# *Deepwater Oyster Recovery Areas (DORAs)*

*DEPARTMENT OF ENVIRONMENTAL QUALITY*

Marine Fisheries

NC Marine Fisheries Commission | McLean Seward, Bennett Paradis, Zach Harrison | May 2026

# *Mechanical Oyster Harvest Management*

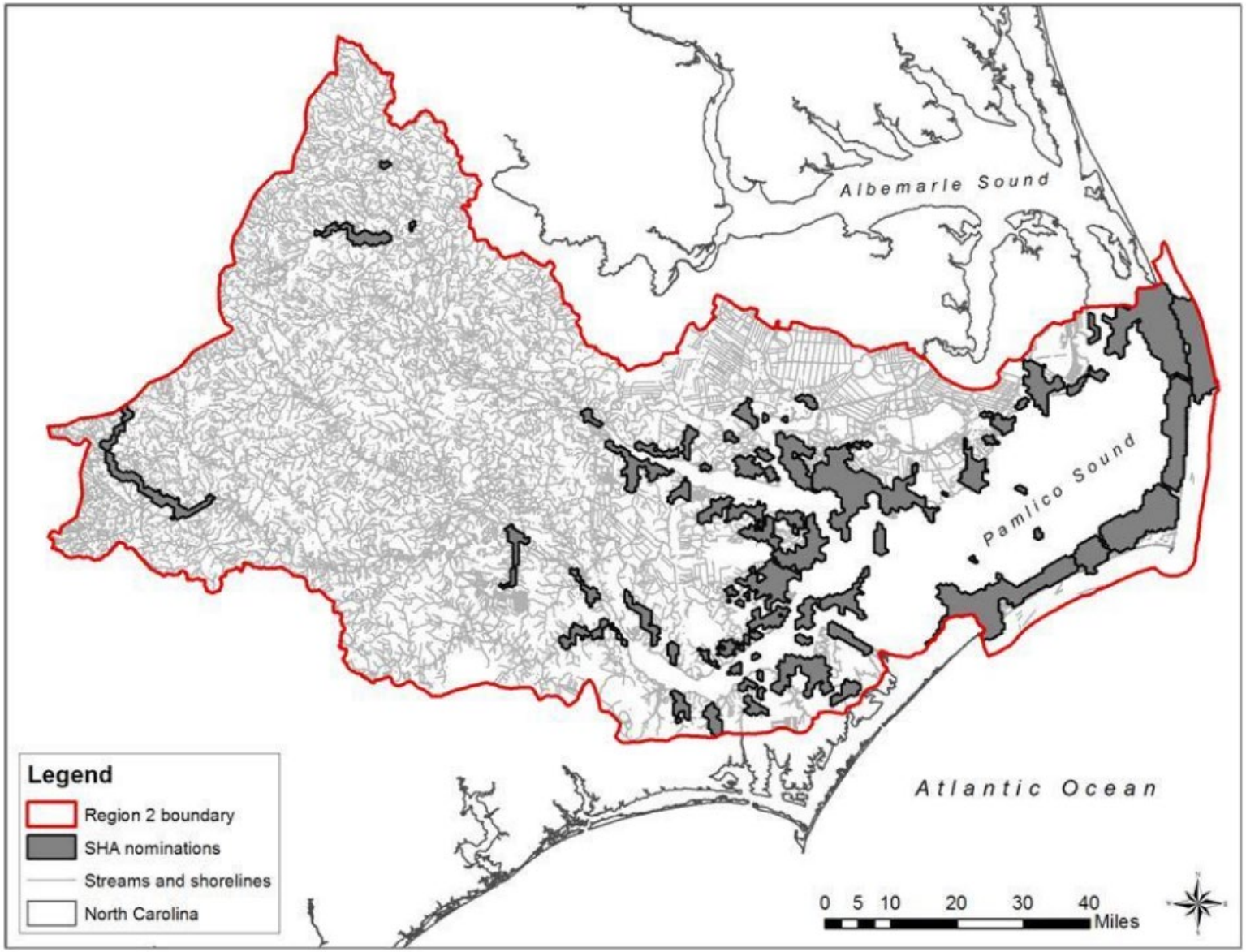
**Strategy 1: Deepwater Oyster Recovery Areas (DORAs)**
(habitat value > fishery value)

**Strategy 2: Cultch Supported Harvest** (habitat value = fishery value)

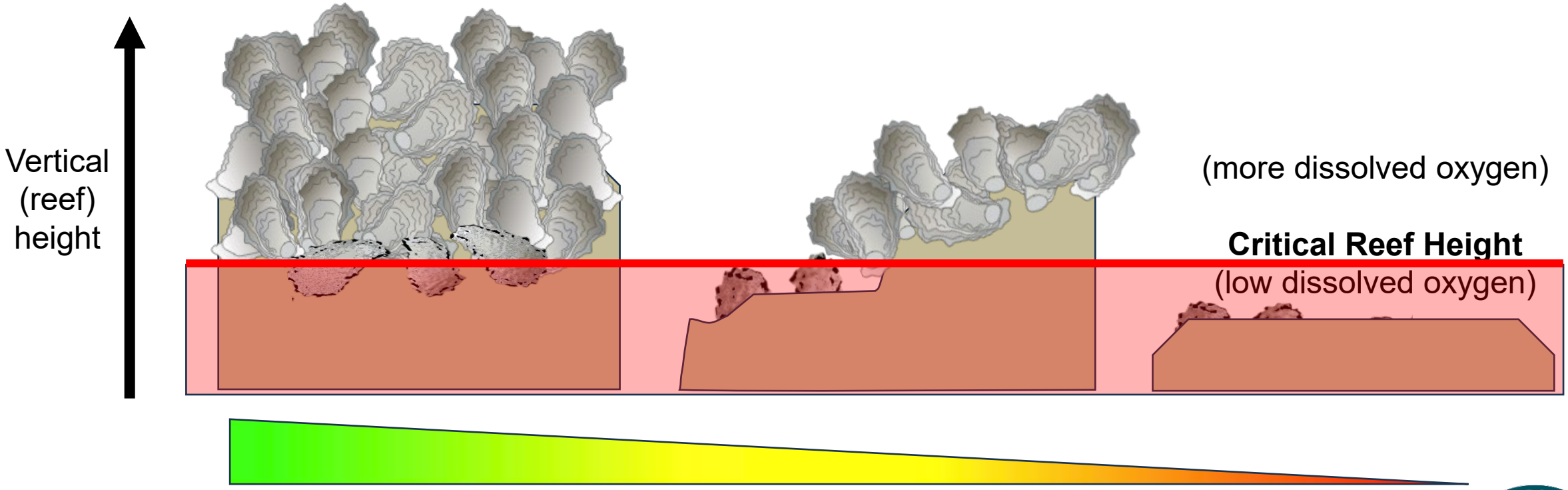
**Strategy 3: Rotational Cultch Sites**
(habitat value < fishery value)

# Background

- Deepwater reefs provide habitat for over 70 species
- MFC Nominated as SHAs in Pamlico Sound
- Reefs exposed to mechanical harvest may lose 1 ft of vertical reef height per pass
- Reefs have shown a decrease in vertical height (historically up to 13 ft off bottom)
- Many reefs have disappeared or been reduced to shell rubble
- Declines in reef heights have been attributed to decades of fishery effort



# *Importance of Vertical Height for Oyster Reefs*



# *Deepwater Oyster Recovery Areas (DORAs)*

- Deepwater reefs suffered mass mortality
- Very few legal or live oysters
- No cultch planting effort

- Division identified two DORAs that include historical Deepwater reefs where mechanical harvest would not be allowed until evaluation in next FMP.
- DORA boundaries based on existing navigational markers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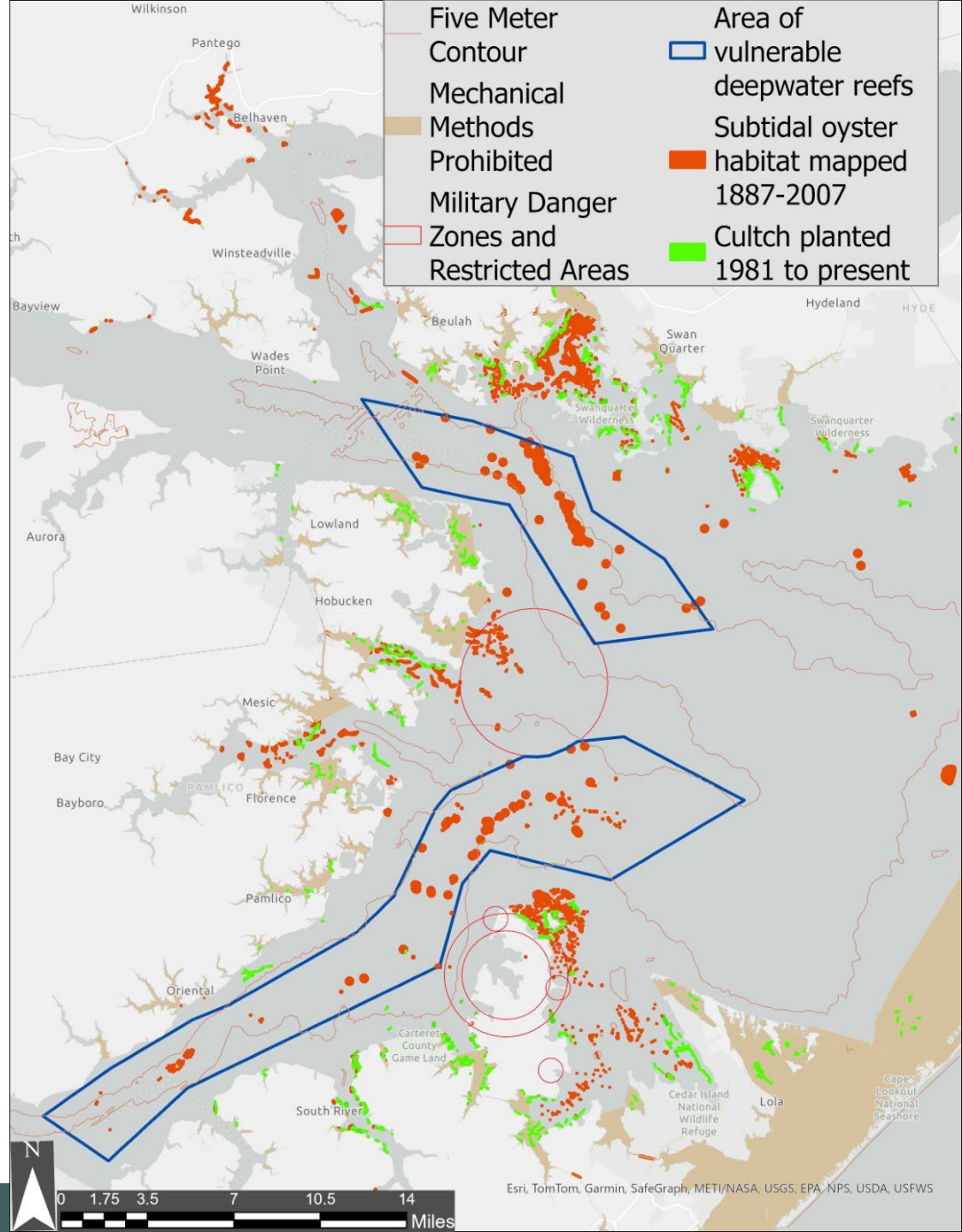
# *Deepwater Oyster Recovery Areas*

- Identified deep water areas with documented historical presence of subtidal oyster reefs
- Focused on reefs deeper than 16ft in the Neuse and Pamlico rivers
- Potential vulnerable oyster habitat = 845 acres
  - 0.9% of 91,158 total identified acres (combined)



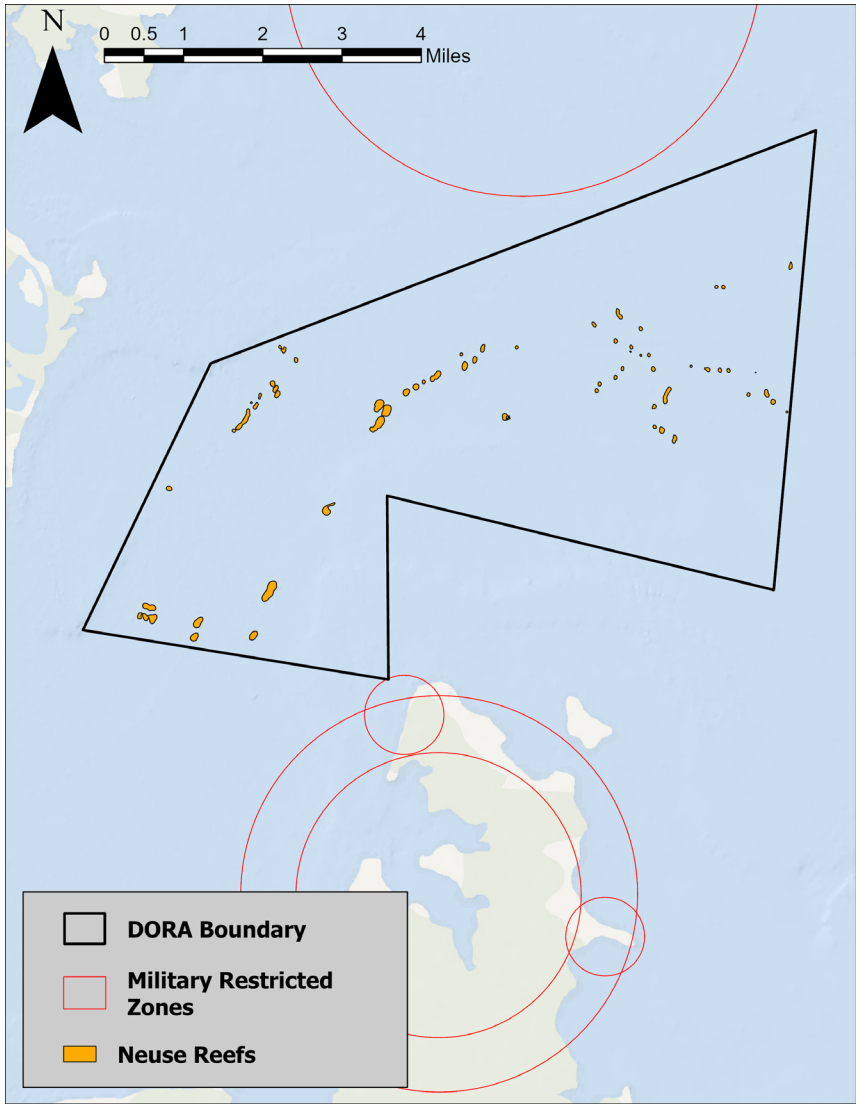
# *Deepwater Oyster Recovery Areas (DORAs)*

**Neuse DORA**

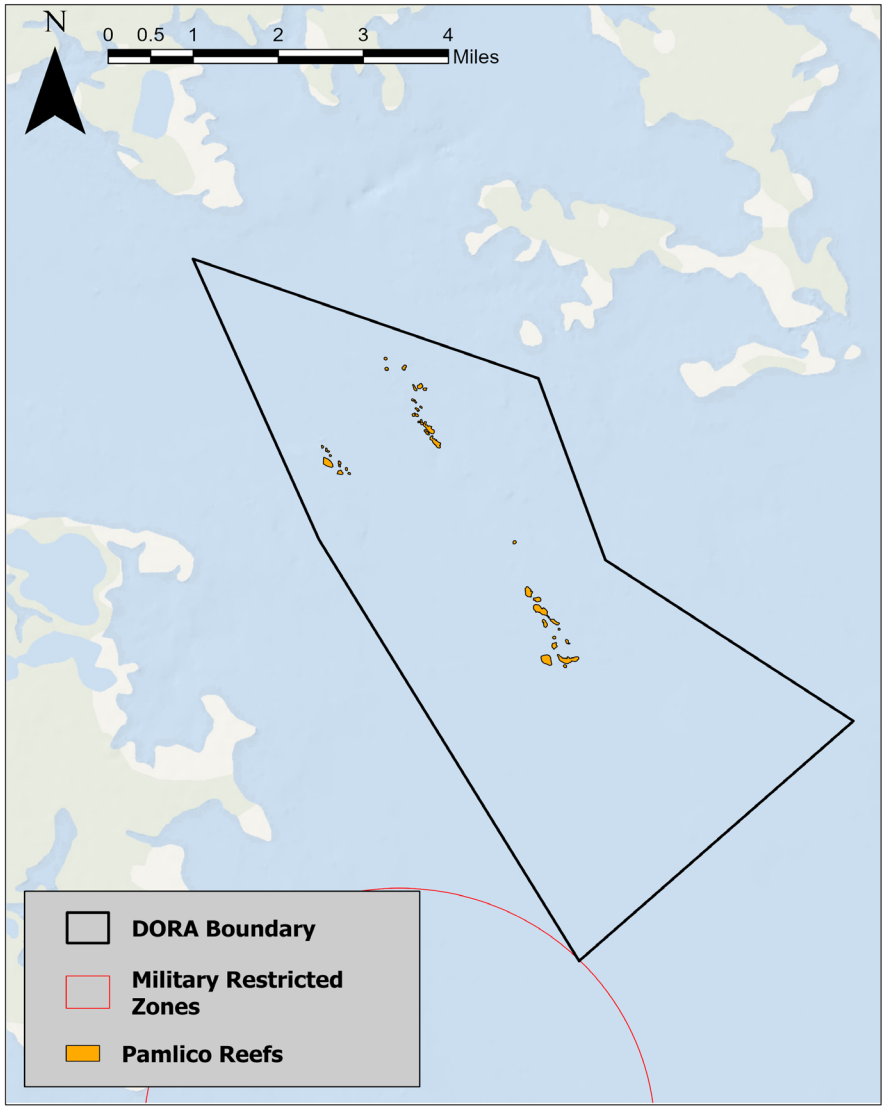
- 130 acres
- 0.6% of total area within the DORA

**Pamlico DORA**

- 115 acres
- 0.7% of total area within the DORA




Neuse DORA




Pamlico DORA

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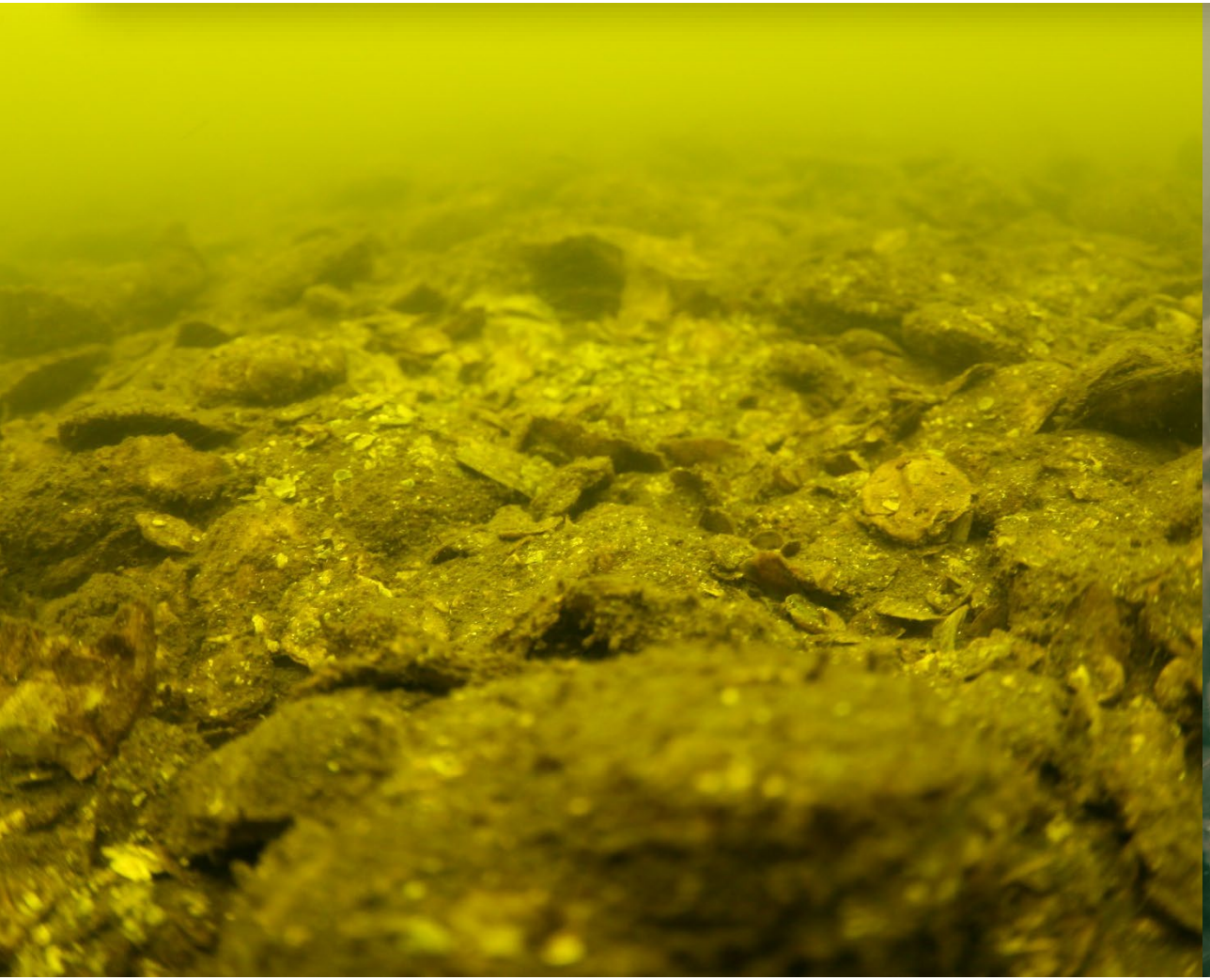
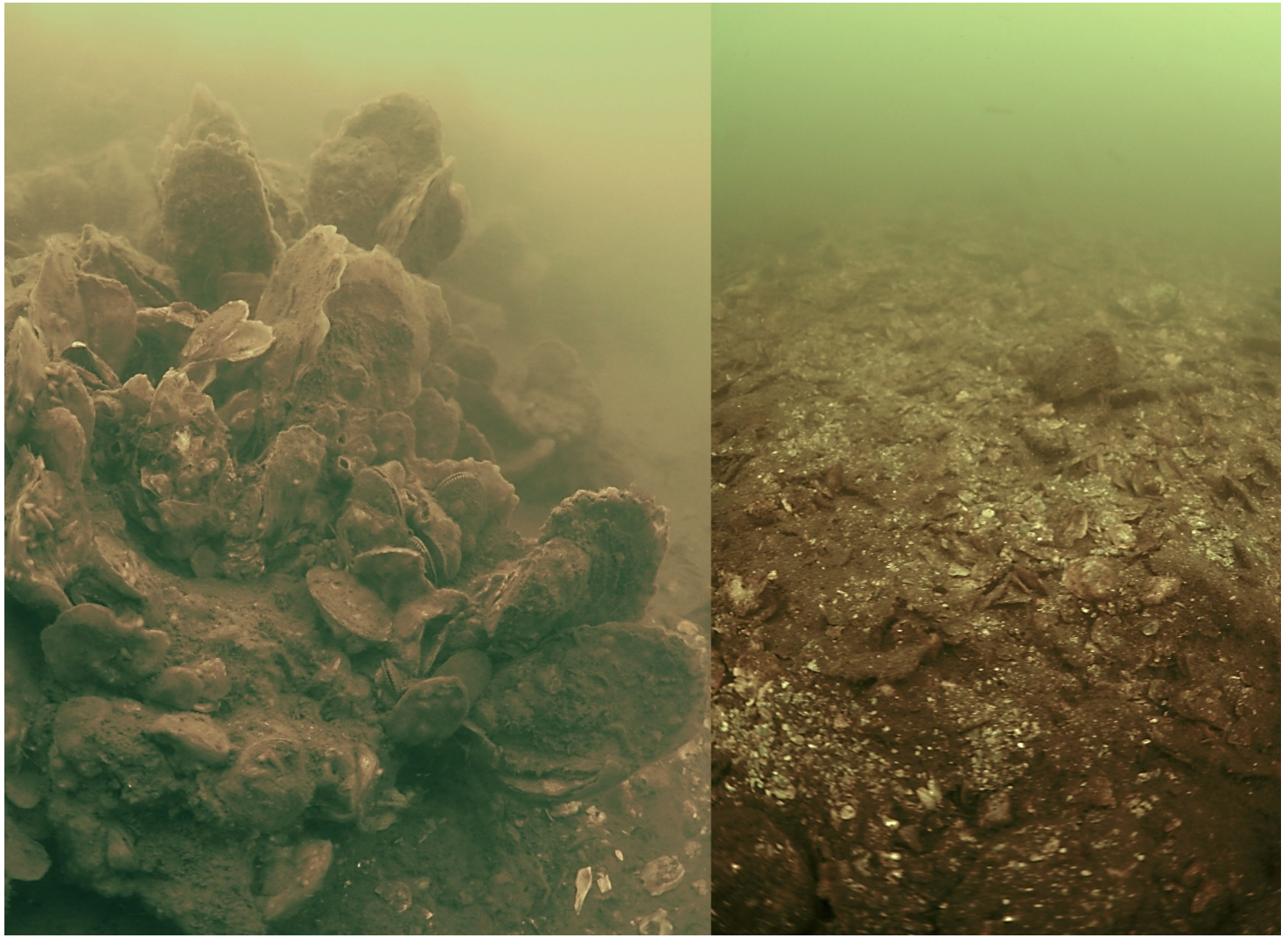


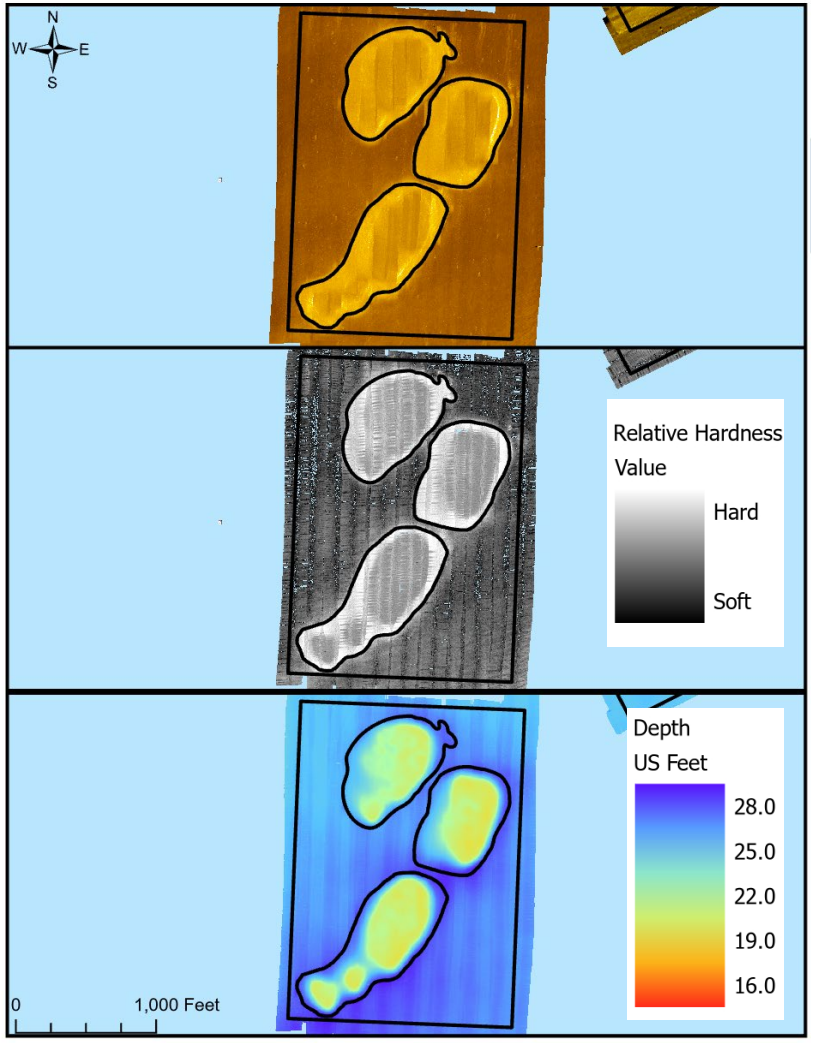
# *Deepwater Oyster Recovery Areas (DORAs)*

**Goals:**

- Reduce gear disturbance to allow for recovery and vertical growth of valuable habitat
- Evaluate effectiveness of closure for future sustainable harvest
- Indirect ecosystem services & benefits of closure areas



# *Side Scan Survey Results ($Y_0$)*




- Backscatter, side-scan, and bathymetric data used to delineate 15 clusters of hard-bottom data
- Example:
  - 30 acres in total
  - Average depth of 23 ft
  - Surrounding area depth of 24.9 ft
  - Average vertical relief ~1.9 ft
- Across 15 sites average relief ranged between 0.3 to 3 ft
- 7 out of 15 survey areas with limited relief

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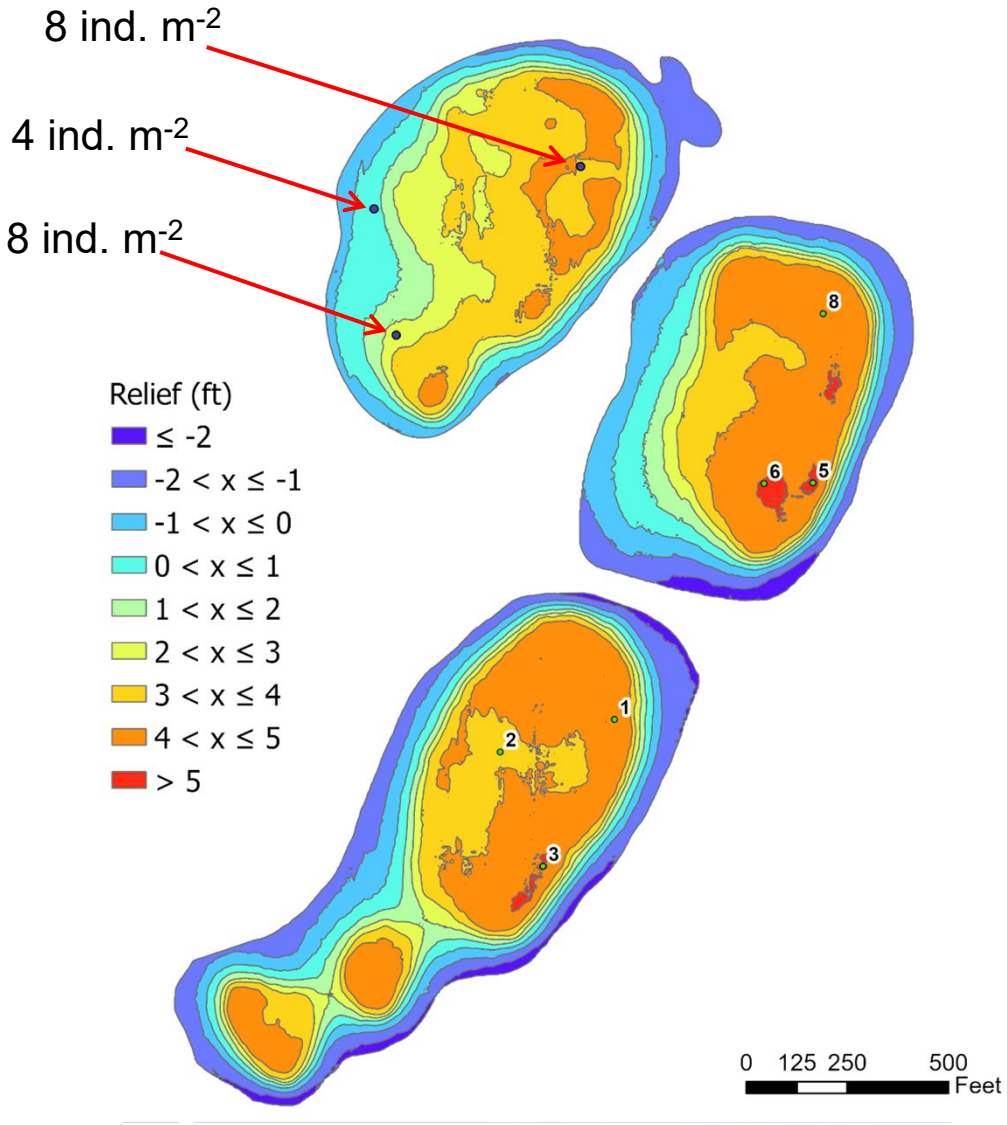



245 acres of hard-bottom shell habitat (HBSB) (including shell hash)

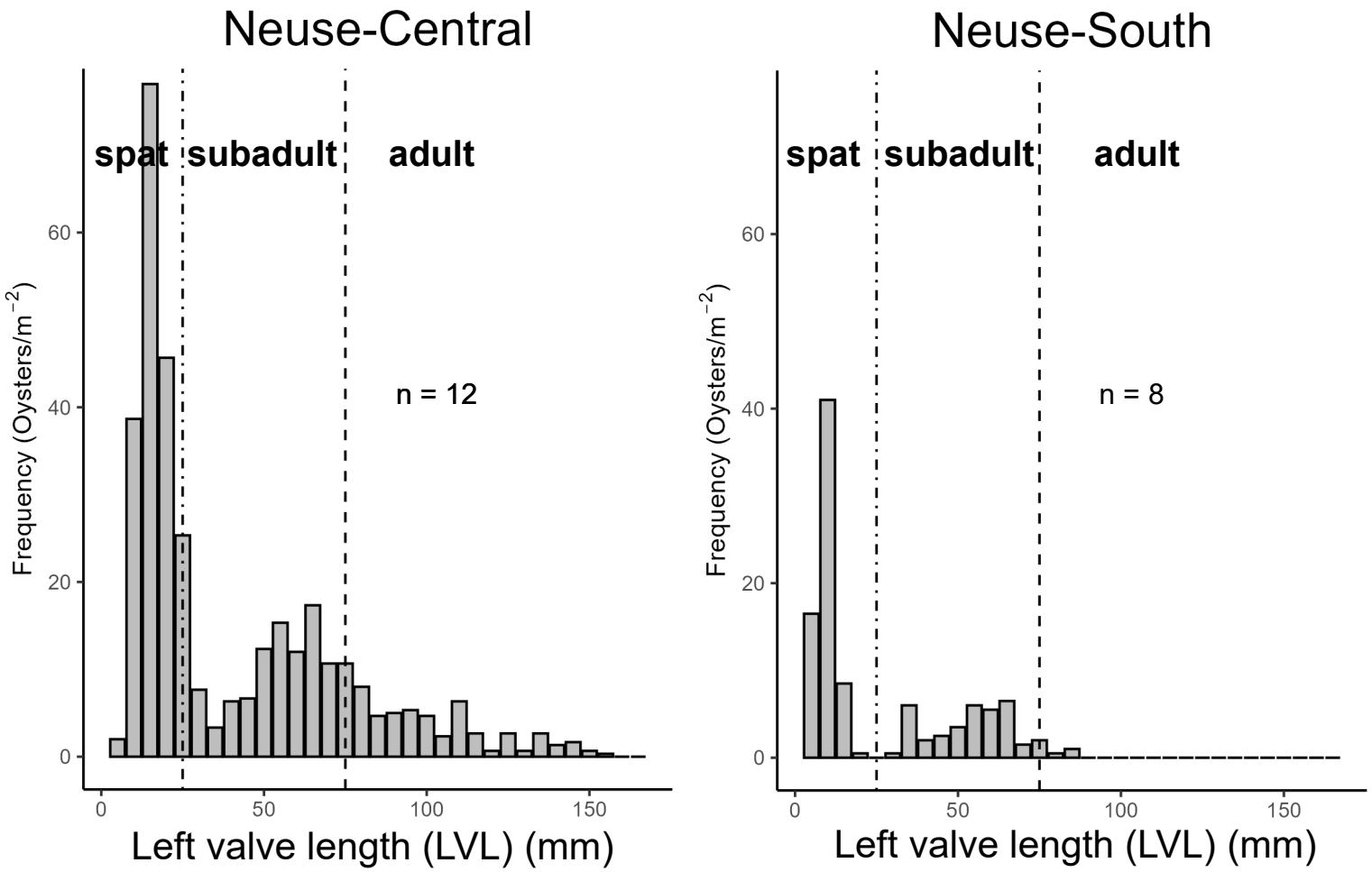
- Pamlico : 114.85 acres
- Neuse : 129.85 acres

Vertical relief breakdown

| Relief (ft) | % of HBSB | Acres |
|---|---|---|
| x ≤ 1 | 49% | 120 |
| 1 < x ≤ 2 | 21.5% | 52.7 |
| 2 < x ≤ 3 | 12.5% | 30.6 |
| 3 < x ≤ 4 | 9% | 22.4 |
| 4 < x ≤ 5 | 7% | 18 |
| 5 < x | <0.3% | 0.6 |

# *SCUBA Survey ($Y_0$)*

- Low oyster density in 95% samples
  - 5.9 adult oysters $m^{-2}$
  - 63.4 sub-adult oysters $m^{-2}$
  - 84.6 spat $m^{-2}$
- One outlier in Neuse-Central
  - 496 adult oysters $m^{-2}$
- DORA dives are ongoing (resuming May 2026)



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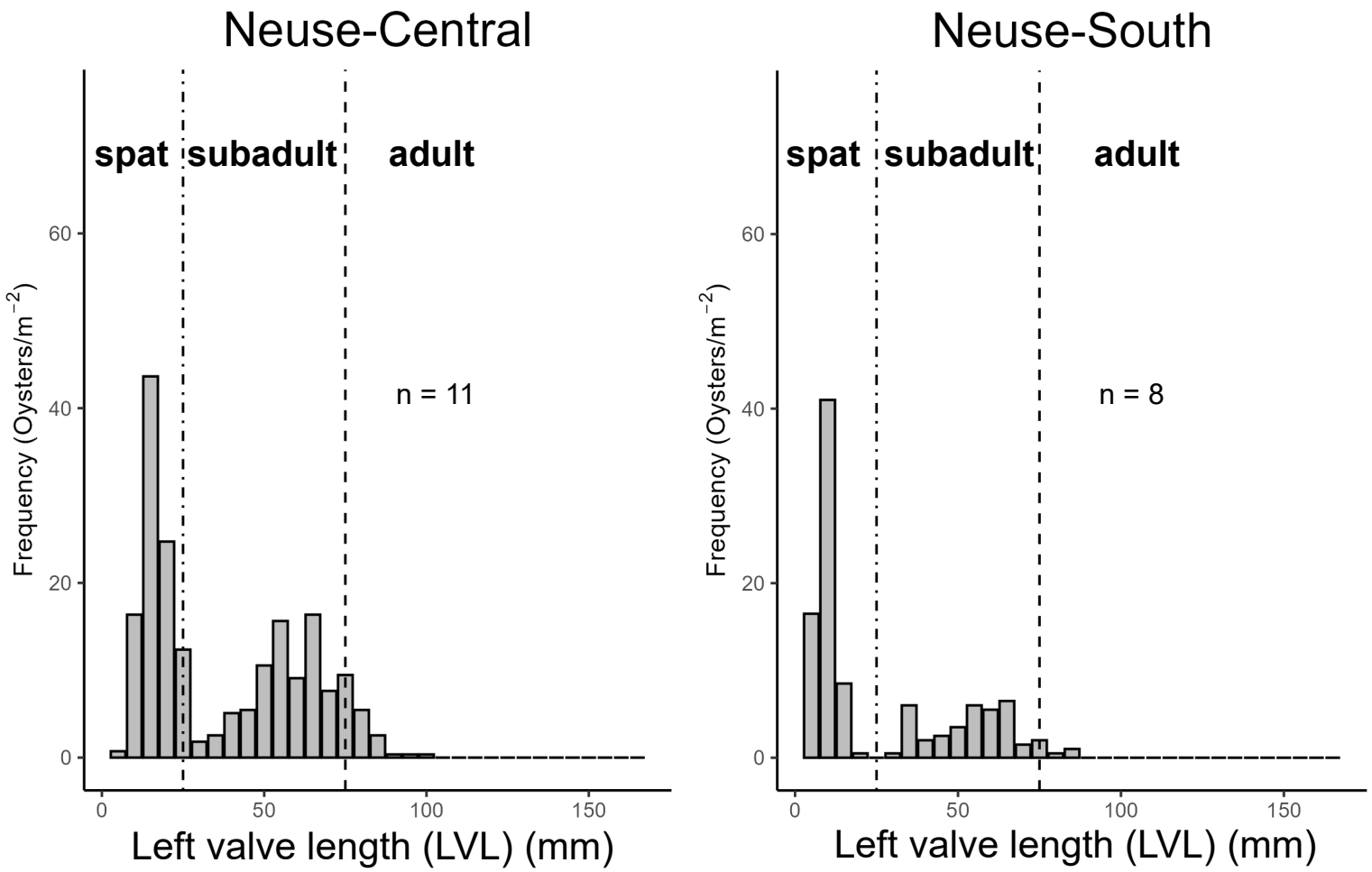
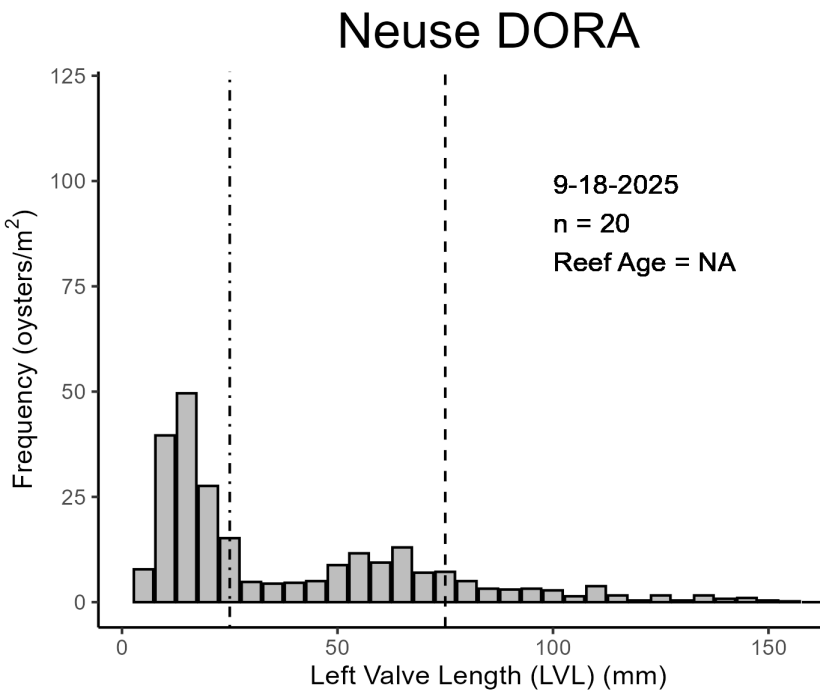


# *Pamlico Sound Oyster Reef Comparison*

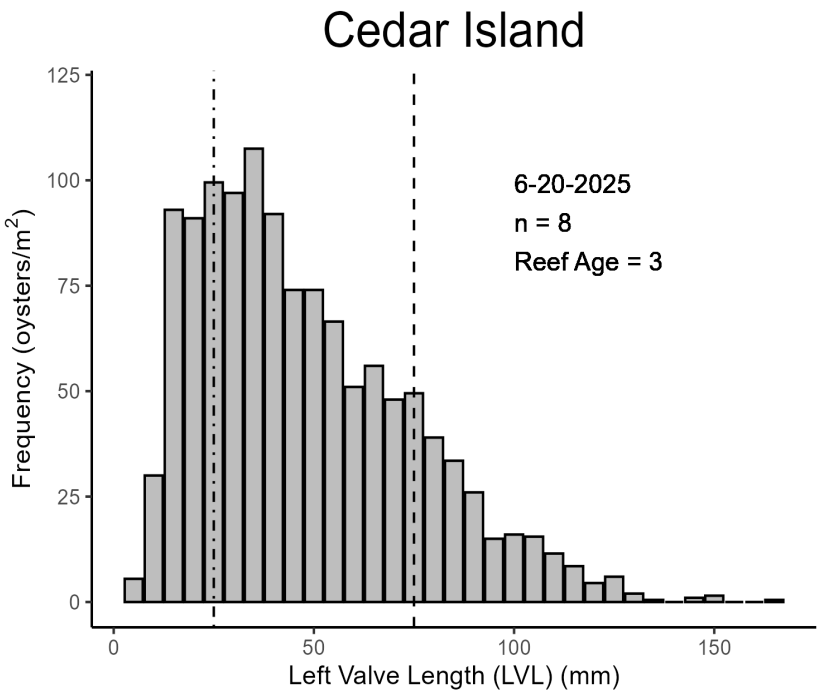
**DORA (SCUBA)**

**30 adult oysters $m^{-2}$**



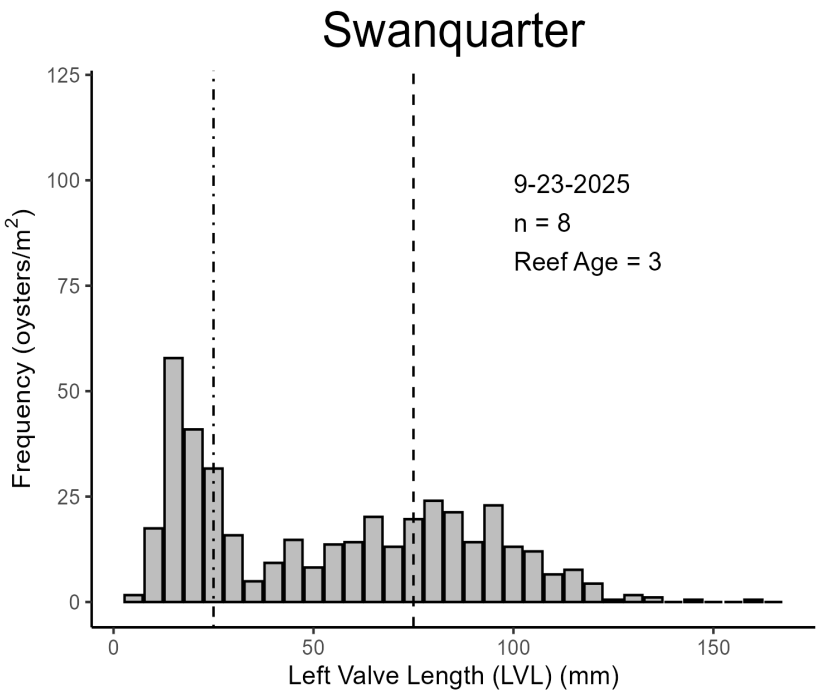

**Sanctuary (SCUBA)**

**140 adult oysters $m^{-2}$**

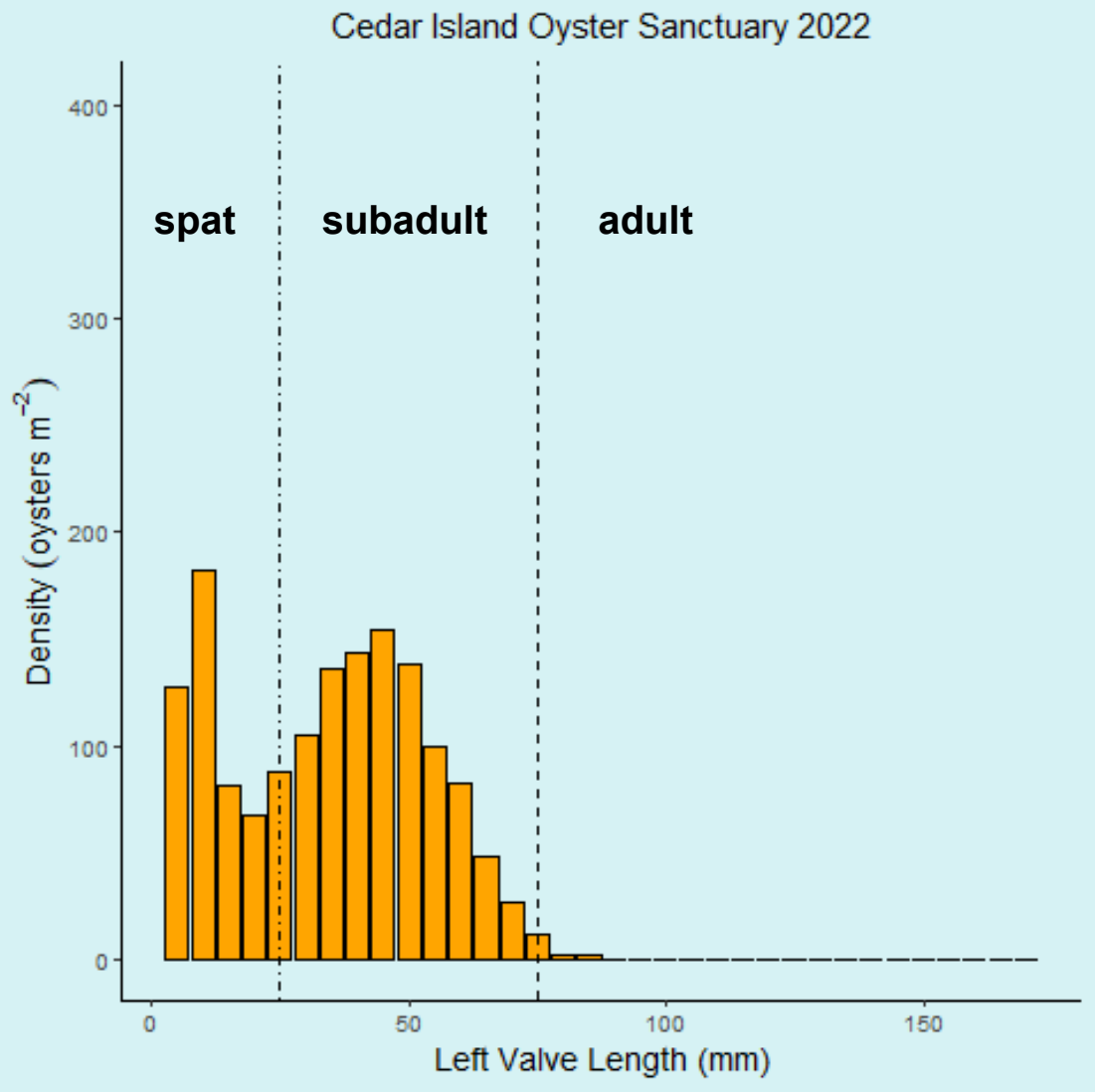



**Cultch (Tong)**

**59 adult oysters $m^{-2}$**



# *DORA Monitoring Goals*




- Observe oyster density over time prior to the next amendment cycle
- Find a relationship between vertical relief and adult oyster density in DORA
- Repeat side-scan survey efforts near the opening of Amendment 6 for review

# *Maximizing the Oyster to Dollar Ratio*


Pamlico Sound oyster enhancement strategies have been streamlined for efficiency at scale

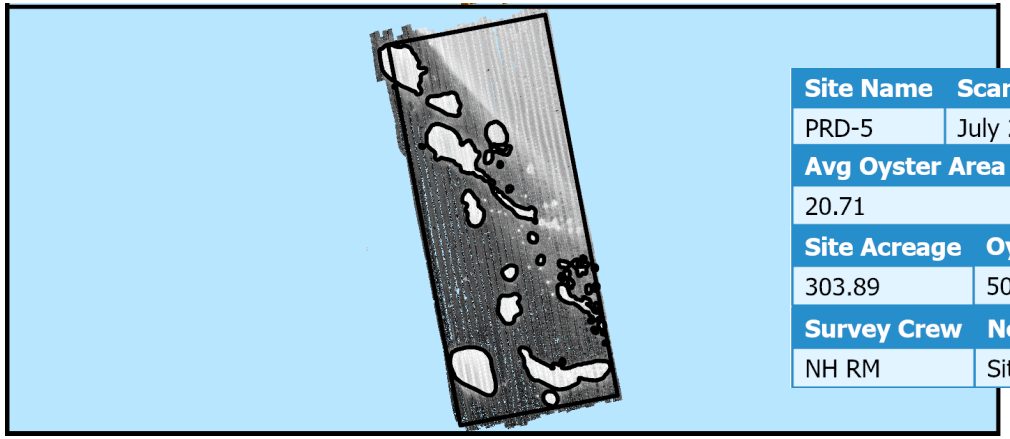
- Cultch – low relief, harvestable reefs, reduce harvest pressure
- Sanctuary – high relief, protected broodstock habitat

Restoration pre-project timeline:

- Identify goals & purpose (harvest vs protected)
- Site selection & impact study
- Identify funds, permit restrictions
- Design → weigh costs, logistics, & scale

# *Over-Planting Limitations*

- Logistics
- Permitting
- Scale
- Funding purpose
  - Appropriations for Cultch and Sanctuaries
    - Outside of Scope
- **Ineffective at Accelerating**

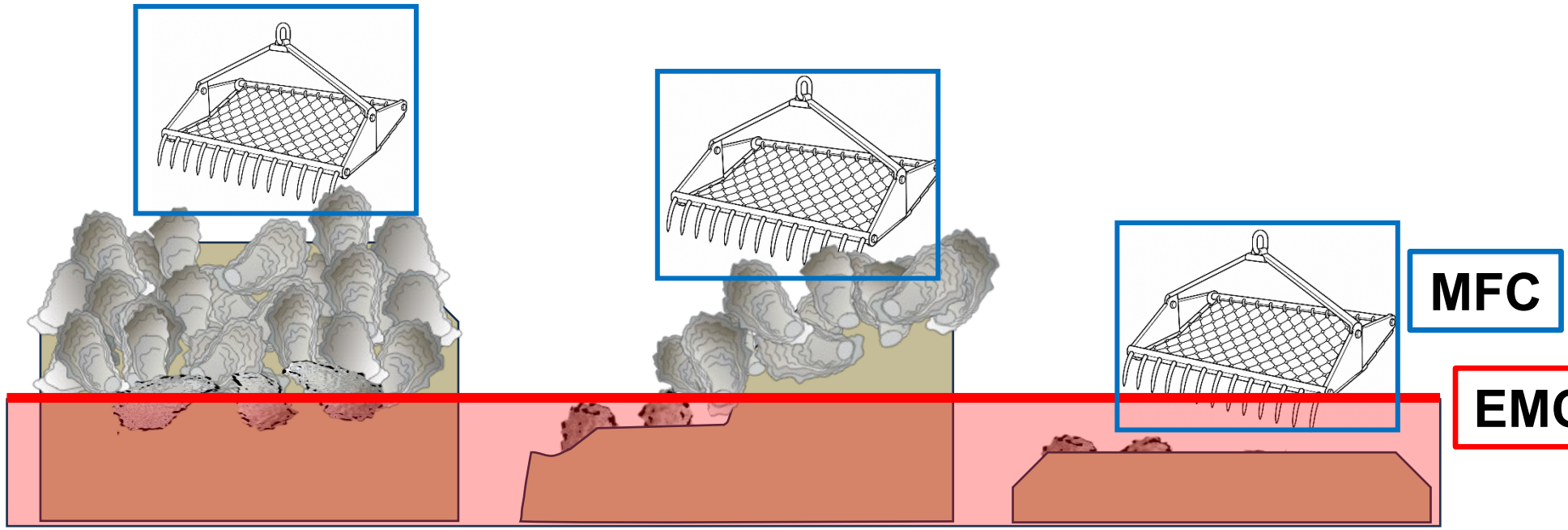


| Site Name | Scan Date | Avg Site Depth (ft) |
|---|---|---|
| PRD-5 | July 24, 2025 | 20.55 |
| **Avg Oyster Area Depth (ft)** | **Oyster Area Relief (ft)** | |
| 20.71 | 2 | |
| **Site Acreage** | **Oyster Area Acreage** | |
| 303.89 | 50.4 | |
| **Survey Crew** | **Notes** | |
| NH RM | Site depth varies throughout, oyser relief is approx. | |

# *Impacts on DORA Reefs*

- DORA Reefs
  - Fishing problem
  - Water quality problem
- DORA designation addresses fishing
  - Slow natural recovery
  - Desire to accelerate

- What else can be done?
- Water Quality Authority
  - Environmental Management Commission
  - Outside of MFC's



# *DORAs as a Model*

- Value of DORAs
  - Fishing Value
  - Habitat Value
    - Primary, Secondary, Tertiary Eco Service
  - Model Value
    - Limited Fishing Impacts
    - Step Down Understanding of Other Impacts (Qualitative)
      - Water Quality

# *Water Quality Rulemaking Efforts at the EMC*

- Tar-Pamlico and Neuse Nutrient Strategy
  - Progress made from Rules
    - 20-Year Analysis
    - Estuaries Remain as Impaired
  - Rise in Nitrogen Delivery—Non-Point Source
    - Climatic Shift
      - Agricultural Loading
    - Increased Development Loading
- Water Clarity Standard
  - DWR led Nutrient Criteria Development Process
    - SAV Minded
    - Could still be positive for DORAs
      - Same Drivers

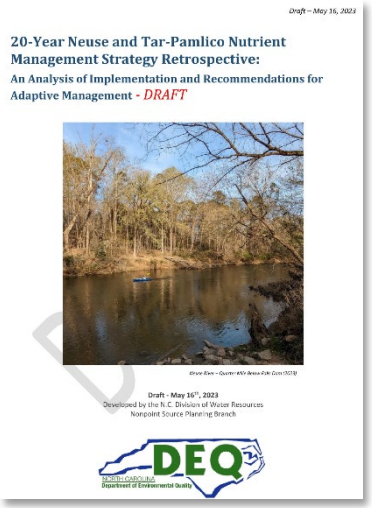
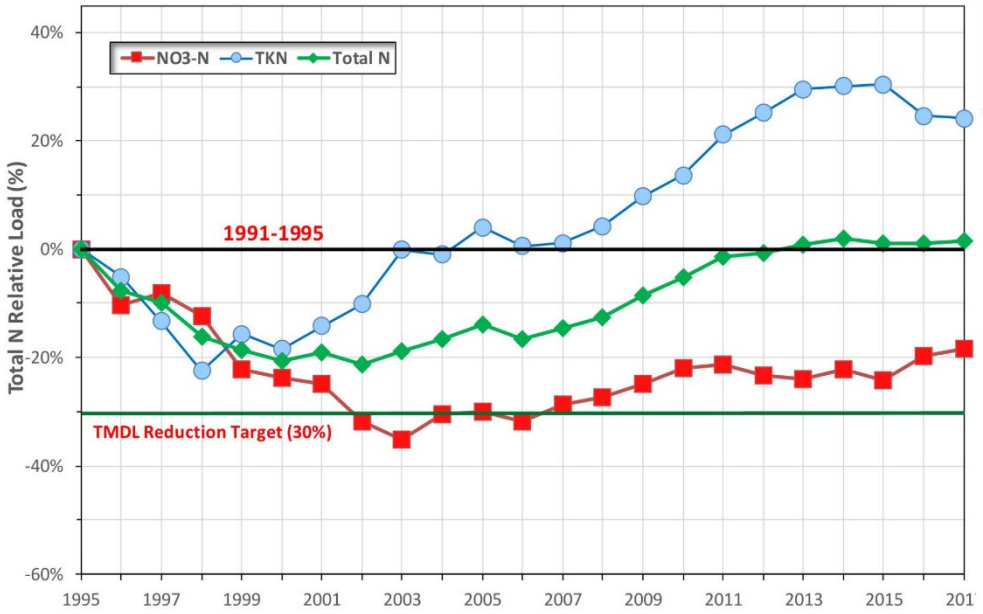



FIGURE 12. NITROGEN REDUCTION FOR AVERAGE FLOW CONDITION COMPARED TO 1991-1995 (FORT BARNWELL)



# *DORA Acceleration*

- MFC represents constituents
- MFC has done their (authority's) part
- Management has effects on users
- Next Step is aiding CHPP and DEQ Staff in these efforts

# *Questions?*


Bennett Paradis
Morehead City Office
Email: bennett.paradis@deq.nc.gov
Phone: 252-515-5482



McLean Seward
Wilmington Regional Office
Email: mclean.seward@deq.nc.gov
Phone: 910-796-7289



Zach Harrison
Morehead City Office
Email: zach.harrison@deq.nc.gov
Phone: 252-269-6169