-Framing the Issue in North Carolina: A Historical Perspective-

Eric Herbst
Coastal Aquaculture Specialist
North Carolina Shellfish Aquaculture Products

**Eastern Oyster** (*Crassostrea virginica*)

**Hard Clams** (*Mercenaria mercenaria*)

**Soft Crabs** (*Callinectes sapidus*)
North Carolina Shellfish Aquaculture History

- North Carolina has provided for the private use of public trust waters for shellfish cultivation for over 150 years.
North Carolina Oyster Leases

- 1989 legislation expanded that role to include shellfish water column leases above existing shellfish bottom leases

Increase in Use of Containerized Gear for Half-Shell Market = Potential Marine Debris
Clam Leases

Clam Leases: Netting Used to Protect Clams from Predators

From Dale Levitt: Applied Shellfish Farming
North Carolina Clam Leases

Clam Leases: Plastic Netting, Sand Bags and Rebar = Potential Marine Debris
## 2020 North Carolina Shellfish Lease Applications

<table>
<thead>
<tr>
<th>County</th>
<th>Lease Applications</th>
<th>Count of Approved Leases</th>
<th>Acres Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaufort</td>
<td>0</td>
<td>3</td>
<td>9.48</td>
</tr>
<tr>
<td>Carteret</td>
<td>2</td>
<td>14</td>
<td>57.68</td>
</tr>
<tr>
<td>Dare</td>
<td>7</td>
<td>2</td>
<td>12.64</td>
</tr>
<tr>
<td>Hyde</td>
<td>6</td>
<td>3</td>
<td>8.16</td>
</tr>
<tr>
<td>New Hanover</td>
<td>9</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Onslow</td>
<td>2</td>
<td>4</td>
<td>19.07</td>
</tr>
<tr>
<td>Pamlico</td>
<td>14</td>
<td>2</td>
<td>9.72</td>
</tr>
<tr>
<td>Pender</td>
<td>14</td>
<td>5</td>
<td>13.47</td>
</tr>
<tr>
<td>Unknown</td>
<td>4</td>
<td></td>
<td>0.00</td>
</tr>
<tr>
<td>Grand Total</td>
<td>58</td>
<td>33*</td>
<td>130.23</td>
</tr>
</tbody>
</table>

*Some 2020 approved leases were applied for in 2018 & 2019. Some 2020 applications are still in approval process.
North Carolina Water Column Shellfish Leases

2020 Water Column Leases: # 97 (+ 15% from 2019); Acres 296 (+ 22% from 2019)

2020 Water Column Leases: # 97 (+ 15% from 2019); Acres 296 (+ 22% from 2019)
### 2020 North Carolina Shellfish Leases (Growing Capacity)

**2020 NC Shellfish Leases**

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Total Acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom</td>
<td>232</td>
<td>1,240.87</td>
</tr>
<tr>
<td>Water Column</td>
<td>97</td>
<td>295.77</td>
</tr>
<tr>
<td>Franchise</td>
<td>48</td>
<td>512.89</td>
</tr>
<tr>
<td>Research</td>
<td>4</td>
<td>23.58</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>381</td>
<td>2,073.11</td>
</tr>
</tbody>
</table>

**2020 Shellfish Leases: 381 Leases Totaling 2,073 acres**
2020 Lease Applications: Water Column = 25 (-48% from 2019); Bottom = 29 (-50% from 2019)
North Carolina Farmed Oyster Production
North Carolina Farmed Oyster Production

2020 Farmed Oysters: 32,307 Bushels (+49% from 2019) 2nd Highest, Slightly < 2017

*2020 Data is preliminary
North Carolina Oyster Production

- Farmed Oysters Increasing
- Wild Harvest Decreasing

*2020 Data is preliminary
North Carolina Farmed Oyster Production

2020 Farmed Oysters: $3.14M (+ 8% from 2019) Highest Ever

*2020 Data is preliminary
North Carolina Oyster Production

2020 Farmed Oysters Highest $ Value Ever
Wild Harvest Lowest $ Value in Last 10yrs

*2020 Data is preliminary
North Carolina Shellfish Aquaculture: The 2020 Story

COVID-19

Spring / Summer Mortality (oysters)

Eastern Oyster (*Crassostrea virginica*)

Hard Clams (*Mercenaria mercenaria*)

Soft Crabs (*Callinectes sapidus*)

What Would Have Happened if No COVID-19 or Summer Mortality in Oysters?
North Carolina Shellfish Aquaculture: Future Growth

Goal of $33M Farm Gate Value By 2030

NORTH CAROLINA
STRATEGIC PLAN FOR SHELLFISH
MARICULTURE:
A VISION TO 2030

FINAL REPORT TO THE NORTH CAROLINA
GENERAL ASSEMBLY

December 2018
We Will Likely See Continued Expansion of Coastal Aquaculture Footprint & Containerized Gear.
North Carolina Storm / Hurricane History

- First recorded Hurricane: 1851
- Hurricane Florence 2018
- Hurricane Dorian 2019
- Hurricane Isasias 2020

Eastern North Carolina: Three Hurricanes in The Last Three Years
North Carolina Tropical & Extratropical Systems: Since 1851

Eastern North Carolina: 287 Tropical & Extratropical Systems
North Carolina Hurricanes: Since 1851

Eastern North Carolina: 73 Hurricanes
North Carolina Major Hurricanes: Since 1851

Eastern North Carolina: 19 Major Hurricanes
Hurricane Florence: September 13-17, 2018

Hurricane Florence: Slow Moving and Heavy Rains (5 days affecting NC)
North Carolina Hurricane Florence

Hurricane Florence: Many Shellfish Farms Completely Destroyed
North Carolina Hurricane Florence

Hurricane Florence: Many Shellfish Farms Completely Destroyed
North Carolina Sea Grant collaborated with partners from NOAA and the N.C. Division of Marine Fisheries and N.C. Department of Agriculture and Consumer Services to tally damage from hurricanes Florence and Michael in 2018.

2018 NC Hurricanes: $2.3M in Property Damage; $7.6M in Crop Losses
## North Carolina Tropical Cyclone Statistics (1851 - 2020)

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Direct Landfalling Storms in NC</th>
<th>Non-landfalling Storms Affecting NC Within 150 Miles</th>
<th>Total Storms Affecting NC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Storms</td>
<td>84</td>
<td>303</td>
<td>387</td>
</tr>
<tr>
<td>Percentage of Storms</td>
<td>4.37%</td>
<td>15.76%</td>
<td>20.12%</td>
</tr>
<tr>
<td>Average Years Between Storms</td>
<td>2.02</td>
<td>0.56</td>
<td>0.44</td>
</tr>
<tr>
<td>Average Storms Per Year</td>
<td>0.49</td>
<td>1.78</td>
<td>2.28</td>
</tr>
</tbody>
</table>

On Average: North Carolina is Affected by 2.28 Tropical Storms Per Year

https://products.climate.ncsu.edu/
North Carolina Storm / Hurricane Future?

The graph above shows the total number of days that North Carolina has been impacted by tropical cyclones on a weekly basis.

Total Storms Affecting North Carolina by Decade
Within 150 Miles (1851-2020)

The graph above shows the total number of tropical cyclones affecting North Carolina by decade.

https://products.climate.ncsu.edu/

North Carolina Has Been Affected by Severe Weather Events Since Time Immemorial
North Carolina Coast & Changing Demography

NC has 322 miles of ocean shoreline and the second largest estuarine system (bays, sounds and wetlands) in the country, which amounts to almost 12,009 miles of estuarine coastline.

- Population 10.6 Million 2020
- 9th most populous state in the Nation
- 4th largest population Increase since 2018
- 10th fastest growing state population
- Growth rate of 1% (2X national average)
- Many coastal counties will grow 25-50% by 2035

https://communitydevelopment.ces.ncsu.edu/community-resilience/urbanization-changing-demographics/
Multiple Interests in Use of Public Trust Water = Potential Conflict
Multiple Interests in Same Resource = Potential Conflict

Currently There are Four Shellfish Aquaculture Moratoriums in North Carolina
North Carolina Shellfish Aquaculture Moratoriums

- Already limited area for Public Shellfishing
- Violates Public Trust Doctrine

Brunswick County - North Carolina House Bill 317 (1949) - Permanent Moratorium

NCDMF: Shellfish Aquaculture Tool: https://arcg.is/1Lu1PC
North Carolina Shellfish Aquaculture Moratoriums

- Private Shellfish Leases Interfere with Fishing and Recreation

Core Sound Moratorium -1993 to 1995; 1996 (East side) and 2003 -Permanent Moratorium on New Leases

NCDMF: Shellfish Aquaculture Tool: https://arcg.is/1Lu1PC
North Carolina Shellfish Aquaculture Moratoriums

- Substantial Increase in User Conflicts

Bogue Sound and New Hanover County Area Moratoriums - July 1 2019 to July 1 2021
North Carolina is Experiencing a Greater Convergence of a Growing Shellfish Aquaculture Industry, Increase in Competing Interests in Public Trust Water Use, and The Ever-Present Threat of Storms

Expanding Shellfish Aquaculture Industry

Competing Interests in Use of Public Trust Waters

Need for Increased Awareness of Aquaculture Gear Management & Storm Preparedness
Many Thanks To:

Jacob Boyd
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Teri Dane
Amanda Tong
Alan Bianchi
Chuck Weirich
Frank López
Bryan Snyder
David Glenn
Ken Riley

Questions? Email Eric Herbst: echerbst@ncsu.edu
North Carolina Case Study: Abandoned Clam Farm Cleanup

Bree Charron
NOAA Marine Debris Project

Project Goals

1. Clean-up a derelict clam farm in Carteret County.
2. Evaluate the use of drone technology for assessment of marine debris.
3. Develop BMPs for NC growers to reduce threat of marine debris from the industry.
UAV Debris Identification

Benefits
- Survey up to 12 sq. km
- High resolution (2.5 cm/pixel)
- Photogrammetry and lidar
- Digital terrain modeling
- Topographic maps
- FAA Permitted

Fixed Wing Platform

Multirotor Platform

Harkers Island, NC
Aerial Survey – 25 acre site

Floating oyster bag
Plastic screens
Plastic screens
Bottom cages
Fabric sandbags
Removal

- November 2017
- 22 Marines = 3000 lbs by hand
Removal

- Winter 2017-2018
- 600,000 lbs by machine
Best Management Practices

Core Partners

• NOAA Coastal Aquaculture Siting and Sustainability (NOAA National Ocean Service, Beaufort Lab)
• NC Sea Grant Marine Aquaculture Specialist
• Work group of growers
• North Carolina Shellfish Mariculture Advisory Committee
Best Management Practices

- SITING
- FARM DESIGN
- FARM OPERATION
- COMMUNITY ENGAGEMENT
Best Management Practices

SITING

- Choose sites with viable waters for shellfish growth.
- Consider channels, inlets, fetch, tidal range.
- Communicate with riparian landowners.
- Scope area for other potential debris sources.

FARM DESIGN

FARM OPERATION

COMMUNITY ENGAGEMENT
Best Management Practices

SITING

- Start small and scale up.
- Design for hurricanes.
- Maintain a well-organized farm.
- Mark lease and gear to fullest extent.

FARM DESIGN
Best Management Practices

- Daily operations should not produce debris.
- Keep lines taut and gear neat.
- Dispose or recycle gear once it is no longer usable.
- Create storm preparation plans.
Best Management Practices

SITING

• Open channels of communication with riparian neighbors

FARM DESIGN

• Join or organize local cleanup efforts

FARM OPERATION

• Be proactive in recovering lost gear

• Every farmer can become the face of the industry
Prevention of Marine Debris from Shellfish Mariculture
Best Management Practices for North Carolina Producers

The shellfish mariculture industry relies heavily on synthetic materials for oyster grow-out within the estuarine systems. If these materials are lost from the farm, they become marine debris which can be detrimental to habitat, aquatic species and the people who work and play on the water. The North Carolina Coastal Federation worked with partners and shellfish growers to produce voluntary best management practices for the prevention of marine debris from shellfish leases.

SITING

The first step to establishing a successful shellfish farm is proper siting. There are many aspects that contribute to a farm’s viability including frequency of closures, survivability of oysters, salinity, wave energy, other physical factors and public use conflicts.

QUICK SITING TIPS
- Choose sites away from navigational channels and inlets.
- Always consider wave energy.
- Scope potential areas of debris spread that might come from your farm or from neighbors (docks, other farms, etc.)
- Be a good neighbor and communicate with adjacent riparian landowners.
- Be aware of tidal range and strong tidal currents.

NC SHELLFISH SITING TOOL

Researchers at the University of North Carolina Wilmington have produced an interactive siting tool for shellfish mariculture that provides invaluable data for growers to scope the feasibility of a potential lease site. The tool includes continuously updated data on salinity, submerged aquatic vegetation, depth, utilized channels and much more. Find the tool at: uncw.edu/benthic/sitingtool

FARM DESIGN

After locating and properly identifying the lease site, thoughtful development of the farm layout and design is a critical step toward developing a successful operation. Organization, gear selection and lease marking are important components of the design stage.

QUICK DESIGN TIPS
- Seek advice from established farmers and mariculture professionals when designing.
- Start small and scale up.
- Design for hurricanes.
- Maintain a well-organized and tidy farm.
- Consult design strength of gear from manufacturer.
- Clearly demarcate lease site to prevent vessel collisions.
- Mark gear units to aid in recovery.

FARM OPERATION

Once the farm is established, daily operations should be set in place that reduce the risk of marine debris generation. Good inspections, materials management, storm readiness and community outreach programs are key to preventing marine debris associated with shellfish farming operations.

QUICK OPERATION TIPS
- Keep lines taut and keep gear neat and orderly.
- Regularly inspect gear and replace items that are worn.
- Keep lines full, so it is obvious when gear is missing.
- Dispose of or recycle used gear once it is no longer usable.
- Prepare the farm for forecasted storms.
- Obtain federal crop insurance.
- Keep lines and materials as deep as possible.
- Pick up loose gear as soon as possible.

For more information, visit nccost.org/bmps

nccoast.org/bmps