Virginia: Oyster Ecosystem Restoration

Susan Conner
Chief, Environmental Analysis Section
U.S. Army Corps of Engineers, Norfolk District

Oyster Management and Restoration

These are two separate, but related, concepts.

Both concepts are very important and should be able to co-exist in harmony.

VMRC has discussed oyster management in Virginia.

This presentation will focus on oyster restoration.

Background

Overarching Goals

Restoration Targets: NORMP

Tier 1 Tributaries/Areas	Restoration Target (Acres)
Great Wicomico River	100 - 400
Lower Rappahannock River	1,300 - 2,600
Piankatank River	700 - 1,300
Mobjack Bay	800 - 1,700
Lower York River	1,100 - 2,100
Pomocoke/Tangier Sound	3,000 - 5,900
Lower James River	900 - 1,800
Upper James River	2,000 - 3,900
Elizabeth River	200 - 500
Lynnhaven River	40 - 150

GIT Oyster Metric Operational Goals

- Reef-level
  - Shell, alternative substrate, or spat-on-shell should cover a minimum of 30% coverage throughout the target reef area.

- Tributary-level:
  - A minimum of 50% of currently restorable area that constitutes at least 8% of historic oyster habitat within a given tributary meets the reef-level goals defined above.

GIT Reef-Level Success Metrics

Threshold (minimum)

- 15 oysters/m^2
- 15 grams dry weight /m^2
- From two year classes
- Covering at least 30% of the reef area

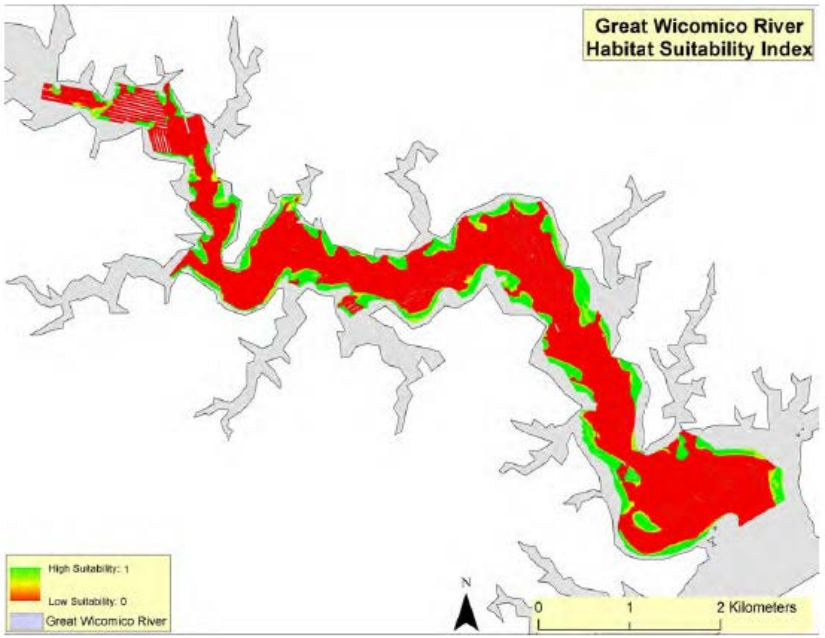
Target (goal)

- 50 oysters/m^2
- 50 grams dry weight /m^2
- From two year classes
- Covering at least 30% of the reef area

- Neutral or positive shell budget and change in reef spatial extent and height

GIT Tributary-Level Success Metrics

- Minimum of 50% of the currently restorable bottom
  - That comprises at least 8% of the historic oyster bottom
    - And meets the reef-level goals



Oyster Restoration Goals

- Executive Order 13508: "Strategy for Protecting and Restoring the Chesapeake Bay Watershed"
  - Restore native oyster habitat and populations in 10 tributaries by 2025

Virginia Oyster Restoration Projects

- Several projects in tributaries throughout the Chesapeake Bay
- Partners in Virginia Oyster Restoration: VMRC, City of Virginia Beach, CBF, TNC, City of Norfolk, ERP, Lynnhaven NOW, USACE, NOAA…
- Multiple stages:
  - Planning
  - Pre-construction / Permitting
  - Post Construction / Monitoring

Reef Structural Growth

Contributing Factors

- Natural spat set
- Oyster growth
- Set and growth of other hard-shelled organisms
- Maintenance plantings of shell or seed oysters

Decreasing Factors

- Subsidence of constructed substrate and/or shell (e.g., post-construction subsidence into soft bottom)
- Sedimentation
- Shell dissolution in excess of accretion
- Negative or illegal harvest activity

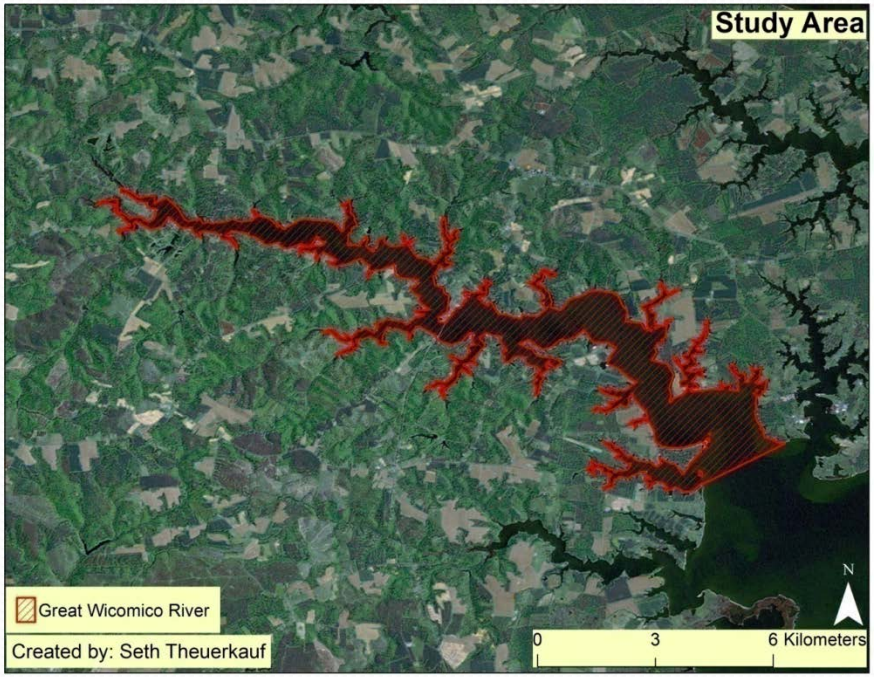
Benefits of Sanctuaries

- High-density interconnected reef system
- All-natural selection for disease resistance
- Enhanced habitat
- Improved water quality and sediment stability

Great Wicomico River

Great Wicomico Project Details

- 85 acres of sanctuary reefs
  - 55 acres of low-relief reefs
  - 30 acres of high-relief reefs
- Construction completed 2004
- $4 million in federal funds



US Army Corps of Engineers
Norfolk District

Northumberland County, VA
OYSTER RESTORATION
GREAT WICOMICO RIVER
Bottom Type

0 250 500 1,000 1,500 2,000 Feet

Legend
Great Wicomico Reefs
Low Relief
Medium Relief
Baylor Grounds

Bottom Type
Oyster Shell Placement
Shells may have been placed
Oyster Rock, VIMS

Shell and Mud
Shell and Sand
Buried Shell
Sand

Sand and Mud
Clay
Gravel
Stones
Barren Bottom
COE Oyster Reef

Projection:
Virginia State Plane
South Zone - NAD 83
U.S. Survey Feet

Base Map:
ESRI Online Imagery

Project Manager: Jennifer Armstrong
E-mail: Jennifer.R.Armstrong@usace.army.mil
Phone: (757) 201-7704

Prepared by: Karin Dridge
Geospatial Section

Map File: gw_suitable_bottom2013.mxd
Map Date: 25 November 2013

GWR Oysters

HIGH-RELIEF REEFS

- HSI > 0.3
  - mean density of 215 adults m^{-2}
  - 100% above target goal
- HSI < 0.3
  - mean density of 118 adults m^{-2}
  - 80% above target goal

LOW-RELIEF REEFS

- HSI > 0.3
  - mean density of 106 adults m^{-2}
  - 73% above target goal
- HSI < 0.3
  - mean density of 24 adults m^{-2}
  - 13% above target goal

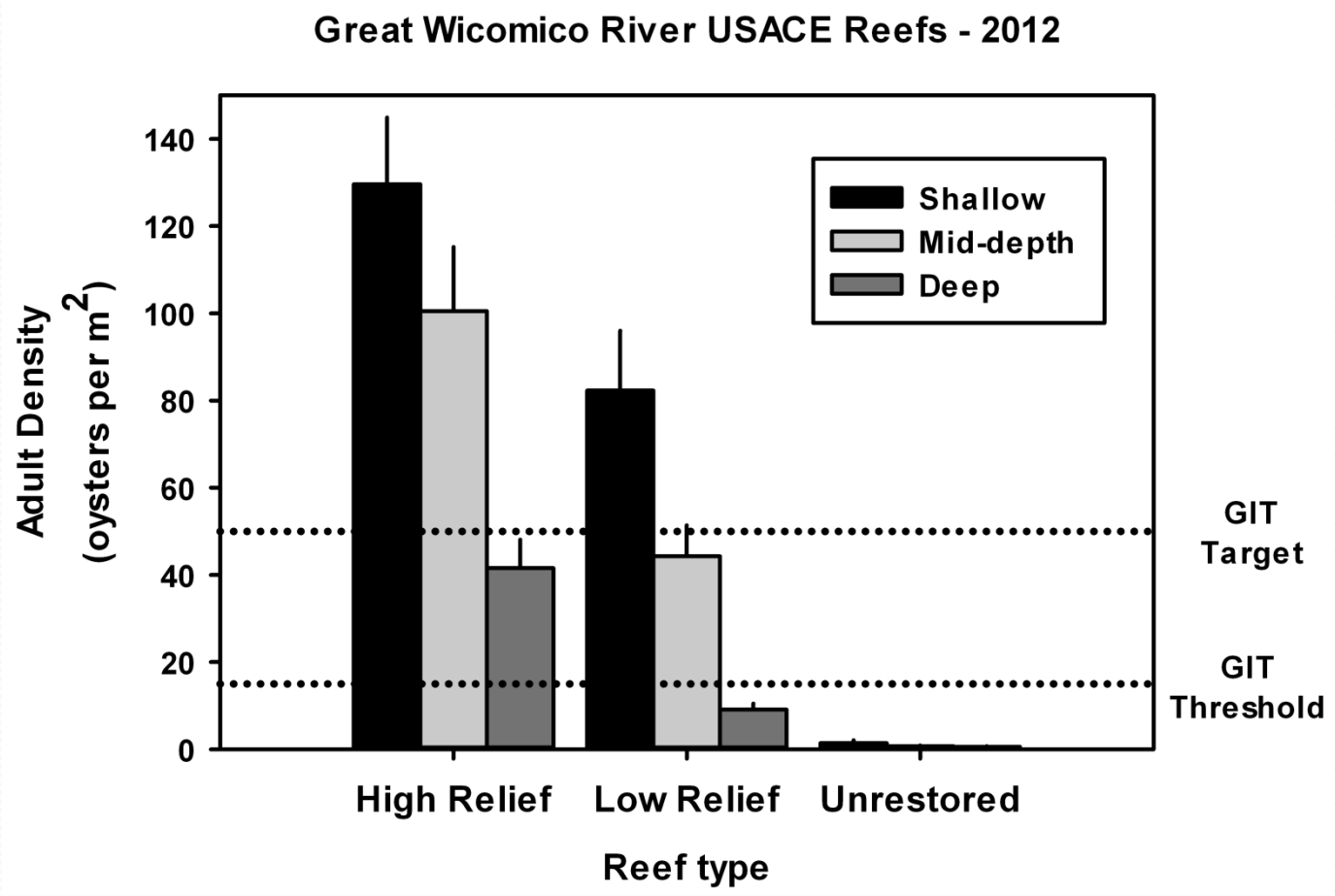
GWR Oysters

Reef Type	Depth	Acres	Adult density m^{-2}	GIT Threshold?
High Relief	Shallow	8.443	129.6	Yes
	Mid-Depth	12.261	100.5	Yes
	Deep	10.856	41.6	Yes
Low Relief	Shallow	20.315	82.3	Yes
	Mid-Depth	9.675	44.3	Yes
	Deep	23.010	9.1	No
Total		**84.56**		**73%**

GWR Oysters

- The GIT target was exceeded in 49% (41.02 acres) of the reef acreage
- High-relief reef performed much better than low-relief reef, as did reefs constructed in shallower habitats

GWR Oysters


Great Wicomico River USACE Reefs - 2012
Adult Density (oysters per m2)
140
120
100
80
60
40
20
0
Shallow
Mid-depth
Deep
GIT Target
GIT Threshold
High Relief
Low Relief
Unrestored
Reef type

Restored Tributary

- 100-400 acres needed for restored tributary
- Currently ~61 acres are meeting GIT threshold

Poaching

- Noted during the 2011 survey
- Market-sized adult oyster missing (> 75 mm or 3”)
- Shells were gone - indication of poaching activity, not disease or predation

Poached vs. Unpoached Reef Samples

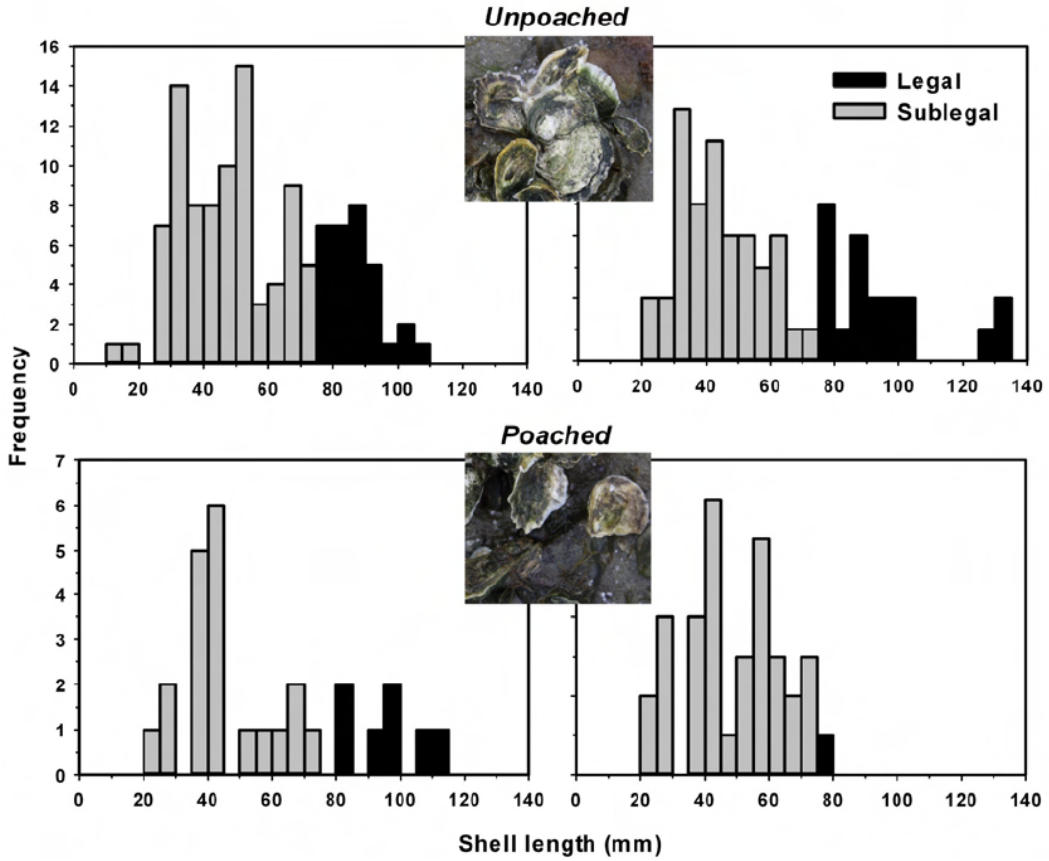


Figure 19: Size frequency histograms for unpoached versus poached oyster reefs derived from the 2011 Great Wicomico River reef monitoring sampling (m^{-2}) (Adapted from Walker et al., 2012 (in prep)).

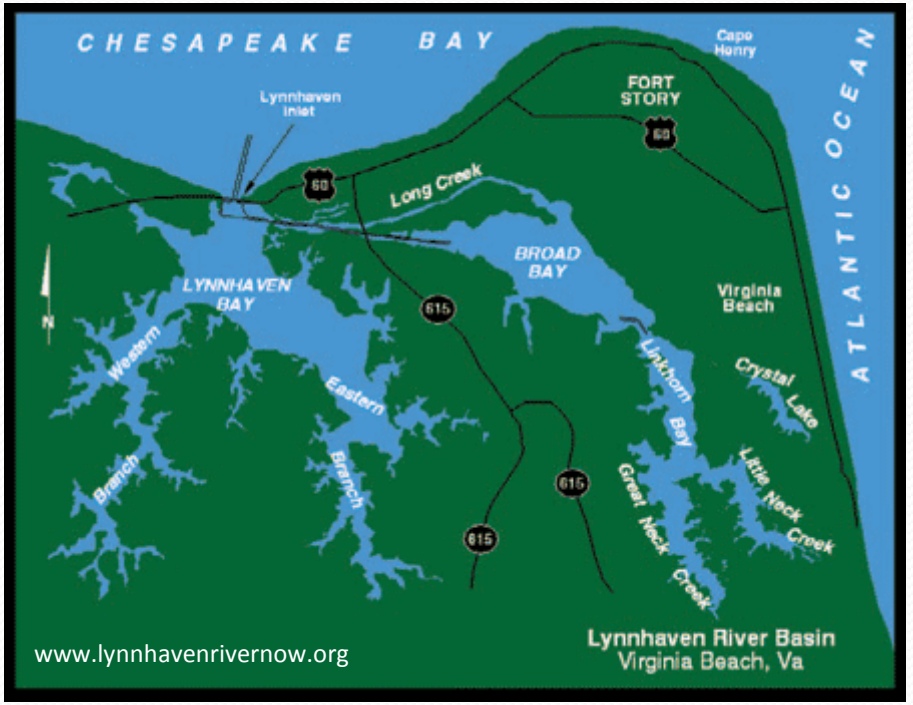
Future Plans…

- Proposed rehabilitation of the Low-Relief and Poached Reefs
- 17.6 acres
- Plans include the use of Anti-Poaching devices – Class 1 VDOT stone
- Collect the healthy oysters
- Bring low-relief up to high-relief
- Replace the healthy oysters

LYNNHAVEN

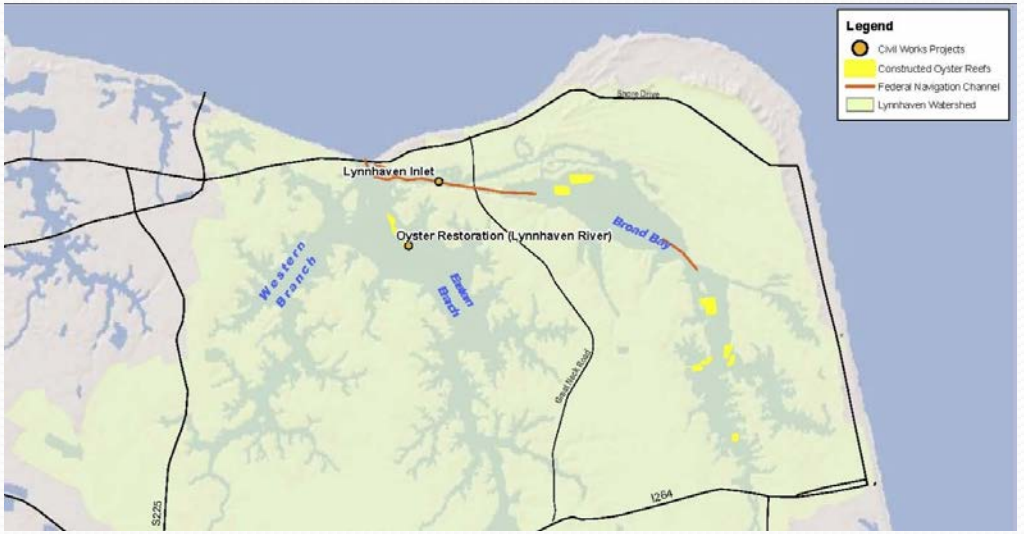
Lynnhaven River Basin

- Subestuary of lower Chesapeake Bay located in the City of Virginia Beach
- Less than 0.01 % of the Chesapeake Bay watershed
- Environmental decline traced to agricultural practices and continues because of dense development.



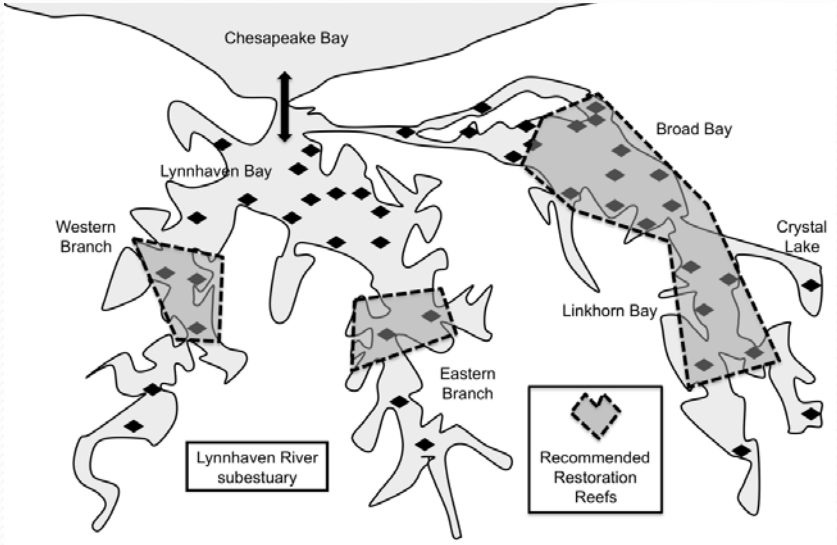
Present…

- High recruitment and large numbers
- Some oysters as large as 8-inches in length!



Lynnhaven Project Details

- 58 acres of sanctuary reefs constructed by USACE, 63 acres total (VMRC, VA Beach, Lynnhaven River NOW)
- Construction completed 2007-2008
- $5 million in federal funds



US Army Corps of Engineers
Norfolk District

Virginia Beach, Virginia

Native Oyster Restoration Project
Lynnhaven River
FY07 and FY08 Construction Areas

0 3,000 Feet

1" = 3,000'

Reef Constructed Areas

Construction Year

2007

2008

Projection:
Virginia State Plane
South Zone - NAD 83
U.S. Survey Feet

Aerial Photography Date:
VGIN south 2007

Project Manager: Brian Rheinhart
E-mail: brian.k.rheinhart@usace.army.mil
Phone: (757) 201-7768
Fax: (757) 201-7036

Prepared by: Geospatial Services Section

Map File: Construction_fy09.mxd
Map Date: 9 Feb 2009

Lynnhaven River Oysters

- Shell Length:
  - Age 0 oysters – shell length generally < 30 mm
  - Adult oysters – 30 – 200 mm
- Density
- Biomass
- Abundance – total almost 16 million
  - Juvenile – 3,784,221
  - Adult – 12,086,971

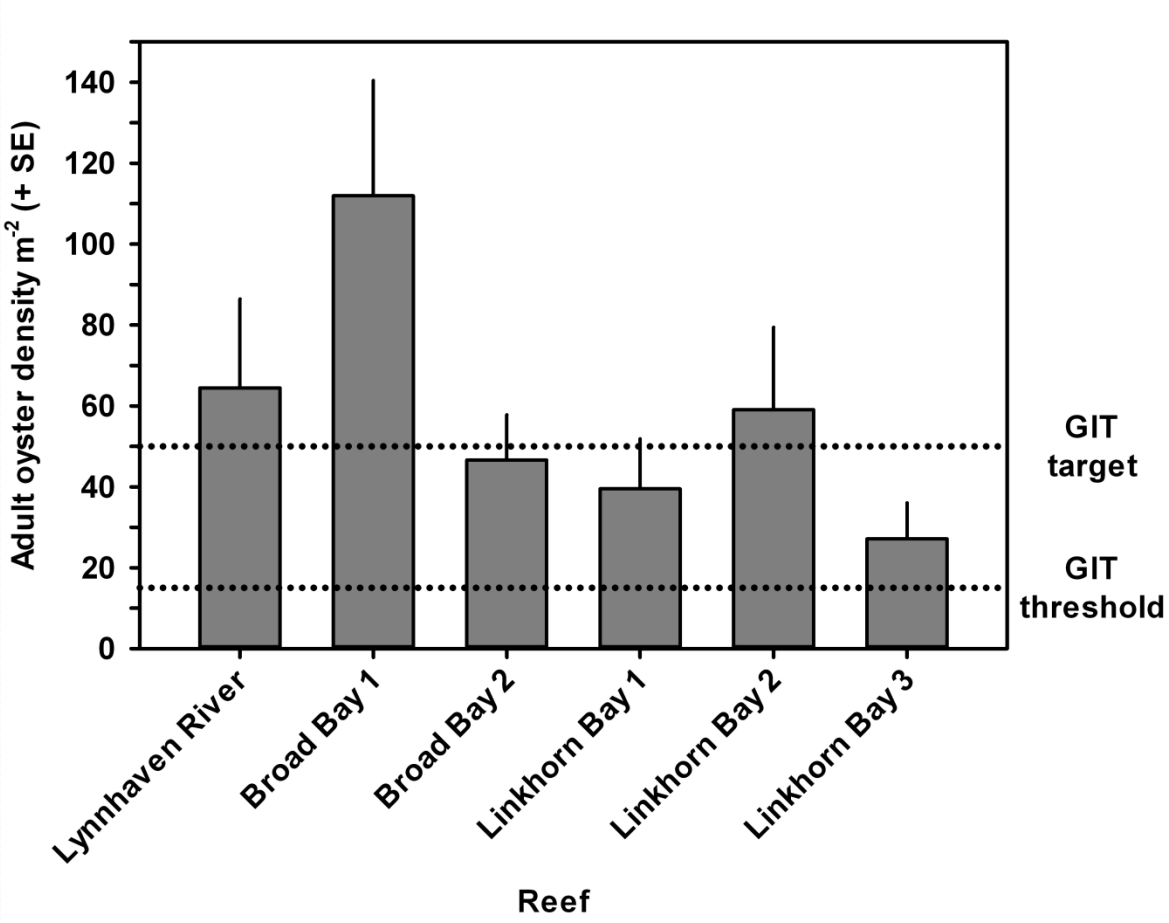
Lynnhaven River Oysters

- All reefs (50.83 acres) sampled exceeded the GIT thresholds for adult oyster density and biomass.
- Two smaller reefs in the Lynnhaven River could not be sampled due to their shallow water depth, and are not included in this analysis.
- The GIT targets, 50 oysters m^{-2} and 50 AFDM g m^{-2} of oysters, were exceeded in 51.2% (26.02 acres) of the reef acreage.

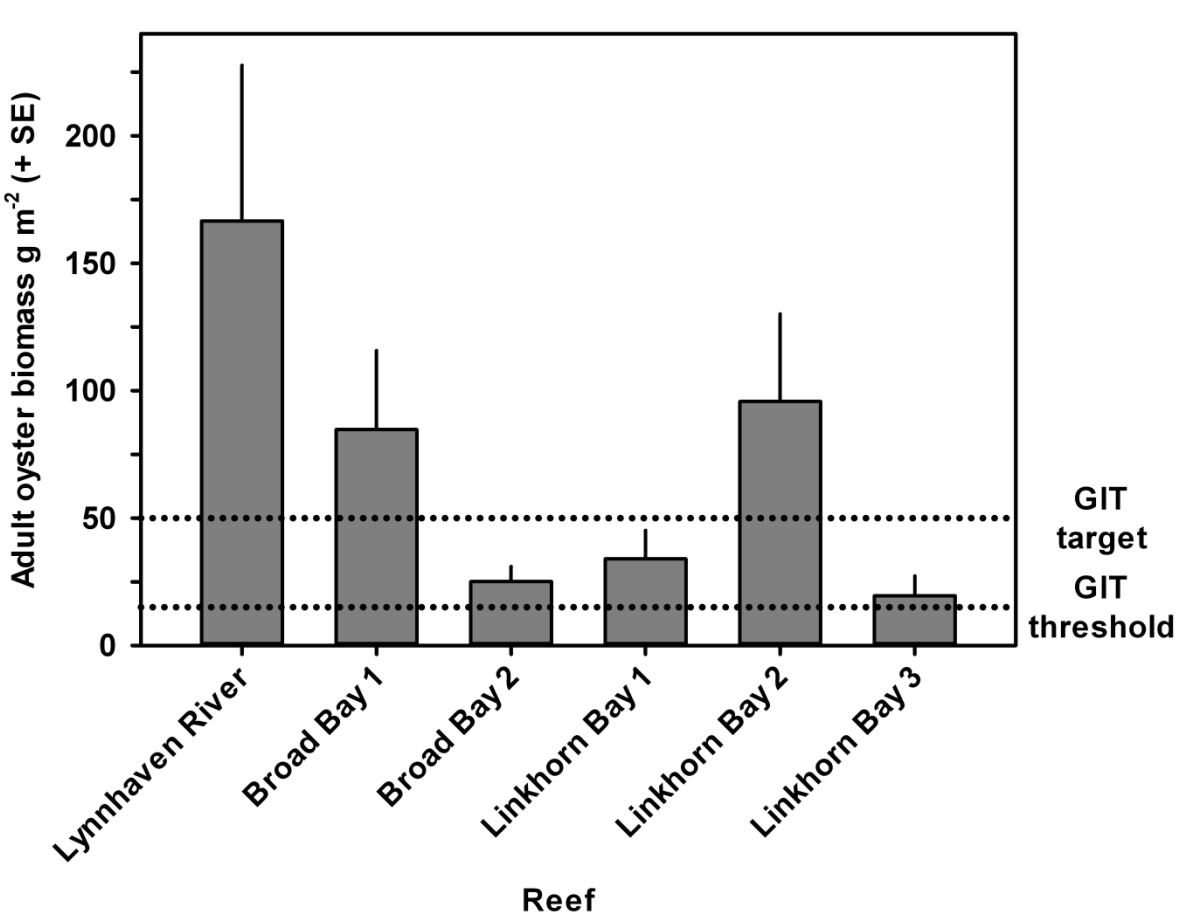
Lynnhaven River Oysters

Location	Acres	Adult density m^{-2}	Adult biomass m^{-2}	GIT Threshold?
Lynnhaven River 1 & 2	4.00	64.46	166.58	Yes
Broad Bay 1 & 2	8.01	111.95	84.71	Yes
Broad Bay 3	12.01	46.65	25.09	Yes
Linkhorn Bay 1	8.01	39.51	34.02	Yes
Linkhorn Bay 2	14.01	59.08	95.74	Yes
Linkhorn Bay 3, 4 & 5	4.79	27.13	19.46	Yes
Total	50.83			100%

Adult Oyster Density

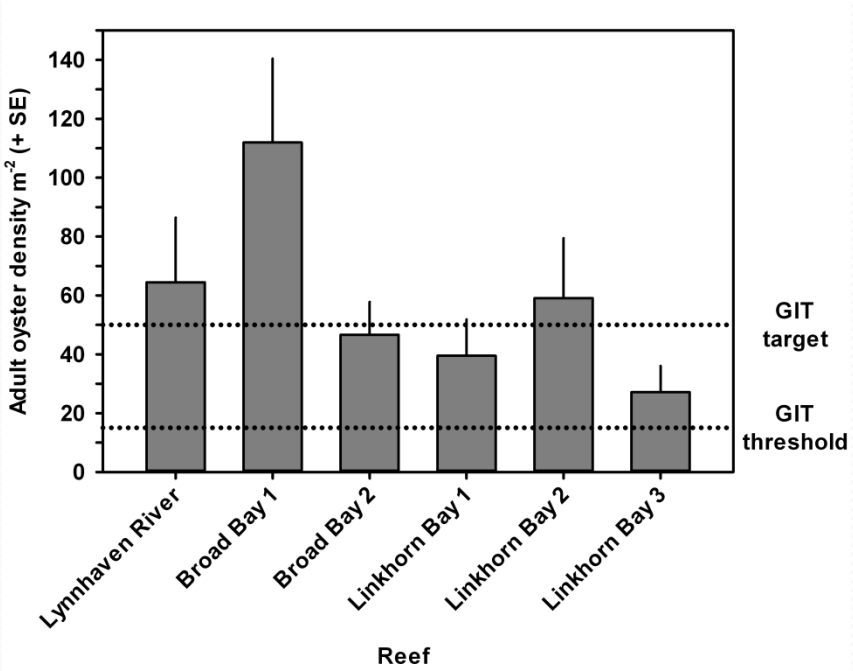


Adult Oyster Biomass

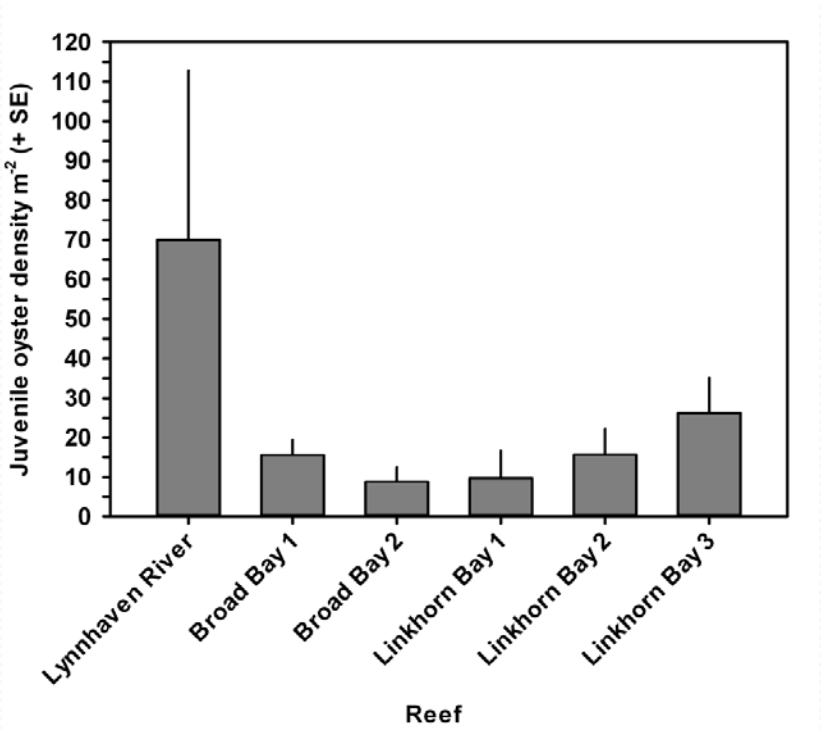


Oyster Density

Adult

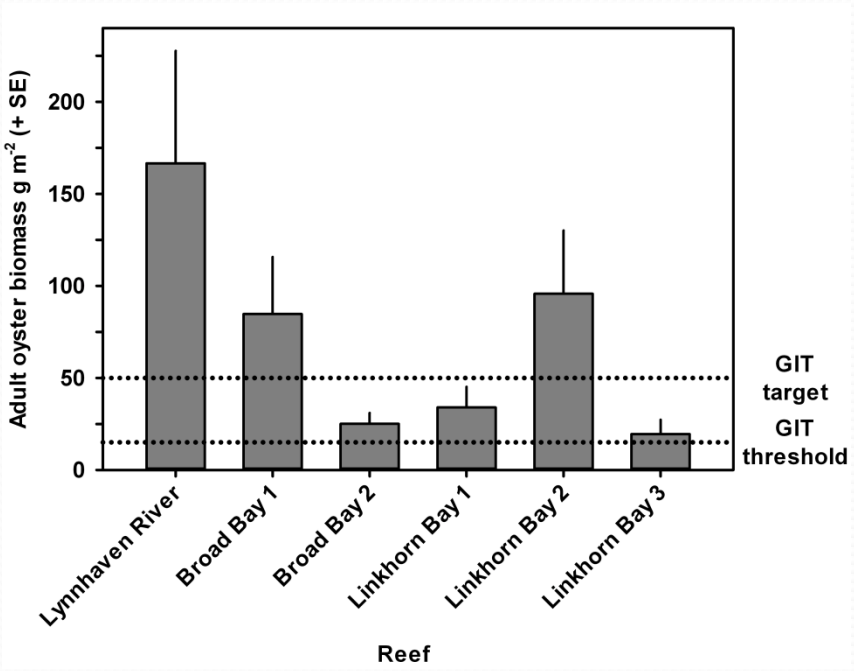


Juvenile

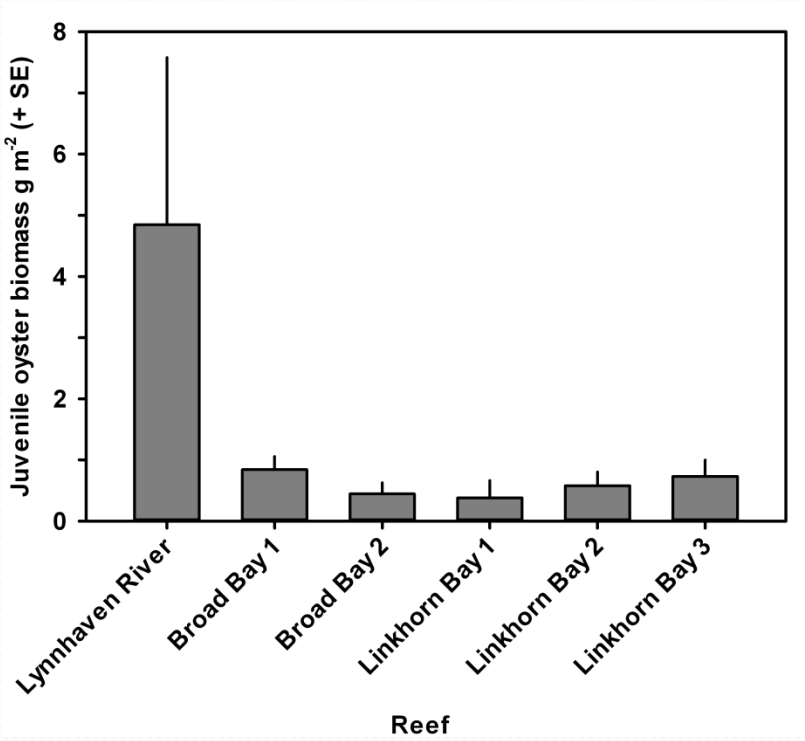


Oyster Biomass

Adult



Juvenile



Steps to Success

- Higher reefs to escape siltation
- Proper positioning maximizes retention of larvae
- Planting of disease-resistant native oysters
- Reefs are permanent sanctuaries and not to be fished for oysters

Restored Tributary

- 40 - 150 acres needed to be restored
- 53 acres restored so far

Future…

- 38 acres wetland restoration and diversification
- 94 acres restoration of SAV beds and 22 acres bay scallop restoration
- 31 acres hard reef habitat - not formulated for oysters but oysters are likely result

LAFAYETTE

Restored Tributary

- 200 - 500 acres needed to be restored (Elizabeth River)
- ?? acres restored so far

Lafayette River

- A 6.2-mile-long tributary of the Elizabeth River
- Restoration projects: ERP, CBF, NOAA, VMRC
- USACE Section 22: Assessment of Oyster Reefs in the Lafayette River as a Chesapeake Bay TMDL BMP
- USACE Section 22: Assessment of Oyster Reefs in the Lafayette River
  - Part 1 – oyster population survey
  - Part 2 – identify locations for future oyster projects

Lafayette River Seabed Habitats

Based on an acoustic (SONAR) mapping survey conducted by the NOAA Chesapeake Bay Office
January 2012

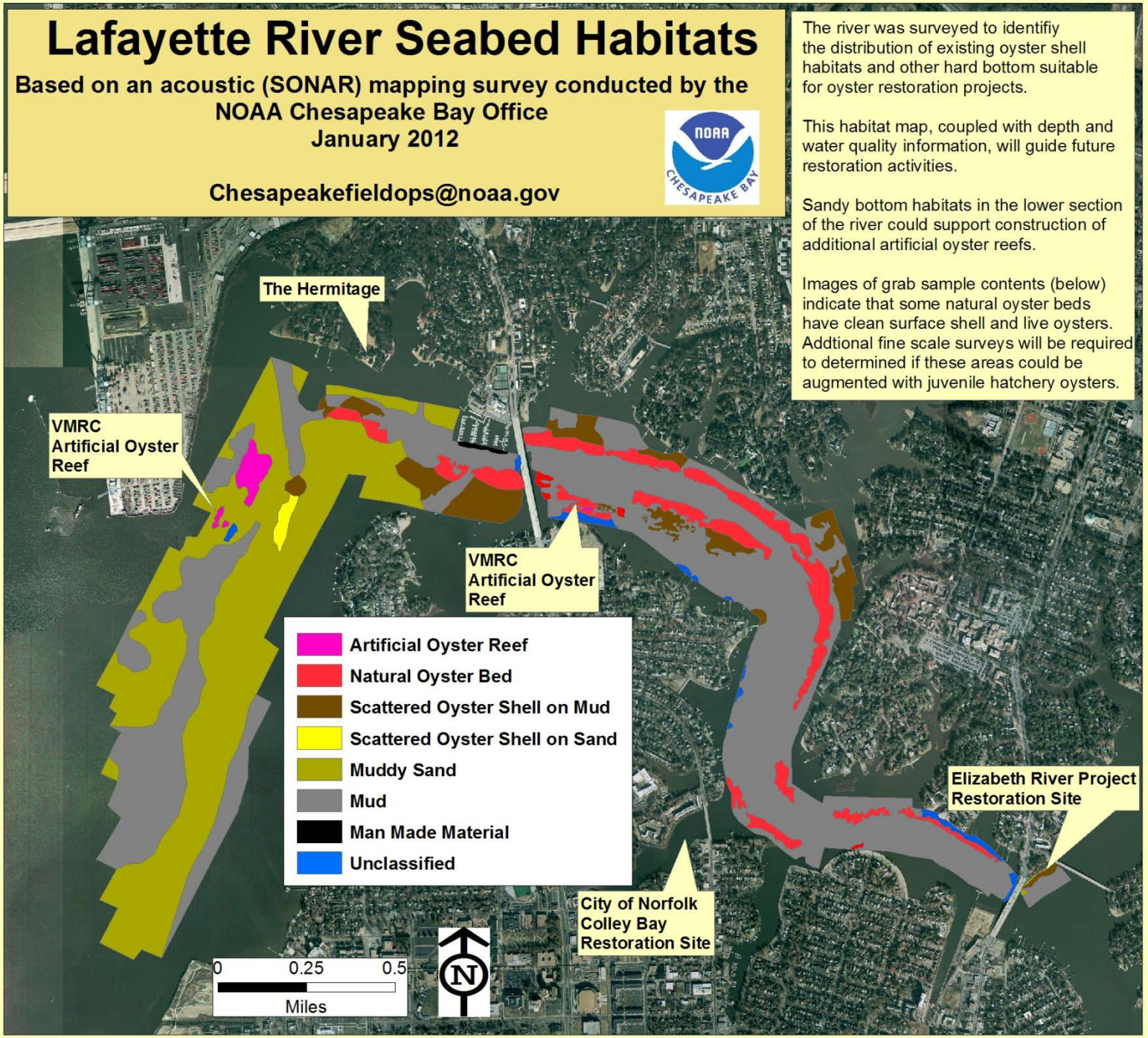
Chesapeakefieldops@noaa.gov

The river was surveyed to identifiy the distribution of existing oyster shell habitats and other hard bottom suitable for oyster restoration projects.

This habitat map, coupled with depth and water quality information, will guide future restoration activities.

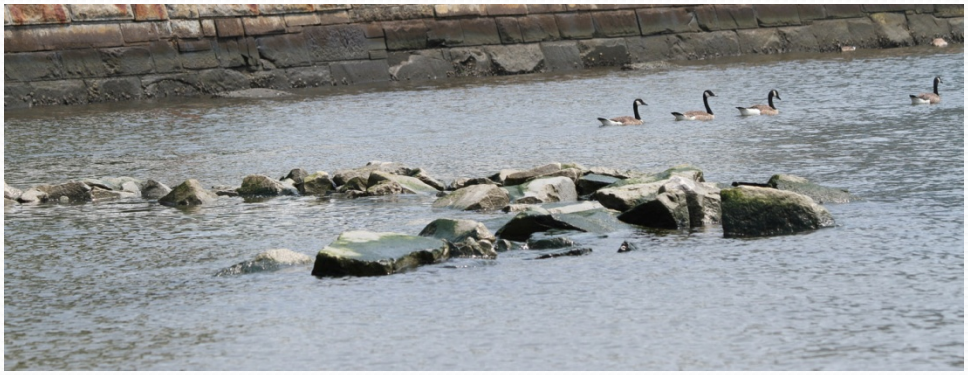
Sandy bottom habitats in the lower section of the river could support construction of additional artificial oyster reefs.

Images of grab sample contents (below) indicate that some natural oyster beds have clean surface shell and live oysters. Addtional fine scale surveys will be required to determined if these areas could be augmented with juvenile hatchery oysters.



Elizabeth River

- STEM – Fort Norfolk Oyster Reef



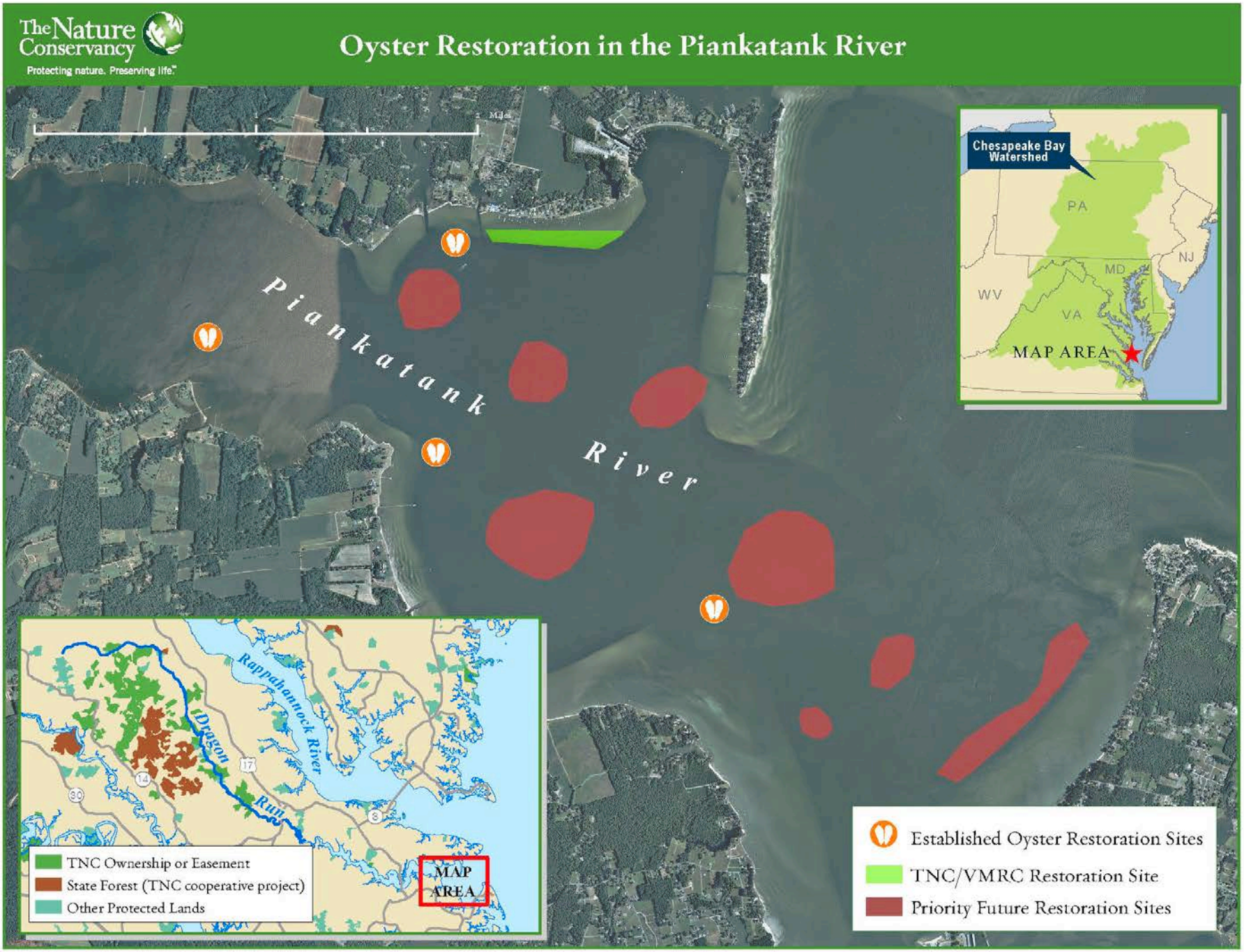
Elizabeth River

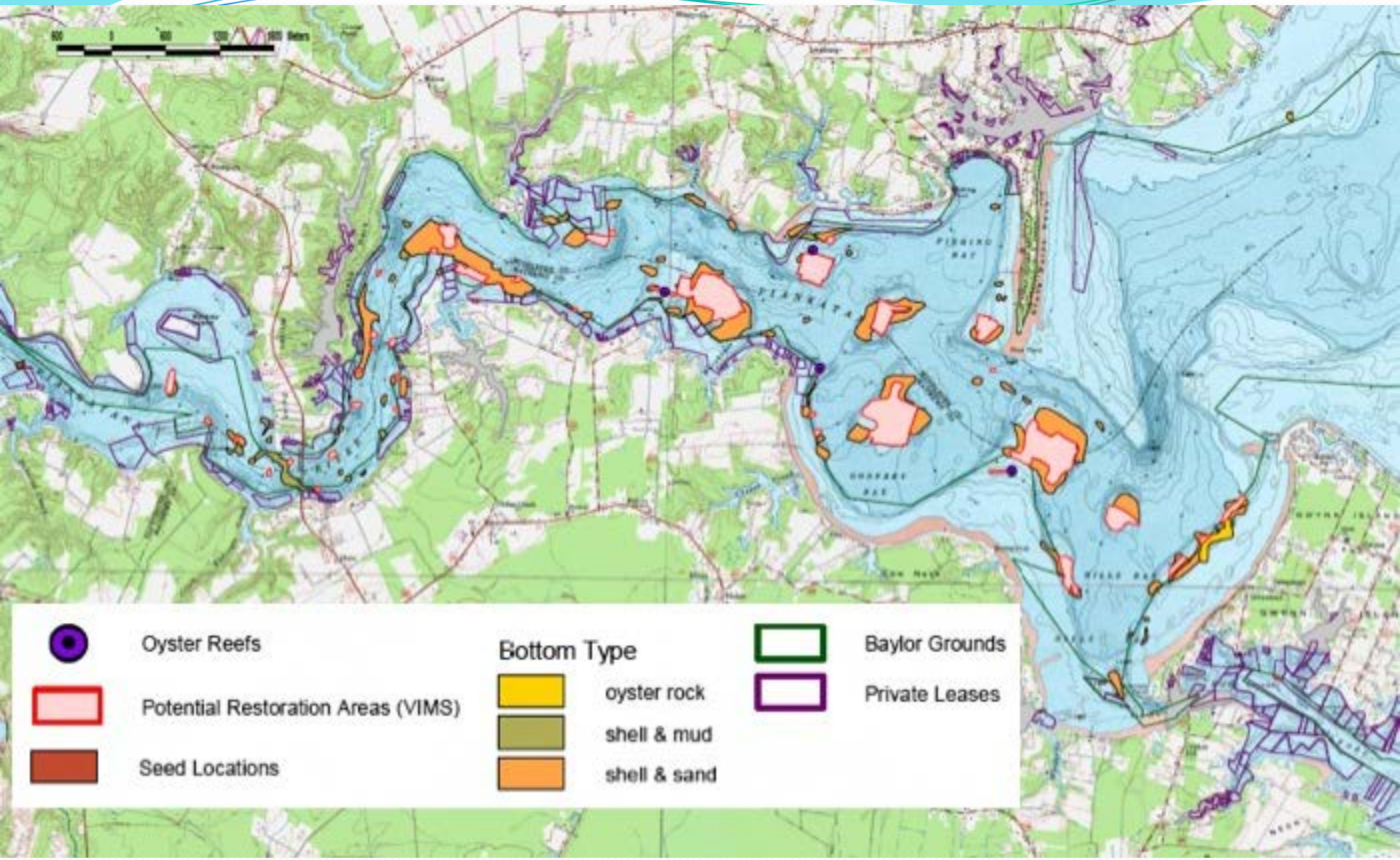
- Seatack Elementary – Virginia Beach

PIANKATANK

Restored Tributary

- 700 - 1300 acres needed to be restored
- Hope to build 50 – 100 acres over next few years


The Nature Conservancy
Protecting nature. Preserving life.
Oyster Restoration in the Piankatank River
Piankatank River
Chesapeake Bay Watershed
PA
NJ
MD
WV
VA
MAP AREA
Rappahannock River
Dragon Run
TNC Ownership or Easement
State Forest (TNC cooperative project)
Other Protected Lands
MAP AREA
Established Oyster Restoration Sites
TNC/VMRC Restoration Site
Priority Future Restoration Sites


Oyster Reefs
Potential Restoration Areas (VIMS)
Seed Locations
Bottom Type
oyster rock
shell & mud
shell & sand
Baylor Grounds
Private Leases

Fossil Shell Survey

Figure 1: Location of the primary study sites in the greater Chesapeake Bay region, Virginia

Study of Methodology

- Traditional methods of seismic interpretation were able to successfully identify buried fossil shell throughout the geologically complex study area
- The acoustic nature of buried fossil shell is site specific and requires groundtruthing and geologic expertise to identify in the seismic data

Conclusions