More than a Mollusk: Using GIS to Effectively Repopulate Oyster Habitats in the South River, MD (A Tributary of the Chesapeake Bay)

Pennsylvania State University
Parrish S Henderson
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Advisors Fritz Kessler/ Justine Blanford
It all started with a question:

What are those cages?
Discussion Points

- Background/Oyster Impacts
- Oyster Habitats
- Study Area
- Oyster Restoration Workflow Process
  - Phase Workflow
  - Phase Results
- Next Steps
- Acknowledgements and Resources
Oyster Impacts

Environmental

Vitality Factors

Ecosystem benefits provided by Oysters

- Improved Water Quality
- Nutrient uptake, sequestration and filtration
- Reduced sedimentation
- Substrate for hard bottom benthos & refuge for other biota

Economic

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue</th>
<th>Comm Landings</th>
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<td>$4,507,620</td>
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<td>2014</td>
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<td>Total</td>
<td>$84,099,117</td>
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| Avg/Year | $4,670,506 | $4.6 million |
| Avg/Year | 16,207,743 | 900,000 lbs |

Restoration Efforts
Oyster Habitats

- Over 150 Varieties of Oysters Worldwide
- Majority of Oysters from Nova Scotia to Gulf of Mexico
- Locations within the Maryland Area of the Chesapeake Bay and Tributaries
- Focus on South River, MD
Study Area

- South River, Maryland
  - 86 miles of Shoreline
  - 10 miles Marsh to Bay
  - ~ 10 Square Miles of water surface

- South River Federation (SRF) Focus
  - Stream and Wetlands
  - Living Shorelines
  - Rain Gardens
  - Oyster Restoration
PHASE I: Identification of Suitable Oyster Husbandry Candidates along the South River

PHASE II: Identification of Suitable Oyster Reef Siting Candidates within the South River

PHASE III: Monitoring efforts of existing reef sites and those created from Phase II efforts.
Methodology

• Research & Collaboration

• Data Collection

• Data Preparation

• Phased Production and Analysis Efforts

• Deliverables
• Telephone and Email Interviews

• Meetings with the SRF mission managers

• Search for available data sources

• Review similar previous project findings
Data Collection

Federal Data
• NOAA, NGA, USGS, NASA, US Army Corps of Engineers

State/Local Data
• Maryland GIS, Anne Arundel Co. GIS, Maryland Department of Natural Resources

Organizational Data
• Chesapeake Bay Conservancy, South River Federation

Commercial Data
• Navionics, Garmin
Data Preparation

- Vector Data Shapefiles
  - Custom Built Shapefiles
  - Topological Correction
  - Reprojected
  - Clipped Data

- Raster Data Files
  - Reprojected
  - Clipped Data

- Raw Excel Files
  - Scripts for Standardization
  - Pivot Tables for Data Creation
  - Data Joins for Layer Production

- Basemaps GDB
- South River Master GDB
- South River Raster GDB
Phase I

- Zone Data
- Salinity Poly to Raster
- Surface Salinity
- Process Rasters via Map Algebra Function
- Oyster Husbhandry Suitability (OHS)
- Raster to Polygon
- OHS Polygon
- Clip Piers to Polygon
- All South River Piers
- Clipped South River Piers
Phase I

Process Step Through

- Water Zone Zones
- Dissolved O2
- Salinity
- Bathymetric Layer
- Map Algebra
- Raster to Polygon
- Add South River Piers
- Clip Piers to Vector for Oyster Husbandry Suitable Candidates
Phase I Results

- Past participation shows efforts spread out along entirety of the river regardless of the quality of water in each area.
- Match address points to pier data to provide focused outreach to those property owners with piers that match suitable water quality areas based on the data.
- This focused effort assures that areas which can provide the greatest oyster growth has the opportunity to yield more oysters for reef building in Phase II.
Phase II

Process Step Through

- Water Zones
- Temperature
- Salinity
- Dissolved Oxygen
- pH
- Map Algebra 1
- Water Quality Sites
- Bottom Surface Composition
- Map Algebra 2

[Map of Chesapeake Bay with different zones and compositions highlighted]
Phase II Results

- The workflow provides a means for testing combined layer suitability.
- Model allows for easy reprocessing of data if criteria changes or different criteria is desired.
- Can produce additional questions of oyster reef siting or possibly reveal other factors that cause possible favorable areas to be unfavorable.
Phase III

Traditional Monitoring Techniques

Drone/Aerial/Satellite Monitoring

Sonar Monitoring

Sechi Water Clarity Monitoring

Water Collection

Oyster Health Monitoring

Standard Deviation of Oyster Reef

Glebe Bay

Oyster Monitoring Through Landsat 8

AA 702
Next Steps

South River Federation Deliverables

• Finalized process chart and full documentation of methodology
• Development of an Oyster Siting Tool Toolbox
• All processed files (Raster, SHP, etc.) in GDB and Shapefile formats
• Soft and hard copies of all requested maps
• Incorporation of data collection through use of Arc Collector with Portal
• Future briefs of this workflow to interested members in the scientific community requested on behalf of the South River Federation
Acknowledgements

• PSU Advisors Fritz Kessler and Justine Blanford

• Chesapeake Bay Foundation Jackie Shannon

• South River Federations Kirk Mantay, Jesse Illiff, Nancy Merrill, Sarah Giordano
References

- Jackie Shannon, CBF.org, Oyster Restoration Questions, 13 October, 2016
- Mid-Atlantic Tributary Assessment Coalition, 2011. Sampling and data analysis protocols for Mid-Atlantic tidal tributary indicators.
QUESTIONS?