Alabama Oyster Management and Oyster Reef Restoration Strategy

5-25-2022
Presentation

Image NOAA
Image © 2015 TerraMetric
Goal of Today’s Presentation

To provide information about:

- The Coastal Alabama Comprehensive Oyster Restoration Strategy as it relates to ongoing oyster reef restoration activities by the Alabama Marine Resources Division (AMRD)

- The role of AMRD and the Alabama Department of Public Health (ADPH) in oyster management

- The status of Alabama’s Public Oyster Reefs

- How AMRD manages oyster harvest

- Oyster Reef Restoration Techniques Past, Present, Future Implementing the Coastal Alabama Comprehensive Restoration Strategy
WHY ARE OYSTERS (and oyster reefs) IMPORTANT?

- Yum!
- Finfish and Invertebrate Habitat / Foraging Grounds
  - Images of fish and crustaceans
- Harvested Commercially and Recreationally
- Filter Water, Shoreline Stabilization, Erosion Control, Support Marsh and Seagrass Habitats

Images include real-life scenes of oyster harvesting and ecological benefits of reefs.
Oyster Reef Restoration Guidance Document

• Co-Written by AMRD and NOAA

• Defines Oyster Reef Restoration Goals in Alabama and

• Aligns Alabama’s Oyster Reef Restoration Goals to the Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS)
The specific goals of this Oyster Strategy Document are to:

Identify and Prioritize Restoration Strategies, Identify Data Gaps, Identify Adaptive Management Strategies

- Identify strategies to yield sustainable and resilient oyster populations in coastal Alabama;
- Prioritize potential restoration and enhancement strategies for implementation in the next 3-5 years;
- Identify science and/or data gaps that could help inform future restoration efforts; and
- Identify adaptive management strategies to address uncertainties associated with changing environmental conditions and/or project implementation.
The Conceptual Model
The Conceptual Model

**DRIVERS**
- Sea Level Rise
- Storms, High Rainfall
- Low Rainfall

**ECOSYSTEM RESPONSE**
- Water Depth Increase
- Sedimentation
- High Freshwater flows

**RESULTING CONDITION (EFFECT ON OYSTERS)**
- Shift landward of suitable depths (RA 1,7)
- Hypoxic/anoxic zones (oyster mortality, reduced feeding) (RA 1,8)
- Low salinity (decreased reproduction) (RA 2,3,4,6)

**RESTORATION ACTIVITIES (RA)**
1. Increase substrate and/or relief by planting culch and/or spat on shell (Techniques A, B, C)
2. Enhance oyster reef productivity through spawning stock enhancement projects (Techniques C)
3. Create reefs along gradient of salinities (Techniques A, C, D)
## The Conceptual Model

<table>
<thead>
<tr>
<th>Restoration Activities (RA)</th>
<th>PDARP Restoration Techniques</th>
<th>Outcomes</th>
<th>PDARP/RESTORE Oyster Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Increase substrate and/or relief by planting cultch and/or spat on shell Techniques A, B, C</td>
<td>A. Restore or create oyster reefs through placement of cultch in nearshore and subtidal areas. Outcomes i, ii, iii, iv, v</td>
<td>i. Enhanced spat settlement and recruitment under a variety of conditions</td>
<td>Restore oyster abundance and spawning stock to support a regional oyster larvae pool sufficient for healthy recruitment levels to subtidal and nearshore oyster reefs. <strong>RESTORE Goal:</strong> Replenish and protect living coastal and marine resources</td>
</tr>
<tr>
<td>2. Enhance oyster reef productivity through spawning stock enhancement projects. Techniques C</td>
<td>B. Construct living shorelines. Outcomes iii, v</td>
<td>ii. Positive rates of shell/reef accretion</td>
<td>Restore resilience to oyster populations that are supported by productive larval source reefs and sufficient substrate in larval sink areas to sustain reefs over time.</td>
</tr>
<tr>
<td>3. Create reefs along gradient of salinities Techniques A, C, D</td>
<td>C. Enhance oyster reef productivity through spawning stock enhancement projects. Outcomes ii, iv</td>
<td>iii. Network of oyster reefs viable under a range of conditions</td>
<td>Restore a diversity of oyster reef habitats that provide ecological functions for estuarine-dependent fish species, vegetated shoreline and marsh habitats, and nearshore benthic communities. <strong>RESTORE Goal:</strong> Restore and Conserve Habitat</td>
</tr>
</tbody>
</table>
Oyster Reef Management

AMRD Fisheries

- Collect Fisheries Dependent and Independent Data
- Oyster management includes reef productivity and harvest monitoring
- Planning and Execution of Reef Restoration Projects

AMRD Enforcement

- Enforce Laws and Regs pertaining to catch and size limits and laws established by the Alabama Department of Public Health (ADPH)
- Oyster management includes patrol of harvest areas, enforcement of sack limits, monitoring no harvest zones, confiscation and handling of oysters harvested/ handled outside of legal compliance

Alabama Marine Resources Division (AMRD)

- Setting harvest/landing time limits based on seasonal water and air temperatures (and other parameters)
- Inspection of seafood dealers / processors for compliance in product handling
- Facilitating Shellfish Harvest Area Openings and Closings based on potential health risk criteria

Alabama Department of Public Health (ADPH)
Alabama’s Main Oyster Reefs

<table>
<thead>
<tr>
<th>Oyster Reef</th>
<th>Acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buoy Reef</td>
<td>302.6</td>
</tr>
<tr>
<td>Cedar Point</td>
<td>2009.2</td>
</tr>
<tr>
<td>Dauphin Island Bay</td>
<td>521.8</td>
</tr>
<tr>
<td>Heron Bay</td>
<td>143.6</td>
</tr>
<tr>
<td>Portersville Bay Reefs</td>
<td>72.9</td>
</tr>
<tr>
<td>Kings Bayou</td>
<td>66.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3116.9</strong></td>
</tr>
</tbody>
</table>

Image: Google Earth
Oyster Landings 1980 – 2020

Commercial Oyster Landings in Meat lbs 1980 - 2020

Landings Include Public and Private Reefs and Aquaculture
<table>
<thead>
<tr>
<th>Harvest Season</th>
<th># Days</th>
<th># Sacks</th>
<th>Sacks/Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2011 - Spring 2012</td>
<td>38</td>
<td>48,581</td>
<td>1,278.4</td>
</tr>
<tr>
<td>Fall 2012 - Spring 2013</td>
<td>81</td>
<td>42,047</td>
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<td>63</td>
<td>12,274</td>
<td>194.8</td>
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<td>56</td>
<td>7,151</td>
<td>127.7</td>
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</tr>
<tr>
<td>Fall 2016 - Spring 2017</td>
<td>35</td>
<td>1,280</td>
<td>36.6</td>
</tr>
<tr>
<td>Fall 2017 - Spring 2018</td>
<td>6</td>
<td>136</td>
<td>22.7</td>
</tr>
<tr>
<td>Fall 2018 - Spring 2019</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Fall 2019 - Spring 2020</td>
<td>36</td>
<td>11,333</td>
<td>314.8</td>
</tr>
<tr>
<td>Fall 2020 - Spring 2021</td>
<td>47</td>
<td>22,070</td>
<td>469.6</td>
</tr>
<tr>
<td>Fall 2021 - Spring 2022</td>
<td>79</td>
<td>50,020</td>
<td>633.2</td>
</tr>
</tbody>
</table>
Hurricanes, Droughts, and Drills

**Hurricanes Caused:**
- Physical Devastation to Oyster Reefs
- Silting to Occur on Many Productive Reefs

**Drought Caused:**
- Decreased Fresh Water Flows Over Reefs
- Increased Average Salinity on Alabama’s Main Oyster Reefs
- Ideal Conditions for Oyster Drills to Proliferate and Decimate Oyster Reefs

*Stramonita haemastoma*
Deepwater Horizon Oil Spill
Salinity and Dissolved Oxygen Levels

- Salinity (ppt)
  - 19 days

- Dissolved Oxygen (mg/L)
  - 6 days
  - 16 days
  - 18 days
Salinity and Dissolved Oxygen Levels
Buoy Reef Jan 1, 2018 – Oct 29, 2018

Salinity (ppt)

Dissolved Oxygen (mg/L)

≈70 of 140 days
Below 4 mg/L
Salinity and Dissolved Oxygen Levels
Cedar Point Jan 1, 2020 – Sep 2, 2020

Salinity (psu)

Dissolved Oxygen (mg/L)
Salinity and Dissolved Oxygen Levels
East Fowl River Jan 1, 2021 – Aug 6, 2021

Salinity (ppt) - Area VI

Dissolved Oxygen (mg/L) - Area VI
Salinity and Dissolved Oxygen Levels

Denton Reef Jan 1, 2021 – Sep 2, 2021

Salinity (ppt) - Denton Reef

Dissolved Oxygen (mg/L) - Denton Reef

29 Days

31 days

39 days
Oyster Reef Assessment

Annual SCUBA Quadrat Dives:

• To determine oyster density on public reefs

• To set initial harvest goal for season
SCUBA Quadrat Sampling
(not to scale, enhanced water clarity)
SCUBA Quadrat Sampling
(not to scale, water clarity… about right)
Quadrat Sample Processing
Additional Oyster Reef Sampling Techniques

Hand Dredge

Hydraulic Patent Tongs
Harvest Monitoring

Flexible Harvest Goal utilizing:

- Oyster Management Station
- Reef Grid System
- On-water Harvester Surveys
Establishment of Oyster Management Stations

Laws and Regulation Changes
Implemented 2011

Public Reef Harvest Season Closed May 1 – Sept 31
Oyster Management Station

Alabama Oyster Management Station Card

Phone #: 251-555-1234
DOB: [Redacted]

Herrmann Jason
First Last
E: Mr. Suf

Ticket Number: 3
Date: 9/16/2011 4:23:47 PM

Fisherman: [Redacted]
Seafood ID: [Redacted]
Vessel: [Redacted]
Gear: 600 - Tongs

Trip Time: 3
Time Fished: 3
Reef Type: Public
Agent: TEST

Gear Quantity: 1
Reef: B3 - Relay Reef South
Area Fished: 10.2

Dealer: [Redacted]
Sacks: 2
Start Tag: 12
End Tag: 13

Dealer: [Redacted]
Sacks: 1
Start Tag: 11
End Tag: 11

Dealer: [Redacted]
Sacks: 1
Start Tag: 10
End Tag: 10

# Of Tags: 4
Tag Price: $0.35
Total Price: $1.40

I hereby certify that the above information is correct and accurate. I further understand that if oysters are transported to a location other than listed above, I must first contact the Alabama Marine Resources prior to delivery.

9/26/2011 9:20:14 AM
OMS Overview: Benefits

- To Consumer Safety
- To the Oyster Industry
- To Oyster Reefs
NEW TAG FOR RECREATIONAL OYSTER HARVEST

All recreational harvesters must purchase a recreational harvest tag at the Oyster Management Station.

Recreational tags cost $0.35

Recreational harvesters may harvest up to 100 legal size oysters per person per day and harvest may only occur during times and in areas open to public harvest.

**ALABAMA OYSTERS**

<table>
<thead>
<tr>
<th>RECREATIONAL OYSTER HARVEST TAG</th>
<th>NOT FOR SALE, BARTER, OR TRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE OF HARVEST</td>
<td>HARVESTER NAME</td>
</tr>
<tr>
<td>TIME OF LANDING</td>
<td>LOCATION</td>
</tr>
</tbody>
</table>

Recreational oyster harvesters may harvest up to 100 legal size oysters per person per day from public oyster reefs. Culling rules apply and will be enforced.

**CRASSOSTREA VIRGINICA**

Tag is required to be attached to each container of oysters at time of landing. Information must be complete and legible. Failure to properly complete each tag can result in confiscation and a fine up to $500.00.

Recreational oyster harvest must only occur during times and in areas that are open to commercial harvest.
Introduced New Reef Grid System in 2020 to help monitor harvest and to reduce overharvesting in specific areas with better resolution we may be able to allow additional harvest instead of closing large reef areas.
AMRD closes blocks of grids when they are harvested sufficiently.
How do harvesters know they are in the correct grid?

1. Navigate to the following link on your smartphone:
   https://www.outdooralabama.com/oysterharvest

2. Push this button at the top of the page

3. Push the “Target” Button

4. Follow directions to turn on location

5. Push the “Target” Button again to display position on Map

Harvester is the BLUE DOT

The BLUE DOT WILL MOVE ON THE MAP WHEN THE HARVESTER MOVES

Only Open Grids are Displayed
Harvester Reports the Grid Harvested

Harvest Effort
Total Sack
- 1.01 - 25.0
- 25.01 - 50.0
- 50.01 - 100.0
- 100.01 - 500.0
- 500.01 - 1000.0
- 1000.01 - 2000.0
- 2000.01 - 5160.2

2021 - 2022 Total Oyster Harvest
Purpose of Harvester Surveys:

- Verification of Grids Reported
- Assess harvest status by evaluating oysters and reef material on harvest vessel cull board
### Status of Alabama Oyster Reefs

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AMRD Oyster Reef Restoration Projects

**Past:**
- Cultch Planting
- Oyster Relaying
- Oyster Seed Planting

**Present:**
- Cultch Planting
- Oyster Relaying
- Oyster Seed Planting
- Experimental Projects Including:
  - Remote Setting of Oysters
  - Reef Cultivation
  - Reef Cultch Height and Cultch Configuration
- Side Scan Sonar and Multibeam Surveys

**Future:**
Implementation of the **Coastal Alabama Comprehensive Oyster Restoration Strategy**
Cultch Planting
782,062 cubic yards of cultch material planted between 1972 and 2016

Deployment of oyster shell, limestone, or other cultch material to provide a substrate for oyster settlement and growth
Oyster Relay Operations
(Large Scale)

Oyster Harvesters were paid to harvest oysters and cultch and deposit on barge (2010) or transplant to deployment area directly (2011).
Oyster Seed Planting

AMRD Staff Deploying Aquacultured Seed
AMRD Cultch Plantings and Relays
2007 – 2012
(Emergency Disaster Relief Program)

<table>
<thead>
<tr>
<th>Year</th>
<th>Cultch (c.y.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>31,500</td>
</tr>
<tr>
<td>2008</td>
<td>24,000</td>
</tr>
<tr>
<td>2009</td>
<td>16,733</td>
</tr>
<tr>
<td>2010</td>
<td>4,757 (Relay)</td>
</tr>
<tr>
<td>2011</td>
<td>4,457 (Relay)</td>
</tr>
<tr>
<td>2012</td>
<td>5,104</td>
</tr>
<tr>
<td>Cultch</td>
<td>77,337</td>
</tr>
<tr>
<td>Relay</td>
<td>9,214</td>
</tr>
<tr>
<td>Total</td>
<td>86,551</td>
</tr>
</tbody>
</table>
AMRD Cultch Plantings
Lower Mobile Bay / MS Sound Spring 2014 and 2016
(National Fish and Wildlife Foundation)

<table>
<thead>
<tr>
<th>Year</th>
<th>Cultch (c.y.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>27,957</td>
</tr>
<tr>
<td>2016</td>
<td>21,554</td>
</tr>
<tr>
<td>Total</td>
<td>49,511</td>
</tr>
</tbody>
</table>
AMRD Cultch Plantings
Mid - Mobile Bay Fall 2014
(National Fish and Wildlife Foundation)

<table>
<thead>
<tr>
<th>Year</th>
<th>Cultch (c.y.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>10,990</td>
</tr>
<tr>
<td>Total</td>
<td>10,990</td>
</tr>
</tbody>
</table>
AMRD Cultch Planting
Lower Mobile Bay / MS Sound 2015
(National Oceanic and Atmospheric Administration, Deepwater Horizon National Resource Damage Assessment)

<table>
<thead>
<tr>
<th>Plant Year</th>
<th>Cultch Planted (yd³)</th>
<th>Heron Bay 01 – HB01</th>
<th>Heron Bay 02 – HB02</th>
<th>Cedar Point East – CPE</th>
<th>Cedar Point West – CPW</th>
<th>All 2015 NRDA Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>OS=13,196.6 LS=52,343.5 Total=65,540.1</td>
<td>= 56.5 acres</td>
<td>= 142.8 acres</td>
<td>= 213.5 acres</td>
<td>= 111.1 acres</td>
<td>= 524.0 acres</td>
</tr>
</tbody>
</table>

Mississippi Sound

Mobile Bay

Image © 2019 TerraMetrics
AMRD Experimental Reef Cultivation
Lower Mobile Bay / MS Sound 2014 and 2016
(National Fish and Wildlife Foundation)

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (Acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>18</td>
</tr>
<tr>
<td>2016</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
</tr>
</tbody>
</table>
AMRD Experimental Remote Setting
Lower Mobile Bay / MS Sound 2016 and 2017
(National Fish and Wildlife Foundation)

<table>
<thead>
<tr>
<th>Year</th>
<th>Deployment Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>2</td>
</tr>
<tr>
<td>2017</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
</tr>
</tbody>
</table>
AMRD Seed Planting
Lower Mobile Bay / MS Sound 2013 – 2015
(for the NFWF made possible by the generous seed donations from the Auburn Shellfish Laboratory, Dauphin Island, AL)

<table>
<thead>
<tr>
<th>Year</th>
<th>Individual Oysters (&lt;0 mm – 50 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total 2013 - 2015</td>
<td>41,069,890</td>
</tr>
</tbody>
</table>
Remote Setting of Oysters

Funded by the National Fish and Wildlife Foundation in collaboration with the Auburn University Shellfish Laboratory

Purpose of Study:
To determine if there is a significant difference in final oyster density of remote set oysters when compared to natural oyster recruitment on cultch material.
DWH NRDA Restore Act Funds

Experimental Restoration Strategies

• Evaluating New Areas to Plant

• Evaluating New Techniques to Plant Cultch

• Reducing Mortality Through Remote Setting of Oysters
Oyster Reef Mapping

AMRD is using side scan sonar to survey recent and historical oyster reef footprints.

This data will be used to find suitable bottoms for reef restoration and update oyster reef maps by determining the area of known oyster reefs.

This will aid in planning future oyster restoration projects.
Reef Height and Configuration Experiments
Small scale experimental projects to look at alternate methods of planting cultch including:

- Planting Cultch in Mounds
- Planting Cultch in Lines to Create Furrows

<table>
<thead>
<tr>
<th>Post Construction Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denton Reef and Area VI of Oyster Shell (OS) and #4 Limestone (LS) Mounds</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Denton Mounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. OS (45 c.y.)</td>
</tr>
<tr>
<td>2. LS (45 c.y.)</td>
</tr>
<tr>
<td>3. OS (45 c.y.)</td>
</tr>
<tr>
<td>4. LS (45 c.y.)</td>
</tr>
<tr>
<td>5. OS (45 c.y.)</td>
</tr>
<tr>
<td>6. LS (45 c.y.)</td>
</tr>
<tr>
<td>Control 1. OS (45 c.y.)</td>
</tr>
<tr>
<td>Control 2. LS (45 c.y.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area VI Mounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a. LS (15 c.y.)/1b. OS (15 c.y.)</td>
</tr>
<tr>
<td>2a. LS (15 c.y.)/2b. OS (15 c.y.)</td>
</tr>
<tr>
<td>3a. LS (15 c.y.)/3b. OS (15 c.y.)</td>
</tr>
<tr>
<td>Control 1. OS (22.55 c.y.)</td>
</tr>
<tr>
<td>Control 2. LS (22.55 c.y.)</td>
</tr>
</tbody>
</table>
Future Projects Through DWH NRDA Restore Act

Deploying Remote Set Oysters Strategically in certain areas and in conjunction with certain projects such as living shorelines and marsh restoration.
AMRD Oyster Reef Restoration Projects

**Future:**

Implementation of the

*Coastal Alabama Comprehensive Oyster Restoration Strategy*

- Cultch Planting various planting techniques
- Oyster Relaying
- Oyster Seed Planting
- Remote Set of oysters on Half Shell
- Side Scan Sonar and Multibeam Surveys to identify additional suitable bottoms for oyster reefs
- Surveys of intertidal oyster populations
- Larval Transport Modeling
- Seasonal flow and hydrology modeling
Larval Transport and Flow Modeling

**Figure 5.** Observed (a) oyster spat settlement (spats m\(^{-2}\) d\(^{-1}\)) and (b) bivalve larval concentration (larvae per 10 L) compared with the model results (c) by physical transport only and (d) by physical transport and biological movement, averaged over surveys 11 to 19. Color bars indicate log\(_{10}\)-transformed data and model results.

Image from Kim et al., 2010
Questions?