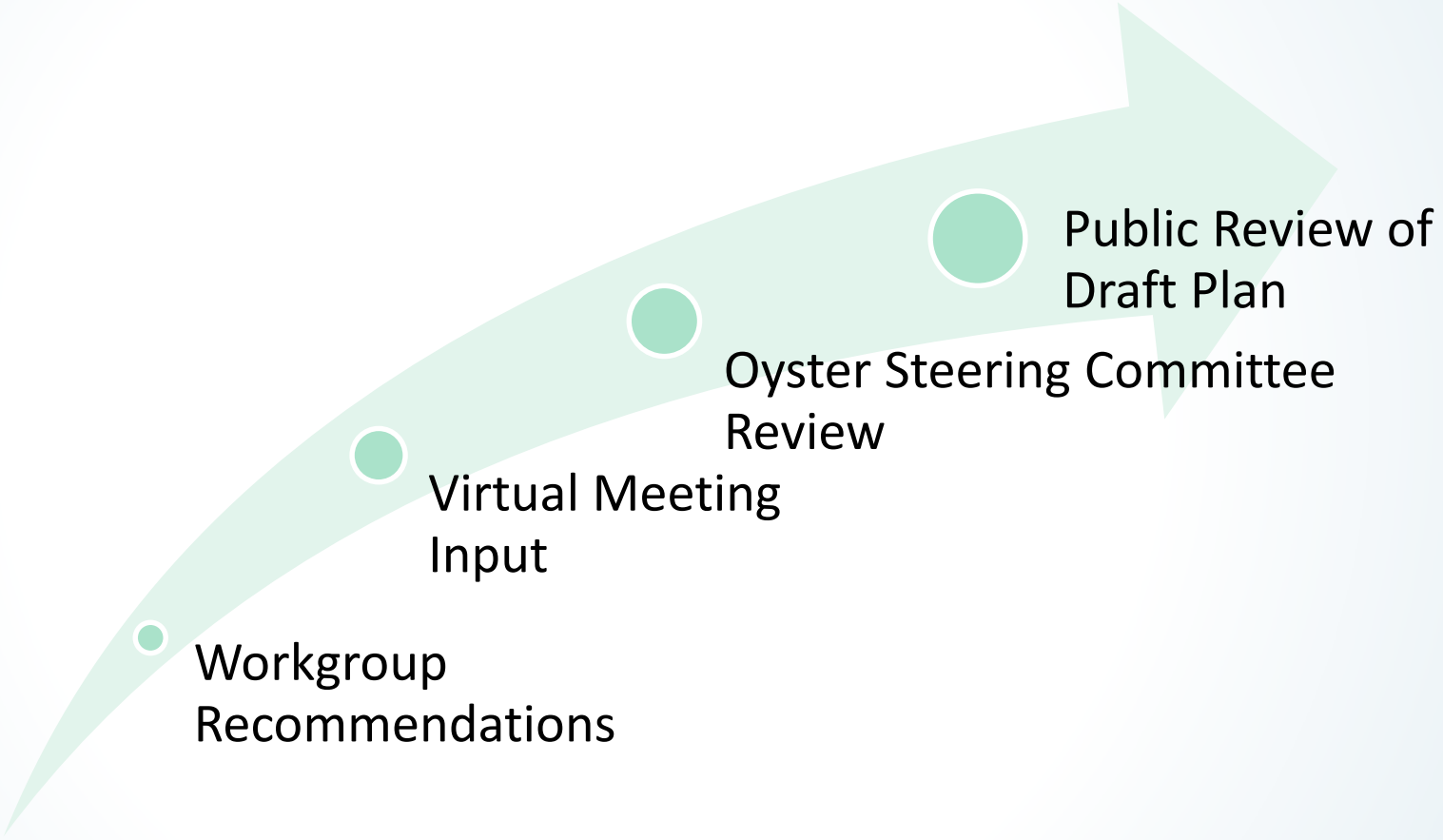
Erin Fleckenstein,
NC Coastal Federation

Process of Updating the Blueprint

Assessing


Blueprint Accomplishments
Stakeholder Survey
Strategy Workgroup Recommendations

Planning


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

North Carolina
Coastal Federation

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