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
- Steering Committee and Regional Workgroups engaged
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.
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.
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
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:
Blueprint Focus Areas

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

- Protect Shellfish Waters
- Education & Outreach
- Oyster Sanctuaries
- Shellfish Aquaculture
- Cultch Planting
- Wild Harvest
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 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

Professional Affiliation of Survey Respondents

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

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Number of Times Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filtering water in the sounds</td>
<td>120</td>
</tr>
<tr>
<td>Creating habitat for fish and other marine life</td>
<td>110</td>
</tr>
<tr>
<td>Providing oysters to eat</td>
<td>80</td>
</tr>
<tr>
<td>Providing economic opportunities - e.g. jobs from...</td>
<td>70</td>
</tr>
<tr>
<td>Continuing the wild oyster fishery</td>
<td>80</td>
</tr>
<tr>
<td>Protecting shorelines</td>
<td>60</td>
</tr>
<tr>
<td>Sequestering extra nutrients</td>
<td>30</td>
</tr>
<tr>
<td>Serving as sites for recreational opportunities -...</td>
<td>30</td>
</tr>
<tr>
<td>Other</td>
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</tbody>
</table>

Number of Times an Oyster Benefit was Selected by Survey Respondents
# Direct Threats to Oysters
Most to Least Concerning

<table>
<thead>
<tr>
<th>Threat Type</th>
<th>Subtype</th>
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<tbody>
<tr>
<td>Physical Destruction to Reefs from Human Related Activities</td>
<td><em>(other than harvest)</em></td>
</tr>
<tr>
<td>Overharvest of Resource</td>
<td></td>
</tr>
<tr>
<td>Siltation/Burying of Reefs</td>
<td></td>
</tr>
<tr>
<td>Incompatible Fishing Practices (e.g. dredging)</td>
<td></td>
</tr>
<tr>
<td>Low Dissolved Oxygen</td>
<td></td>
</tr>
<tr>
<td>Lack of Spawning due to Low Oyster Population</td>
<td></td>
</tr>
<tr>
<td>Shellfish Diseases</td>
<td></td>
</tr>
<tr>
<td>Salinity Changes (too high/too low)</td>
<td></td>
</tr>
<tr>
<td>Lack of Settlement due to Low Substrate Availability</td>
<td></td>
</tr>
<tr>
<td>Introduced Invasive Species</td>
<td></td>
</tr>
<tr>
<td>Ocean Acidification</td>
<td></td>
</tr>
<tr>
<td>Physical Destruction to Reefs from Storms or Natural Causes</td>
<td></td>
</tr>
<tr>
<td>Predation</td>
<td></td>
</tr>
<tr>
<td>Lack of Sufficient Food for Oysters</td>
<td></td>
</tr>
</tbody>
</table>
What do you consider to be the single greatest threat to oysters in North Carolina in the next 5-10 years and why?

<table>
<thead>
<tr>
<th>Threat</th>
<th># of Times Selected</th>
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</thead>
<tbody>
<tr>
<td>Water Quality</td>
<td>11</td>
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<tr>
<td>Incompatible Fishing Practices</td>
<td>8</td>
</tr>
<tr>
<td>Overharvest of Resource</td>
<td>5</td>
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<tr>
<td>Land-based Development</td>
<td>4</td>
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<tr>
<td>Storms</td>
<td>4</td>
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<tr>
<td>Ocean Acidification</td>
<td>3</td>
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<tr>
<td>Shellfish Diseases</td>
<td>3</td>
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<tr>
<td>Physical Destruction to Reefs</td>
<td>3</td>
</tr>
<tr>
<td>Management</td>
<td>3</td>
</tr>
<tr>
<td>Lack of Spawning</td>
<td>2</td>
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<tr>
<td>Lack of Substrate</td>
<td>2</td>
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<tr>
<td>Siltation</td>
<td>2</td>
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<tr>
<td>Swings in Salinity</td>
<td>1</td>
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<tr>
<td>Lack of Awareness</td>
<td>1</td>
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<tr>
<td>Multiple Threats/Interactions</td>
<td>66</td>
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</table>
Respondents provided 241 actions to be considered for Oysters

<table>
<thead>
<tr>
<th>Action Related to:</th>
<th>Number of Times Made</th>
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<tbody>
<tr>
<td>Habitat Enhancement</td>
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<tr>
<td>Water Quality Improvements</td>
<td>52</td>
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<tr>
<td>Shellfish Aquaculture</td>
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<td>Fisheries Management</td>
<td>38</td>
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<tr>
<td>Education/Awareness</td>
<td>6</td>
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<tr>
<td>Other</td>
<td>8</td>
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</tbody>
</table>
Water Quality

- Improve (24)
  - Reduce Inputs (10)
  - Better Building/LID (5)
  - General Improve (5)
  - Oysters/In water BMPs (2)
  - Reduce Sediment (2)

- Policy (9)
  - Protection (7)
  - Buffers (5)
  - Funding (3)
  - Management (2)
  - Maintenance (1)
  - Monitor (1)
WATER QUALITY
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

Department of Environmental Quality
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

Department of Environmental Quality
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

Department of Environmental Quality
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

Department of Environmental Quality
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
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

Department of Environmental Quality
Shellfish Classification - Status

Coastal North Carolina

- Closed
- Open

Department of Environmental Quality
### Shellfish Classification - Status and Trends (Acres)

<table>
<thead>
<tr>
<th>Year</th>
<th>Open</th>
<th>Closed</th>
<th>Approved</th>
<th>Conditionally Approved Open</th>
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<td>18658</td>
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</tbody>
</table>

*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

Department of Environmental Quality
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Department of Environmental Quality
Temporary Closures

• 559 days due to rainfall *
• 111 days due to sewer discharge *
Temporary Closures

Department of Environmental Quality
Temporary Closures – Wild Harvest & Aquaculture

Department of Environmental Quality
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Morehead City, NC 28557
(252) 726-6827
shannon.jenkins@ncdenr.gov
Protecting and Restoring Water Quality in High Priority Shellfish Growing Areas:

Lessons Learned and Accomplishments

Todd Miller
North Carolina Coastal Federation
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
Protecting and Restoring Water Quality in Shellfish Growing Areas

Watershed Strategy

Replicate natural hydrology by focusing on the watershed as a whole

Pre-treatment Hydrograph Years 2000-2017

- 2000: “TURNING BACK THE CLOCK” TO A YEAR WHEN THERE WAS LESS VOLUME OF RUNOFF
- 2009: INCREASED RUNOFF VOLUME THROUGH INFILTRATION AND REUSE
- 2017: REDUCED RUNOFF VOLUME THROUGH INFILTRATION AND REUSE
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
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
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
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
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).


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).
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).
Oyster Restoration and Protection Plan for North Carolina
Water Quality Recommendations
for Inclusion in the 2021-2025 Update

Recommendation 3:

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
Recommendation 5:

Integrate Protection and Restoration Strategies into Multiple State Programs.
Recommendation 6:

Revise Scoring Criteria for State-administered Grant Funding Programs.
Wrap up and Next Steps

Erin Fleckenstein,
NC Coastal Federation
Process of Updating the Blueprint

- Assess
- Plan
- Action
Assessing

- Blueprint Accomplishments
- Stakeholder Survey
- Strategy Workgroup Recommendations
Planning

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