

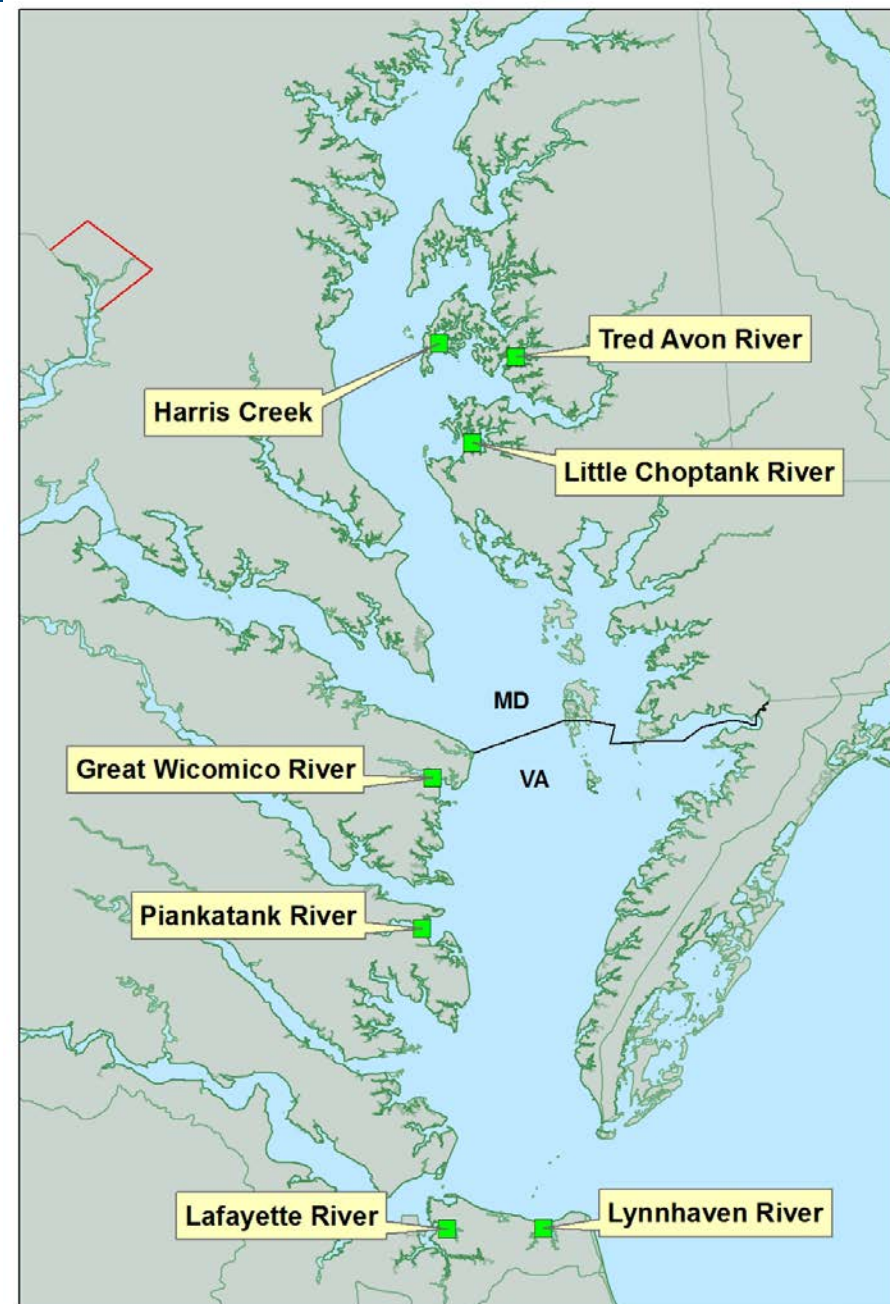
ASSESSING THE BENEFITS OF CHESAPEAKE OYSTER RESTORATION: Ecosystem Services



David Bruce

NOAA Fisheries
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Chesapeake Bay Office

Chesapeake Bay Oyster Restoration Ecosystem Services Projects



NOAA Project Awards - 2013 and on-going

- Virginia Institute of Marine Science (VIMS), *“Ecosystem Services of Restored Oyster reefs in the Lower Chesapeake Bay”*
Principal Investigators: R. Lipcius, R. Seitz
- University of Maryland/VIMS, *“Macrofaunal and Productivity Utilization, Secondary Production, and Nutrient Sequestration”*
Principal Investigators: K. Paynter, L. Kellogg, P. Ross
- VIMS, *“Fish and Crustacean Utilization, Secondary Production, and Trophic Linkages”*
Principal Investigators: L. Kellogg, M. Luckenbach, P. Ross
- University of Maryland Center for Environmental Science (UMCES)/VIMS, *“Integrated Assessment of Oyster Reef Ecosystem Services: Quantifying Denitrification Rates and Nutrient Fluxes”*
Principal Investigators: J. Cornwell, M. Owens, L. Kellogg

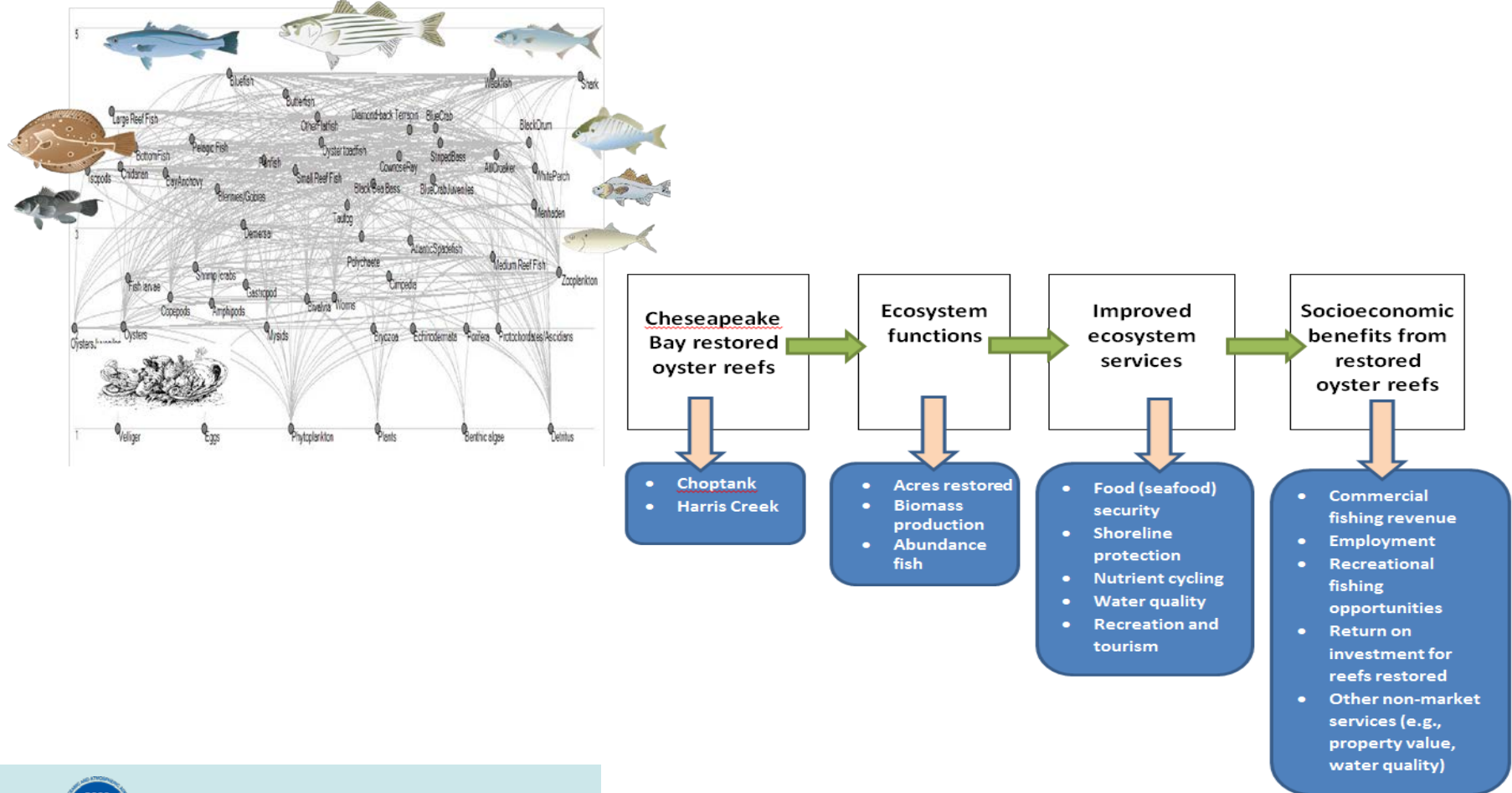
NOAA Project Awards - 2014 and on-going

- *UMCES, "Natural Engineers in Ecosystem Restoration: Modeling Oyster Reef Impacts on Particle Removal and Nutrient Cycling"*
Principal Investigators: L. Harris, J. Testa, E. North, L. Sanford
- *Virginia Commonwealth University (VCU), "Pathways to Production: An assessment of fishery responses to oyster reef restoration and the trophic pathways that link the resource to the reef"*
Principal Investigator: S. McIninch
- *Smithsonian Environmental Research Center (SERC), "Application of Dual-frequency Imaging Sonar to the Study of Oyster Reef Ecosystem Services"*
Principal Investigators: A. Hines, M. Ogburn

National Fish and Wildlife Foundation Award - 2016

- Morgan State University , *“Choptank River Complex Habitat Focus Area: Quantifying Ecosystem Services”*

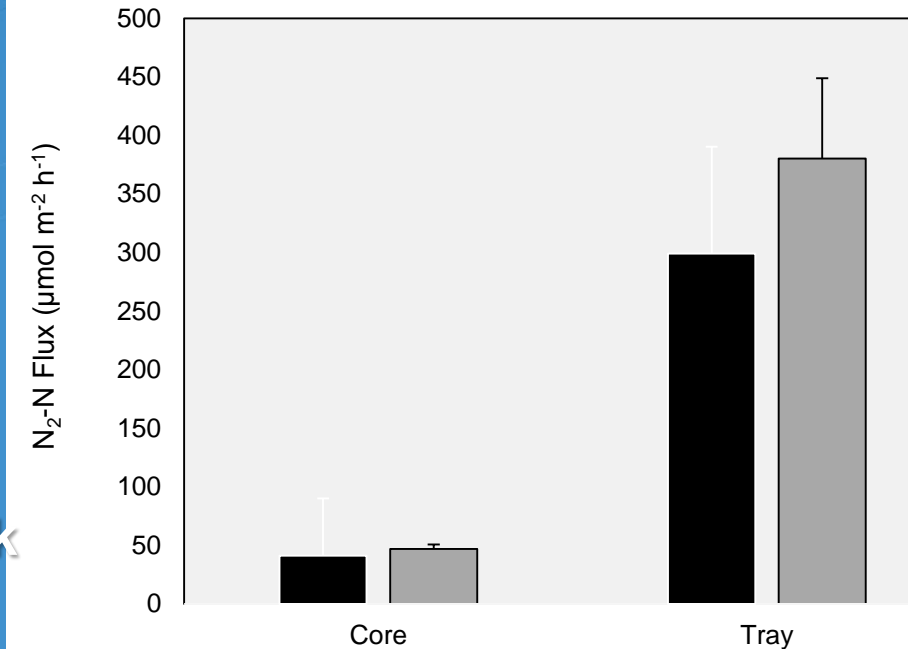
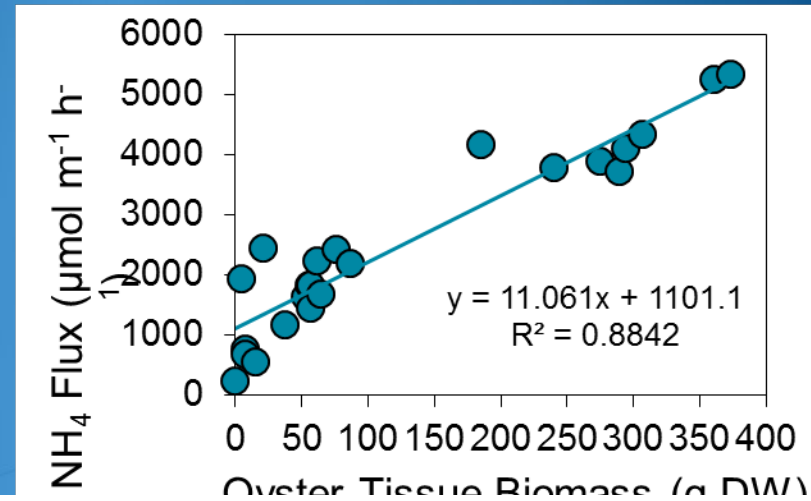
Principal Investigators: S. Knoche, H. Townsend, J. Holzer, D. Lipton



Quantifying Denitrification Rates and Nutrient Fluxes

Principal Investigators: J. Cornwell, M. Owens, L. Kellogg

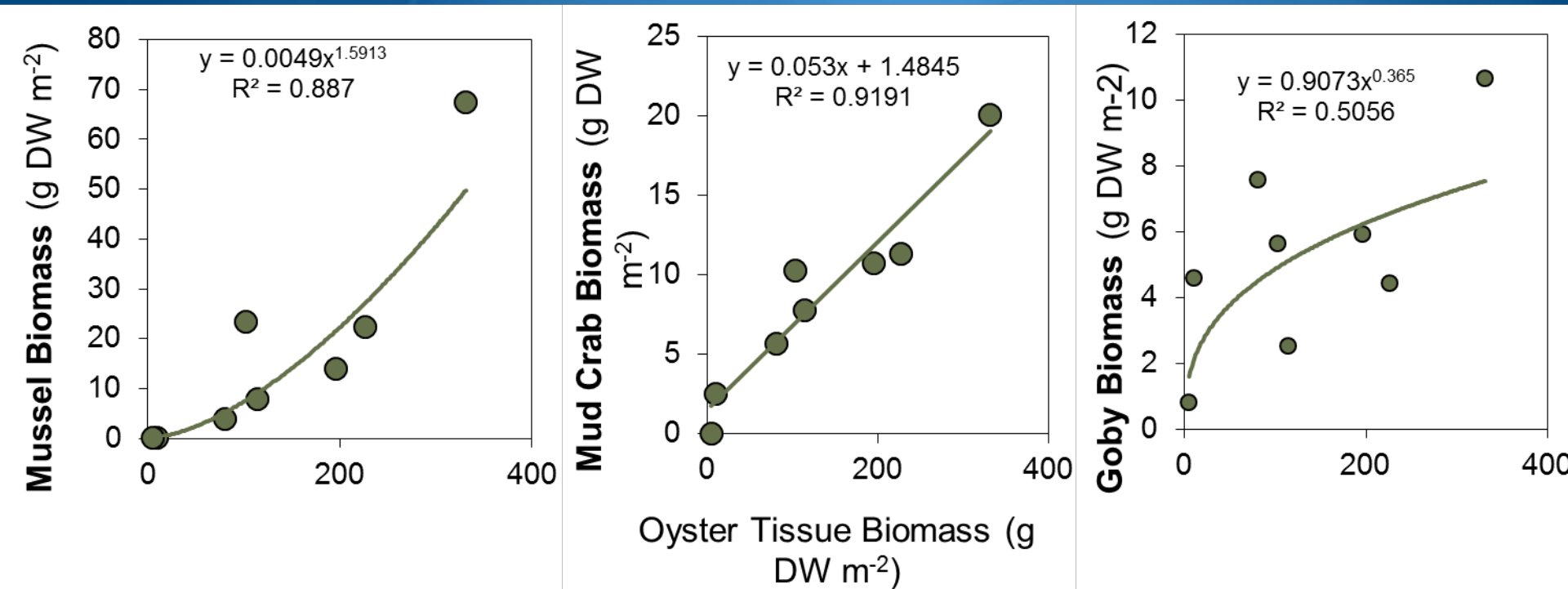
- Rates of nitrogen (NH_4 , NO_3 , N_2) flux greater on restoration sites than on reference sites
- Denitrification rates related to oyster abundance
- Site depth, light penetration, and benthic algal photosynthesis affects net nutrient exchange with the bottom
- Denitrification rates at Harris Creek sites less than more mature restoration sites elsewhere in the Choptank River system



Macrofaunal and Productivity Utilization, Secondary Production, and Nutrient Sequestration

Principal Investigators: K. Paynter, L. Kellogg, P. Ross

Hooked Mussel, Mud Crab, Naked Goby



NOAA Chesapeake Bay Office (NCBO), *"Fish Utilization of Oyster Restoration Sites in the Little Choptank River and Tred Avon River (MD) Oyster Sanctuaries"*

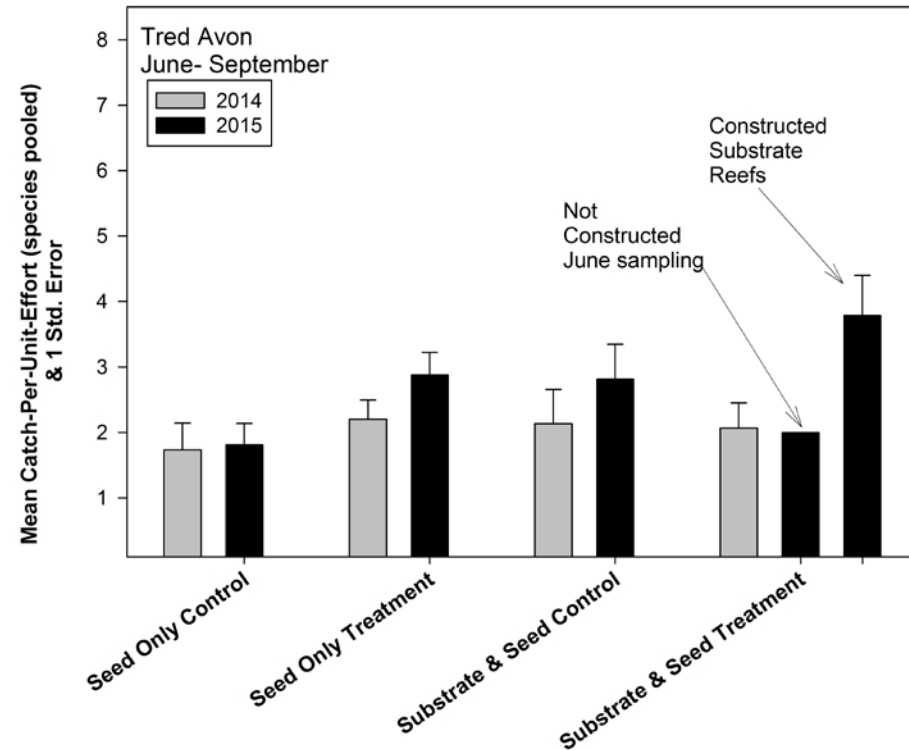
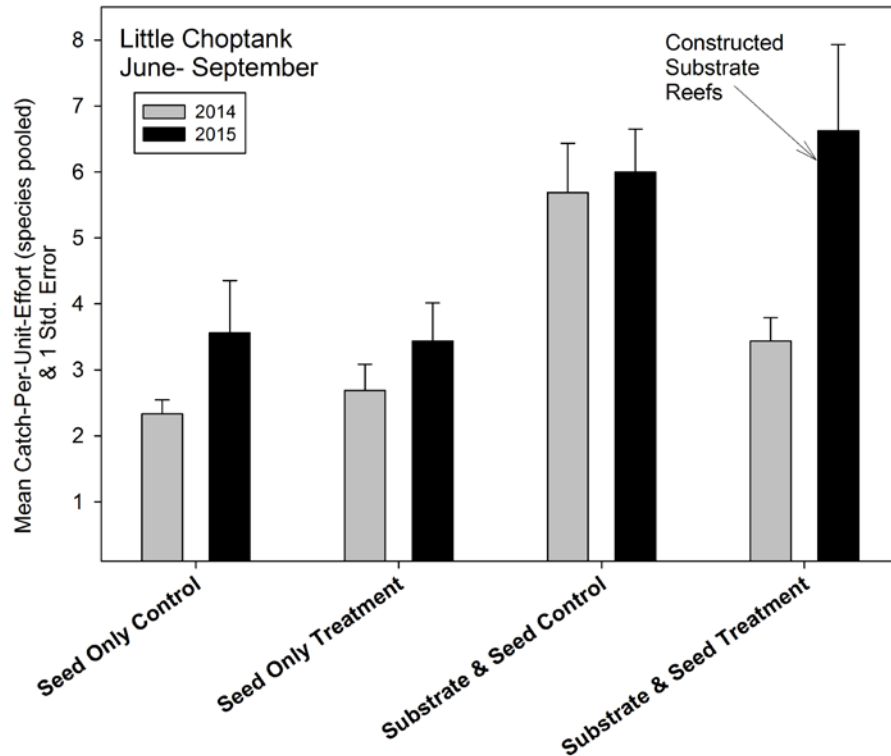
Principal Investigator: D. Bruce
2014 and on-going

- Two locations, 8 treatment sites and 8 reference sites
- Five fish traps types (baited) per string, 2-3 trap string replicates per site
- 2014 sampling: pre-restoration
- 2015 sampling: 4 reef sites constructed
- 2016 sampling: 4 seed-only sites and 4 constructed sites seeded with YOY hatchery oysters
- 2017 & 2018: post-restoration



- NOAA Chesapeake Bay Office (NCBO), *"Fish Utilization of Oyster Restoration Sites in the Little Choptank River and Tred Avon River (MD) Oyster Sanctuaries"*

Principal Investigator: D. Bruce



- 2104 : pre-restoration
- 2015 : substrate reef construction only (no seeding)
- 2016 : seeding of reef and seed-only sites

Summary

- All projects in varying stages of maturity
- Lag time: ecosystem services not fully realized until have functioning oyster reef ecosystem supported by high densities of mature oysters
- Challenge to identify utilization linkages between restoration sites and larger mobile species

ORES Research Updates on NCBO WebSite


<http://www.chesapeakebay.noaa.gov/images/stories/habitats/2015oresresearchupdate.pdf>

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chesapeakebay.noaa.gov
http://www.chesapeakebay.noaa.gov/images/stories/habitats/2015oresresearchupdate.pdf



2015 Oyster Reef Ecosystem Services (ORES) Research Update

July 2015

In order to quantify the ecosystem benefits provided by restored oyster reefs, the NOAA Chesapeake Bay Office (NCBO) initiated the Oyster Reef Ecosystem Services (ORES) project. This effort consists of three primary efforts: an NCBO-implemented field study of fish utilization of a variety of sites in the Choptank River area; NOAA-funded work being carried out by other research institutions on fish utilization, denitrification rates, and other topics; and computer modeling to explore ecosystem and economic benefits of restored reefs.

NOAA Chesapeake Bay Office Fish Utilization Field Study

To identify the fish and other species currently using oyster reefs as habitat in the Choptank River area, the NCBO field science team has conducted field work since 2013. (The Choptank River watershed was designated to be a NOAA Habitat Focus Area in 2014.) Working from on board NCBO's research vessel Bay Commitment, NCBO scientists deploy and then retrieve—after soaking for 24 hours—numerous of lines of fish traps. Each line includes traps of different sizes, each designed to catch different types of fish. While retrieving traps, NCBO staff record the species, numbers, and size of each animal before returning them to the water.


In summer 2014, sampling work was done in the Little Choptank and Tred Avon Rivers, prior to oyster reef restoration work in those subtributaries. Restoration at the Little Choptank sampling sites began in fall 2014, and gets under way in the Tred Avon in early 2015. Fish sampling will continue in summer 2015 in both tributaries.

In each location, fish traps were set on eight sites (two lines at each site, each line consisting of six different trap types) that were defined in four categories:

- Existing oyster shell bottom to be restored by augmentation with hatchery oyster seed,
- Sandy bottom to be restored by substrate reef construction and hatchery seed,
- Sandy bottom, suitable for substrate reef construction, but not to be restored, and
- Oyster shell bottom, suitable for hatchery oyster augmentation, but not to be restored.

This is a before-after, control-impact (BACI) study design, which allows comparison of fish abundance before and after restoration in addition to comparisons between restored and unrestored sites.

Nine fish taxa were observed in the Little Choptank samples and 11 from the Tred Avon; American eel, blue crab, oyster toadfish, and white perch were the most frequently encountered. Similar sampling was accomplished in the Tred Avon River in 2013, but only four trap types were used then.



ORES research is under way in seven tributaries around the Chesapeake Bay.

