Life

28/29 Oct 2020

COLLOQUE

Baie de l'Aiguillon

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Restauration des fonctionnalités environnementales du littoral en contexte conchylicole

Restoration of coastal environmental functions in a shellfish farming area

Forum des Pertuis, La Rochelle

Nature Hommes Vasières Oiseaux Eau douce Eau salée Littoral Roztes Habitats Dunes Huîtres Conchyliculture Bouchots Zone humide Terre Mer Crassats Saliniers Estuaire

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Large-Scale Oyster Restoration in Chesapeake Bay, Atlantic Coast, USA

Stephanie Westby

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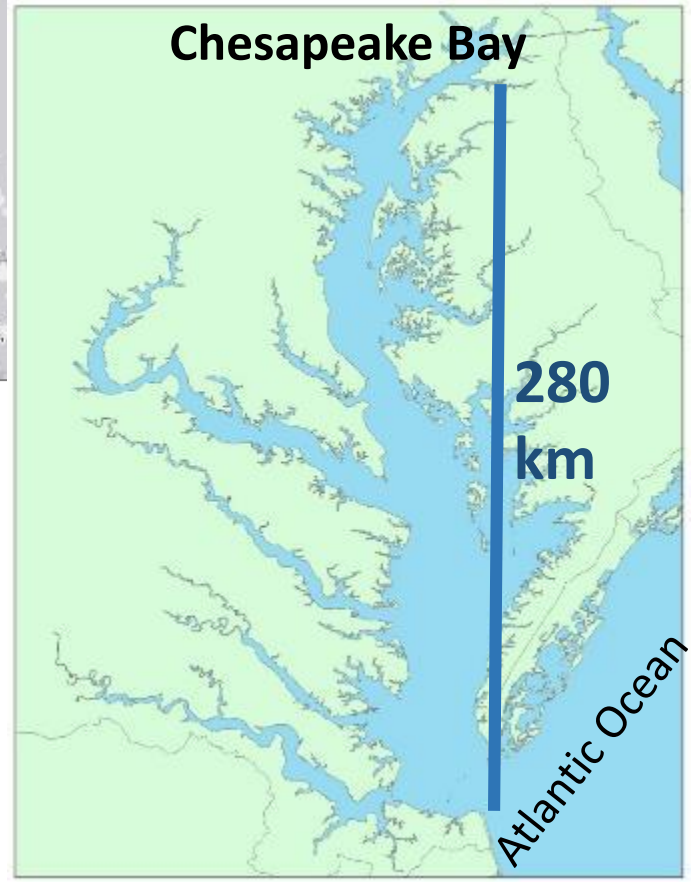

Chesapeake Bay
280 km
Atlantic Ocean

Issue

- **Chesapeake Bay's oyster (*Crassostria virginica*) population is at 1% of historic levels.**
- **Oyster reefs provide fish habitat and water filtration, among other ecosystem services.**
- **Ecosystem services are diminished along with the population.**

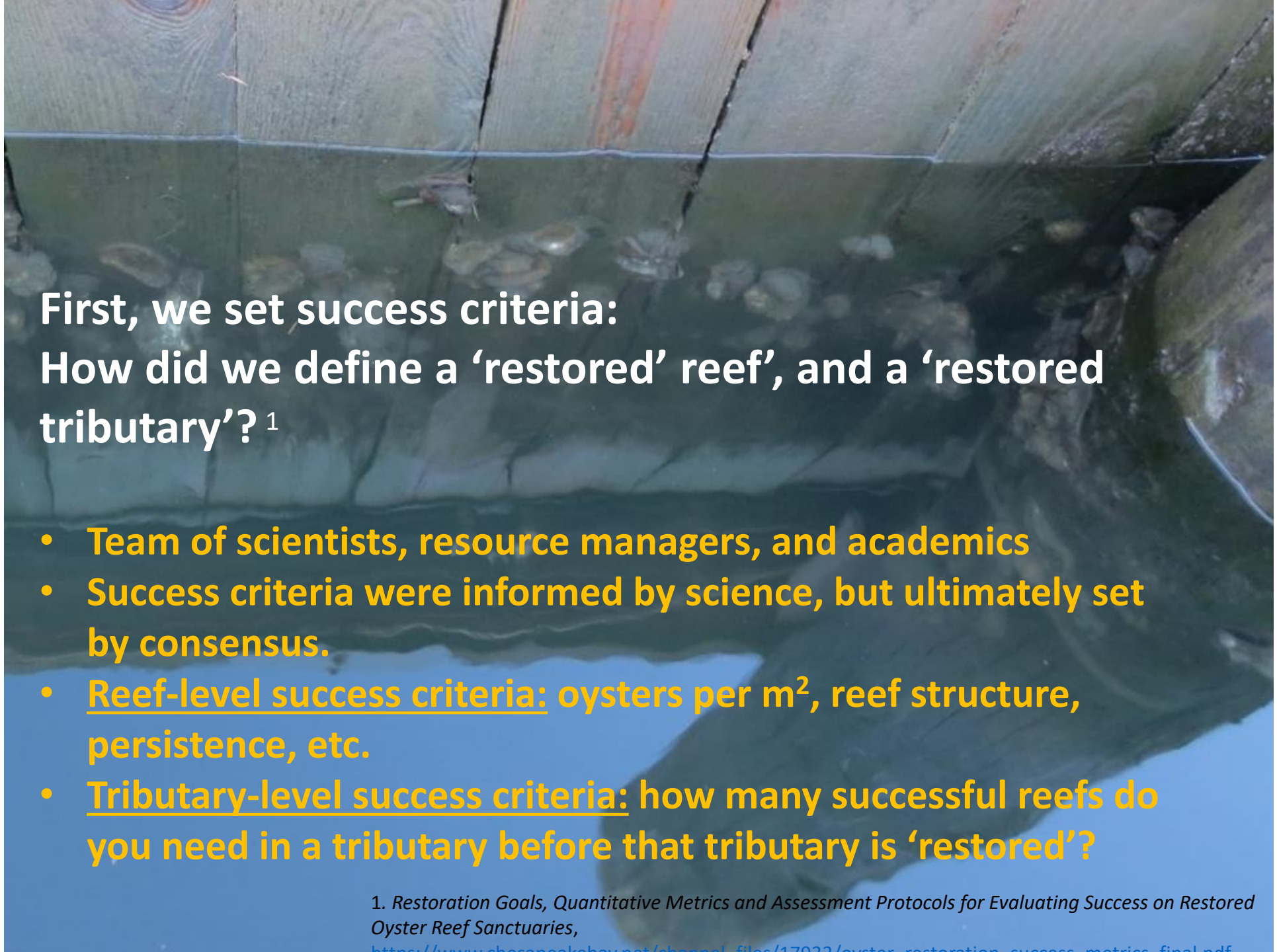
Goal

2014 Chesapeake Bay Watershed Agreement

- **Signed by state governments in the Chesapeake Bay watershed and the federal government**

Called for:

- ***Restoring oysters in 10 Chesapeake tributaries by 2025, and ensuring their protection.***



First, we set success criteria:
How did we define a ‘restored’ reef’, and a ‘restored tributary’? [1]

- Team of scientists, resource managers, and academics
- Success criteria were informed by science, but ultimately set by consensus.
- Reef-level success criteria: oysters per m^2, reef structure, persistence, etc.
- Tributary-level success criteria: how many successful reefs do you need in a tributary before that tributary is ‘restored’?

1. *Restoration Goals, Quantitative Metrics and Assessment Protocols for Evaluating Success on Restored Oyster Reef Sanctuaries*,

Success Criteria:

Reef level:

Oyster density:

- **Min = 15 oysters per m^2 over 30% of the reef**
- **Target = 50 oysters per m^2 over 30% of the reef**

Oyster biomass:

- **Min = 15 g dry tissue weight per m^2 over 30% of the reef**
- **Target = 50 g dry tissue weight per m^2 over 30% of the reef**

Multiple year classes: present

Shell budget: stable or increasing

Reef height: stable or increasing

Reef footprint: stable or increasing

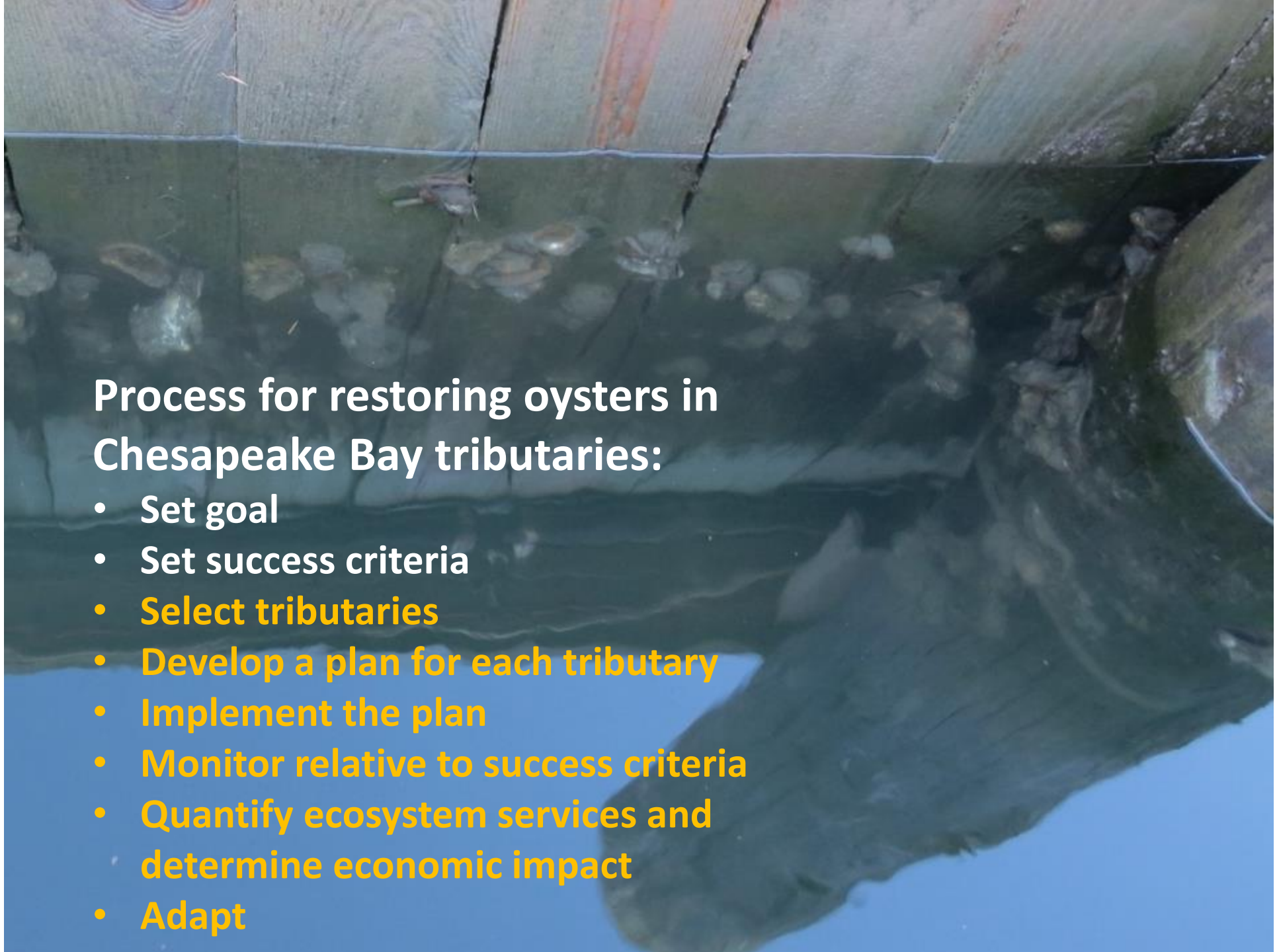
Tributary level:

Two-prong test for a restored tributary:

1) Successful reefs covering at least 50 'currently restorable oyster habitat'

- **Good water quality**
- **Seafloor suitable for reef construction**

2) Successful reefs covering at least 8% of historic oyster bottom



Process for restoring oysters in Chesapeake Bay tributaries:

- Set goal
- Set success criteria
- Select tributaries
- Develop a plan for each tributary
- Implement the plan
- Monitor relative to success criteria
- Quantify ecosystem services and determine economic impact
- Adapt

Process

- Set goal
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- Select tributaries
- Plan
- Implement
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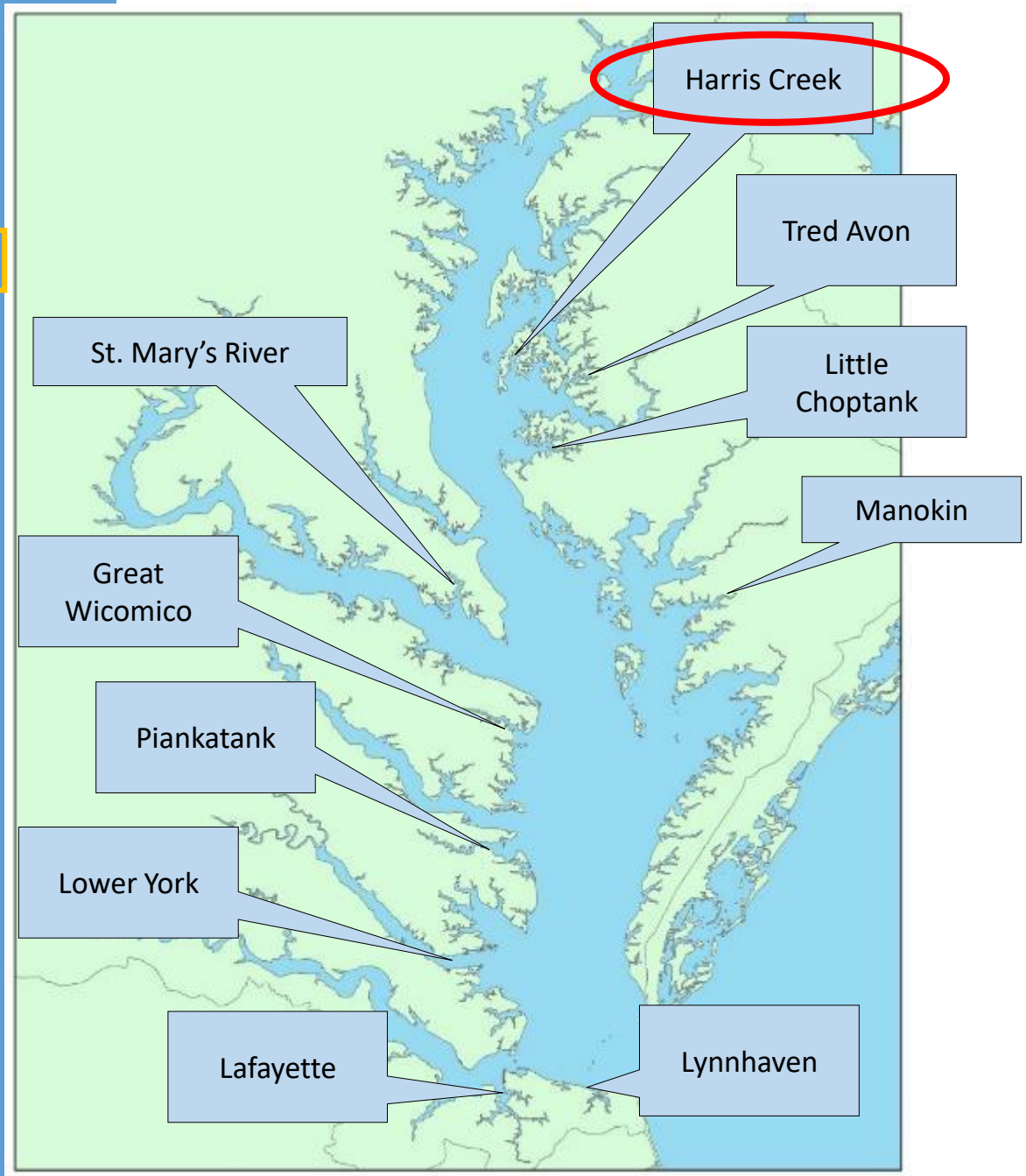

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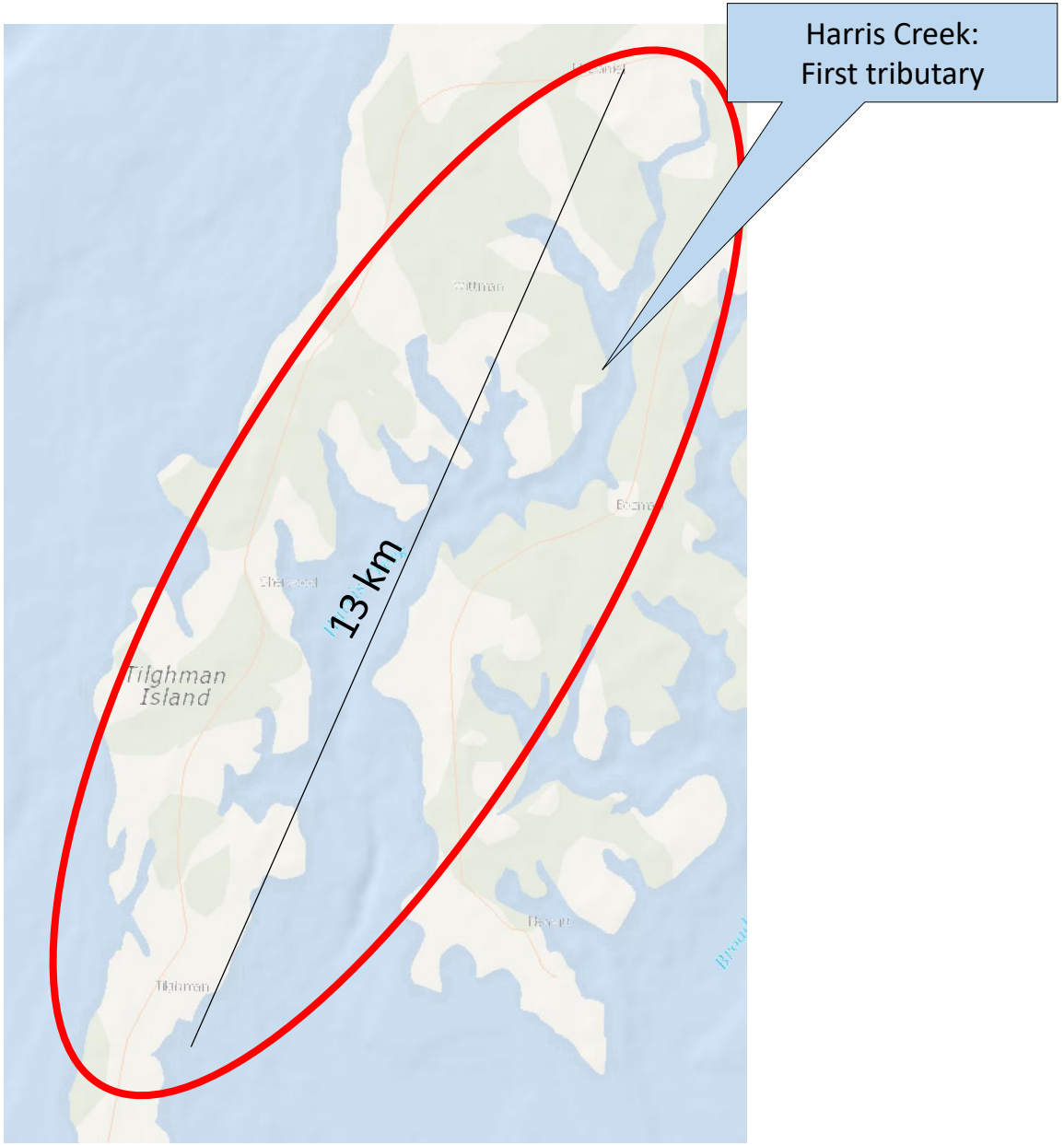

Process

- Set goal
- Set success criteria
- Select tributaries
- Plan
- Implement
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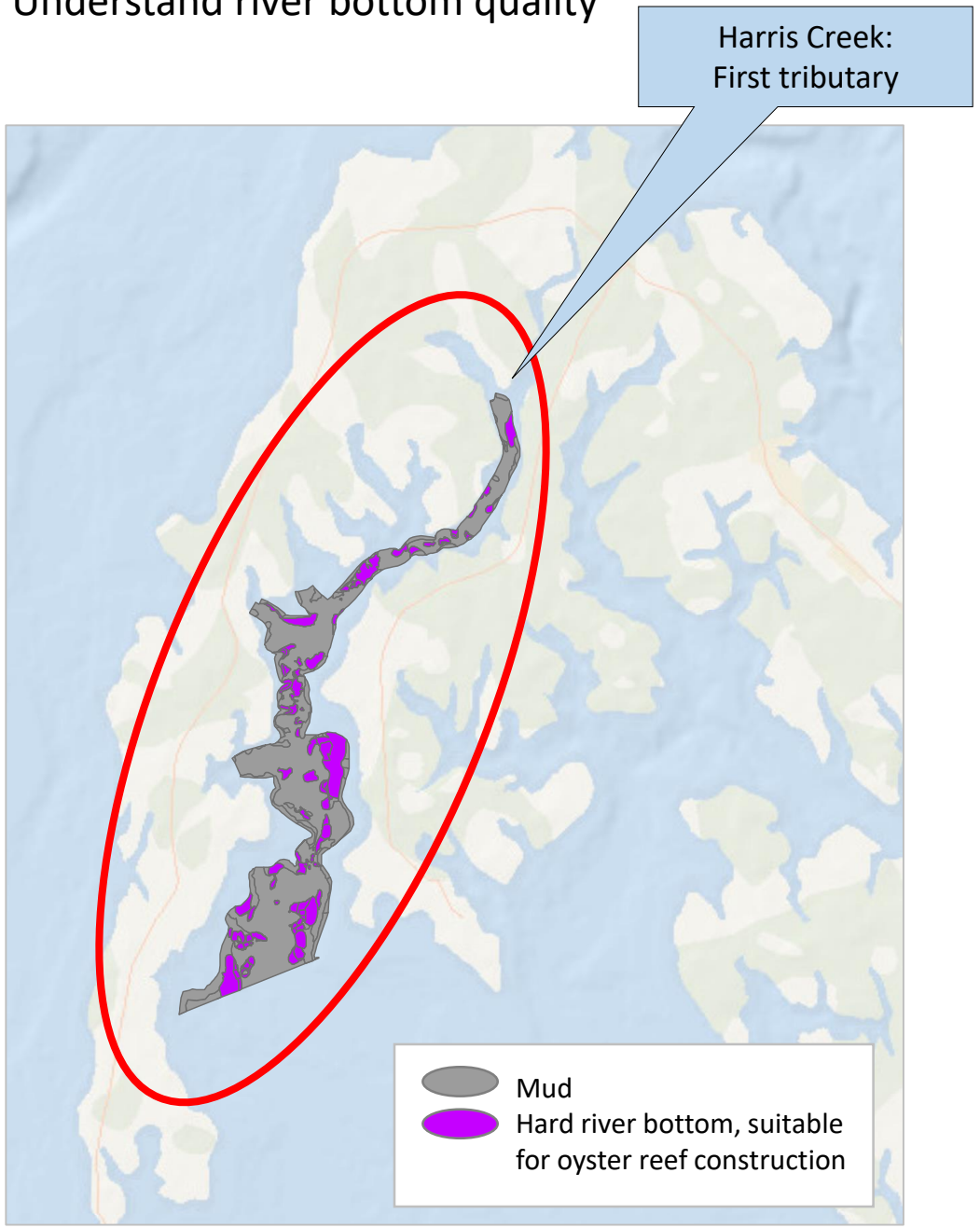
- Quantify ecosystem services and determine economic impact
- Adapt

- Understand river bottom quality



Process

- Set goal
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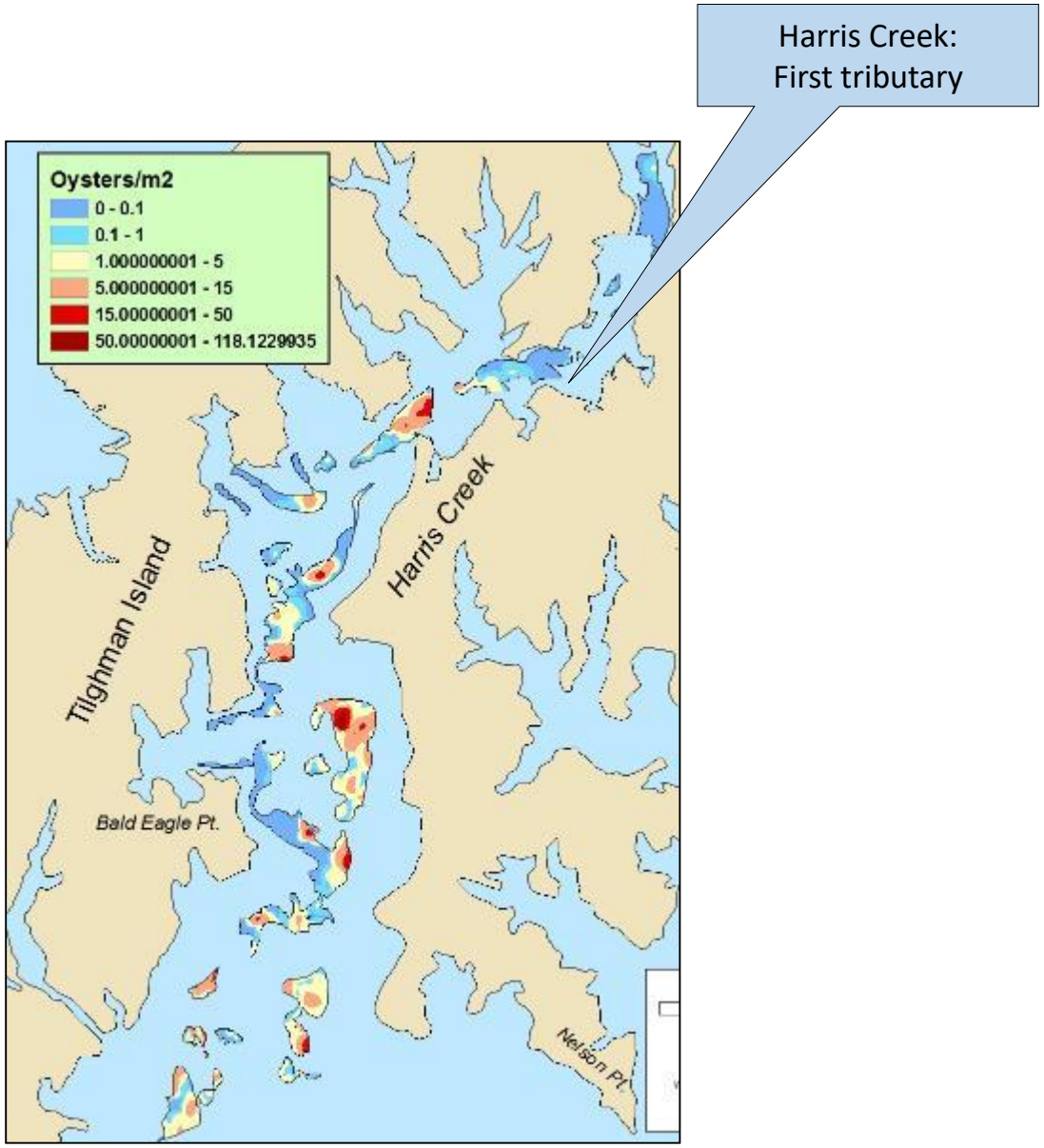
- Understand river bottom quality
- Understand existing oyster population distribution



Process

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- Implement
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- Understand river bottom quality
- Understand existing oyster population distribution
- Outreach to stakeholders, scientific community, public

Process

- Set goal
- Set success criteria
- Select tributaries
- Plan
- Implement
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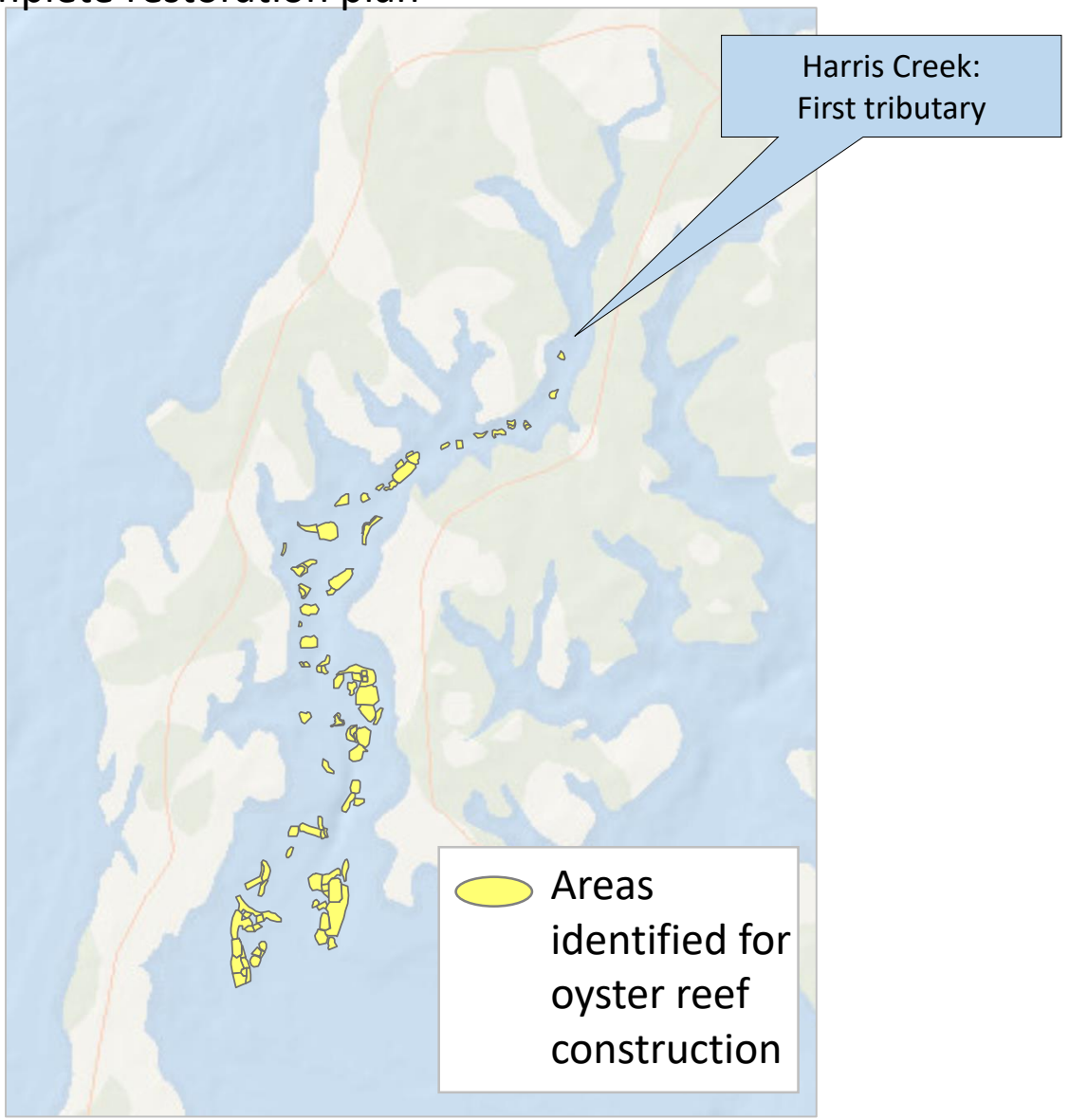
- Understand river bottom quality
- Understand existing oyster population distribution
- Outreach to stakeholders, scientific community, public
- Complete restoration plan[1]



1. Harris Creek Oyster Restoration Tributary Plan: A blueprint to restore the oyster population in Harris Creek, a tributary of the Choptank River on Maryland's Eastern Shore, https://www.chesapeakebay.net/documents/Oyster_Restoration_Blueprint_Harris_Creek_1.13_2.pdf

Process

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Reef Restoration Techniques

Oyster seed only

Substrate only

Substrate and seed

- Used in low natural recruitment areas (low oyster reproduction)
- Hatchery-produced oysters are planted onto existing reefs to increase oyster populations
- Oysters are produced at University of Maryland's oyster hatchery

'Spat-on-shell' (juvenile oysters attached to shell)

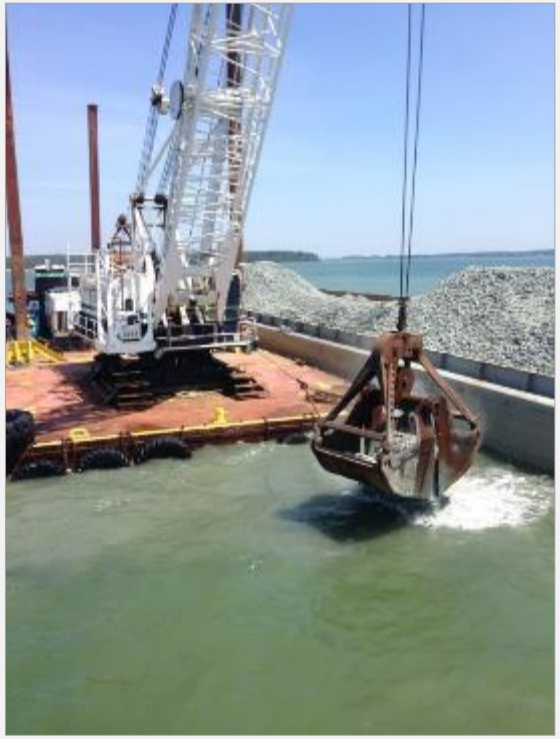
Reef Restoration Techniques

Oyster seed only

Substrate only

Substrate and seed

- Used where natural recruitment is high (no seed is required)
- Used where reef structure needs to be improved
- Substrates used are primarily shell and stone



Reef Treatments:

- Oyster seed only
- Substrate only
- Substrate and seed

+

Process

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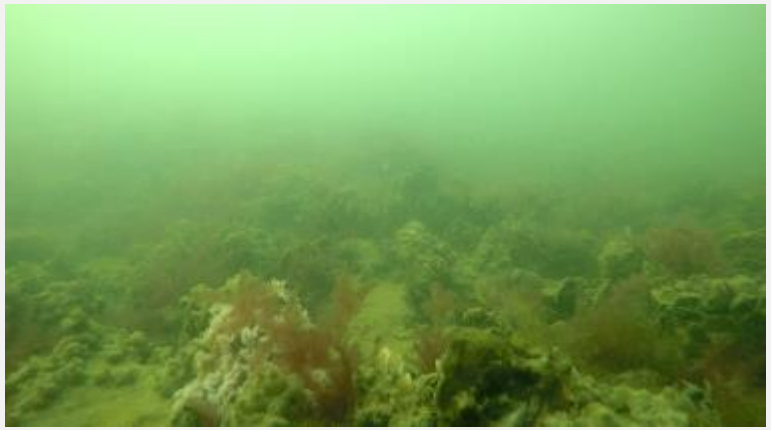
Harris Creek Oyster Restoration: Scale

- 142 hectares of reefs
- 2.5 billion ‘spat’ (juvenile oysters) planted
- Cost: US$29 million
- Thought to be the world’s largest sanctuary (non-harvest) oyster restoration project

Before restoration

After restoration



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- Reefs are monitored 3 years and 6 years after restoration
- 97% of 6-year-old reefs meet oyster density success criterion
- Other success metrics show similar results

Process

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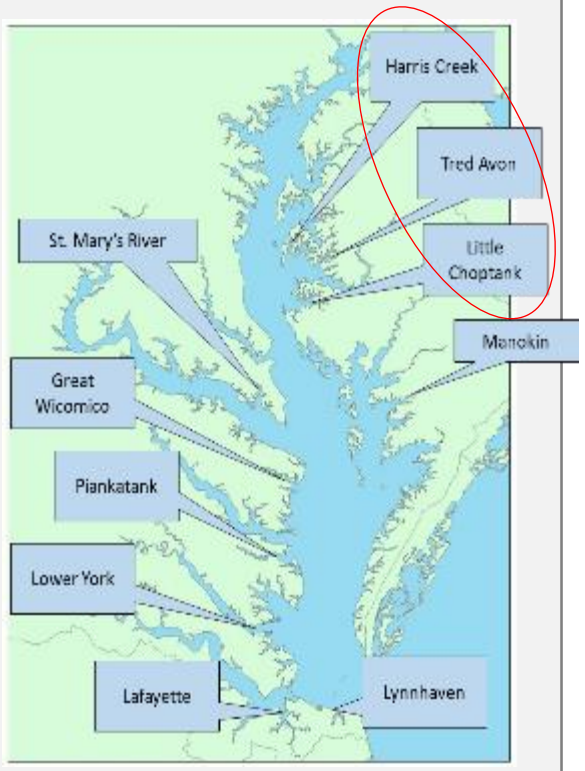
Harris Creek

- Restored reefs annually remove:
  - 45,000 kg of nitrogen
  - 2,130 kg phosphorous
- Estimated US$3 million annually in nitrogen and phosphorous reductions[1]
- Restoration cost: $29 million

Harris Creek and two nearby tributaries combined

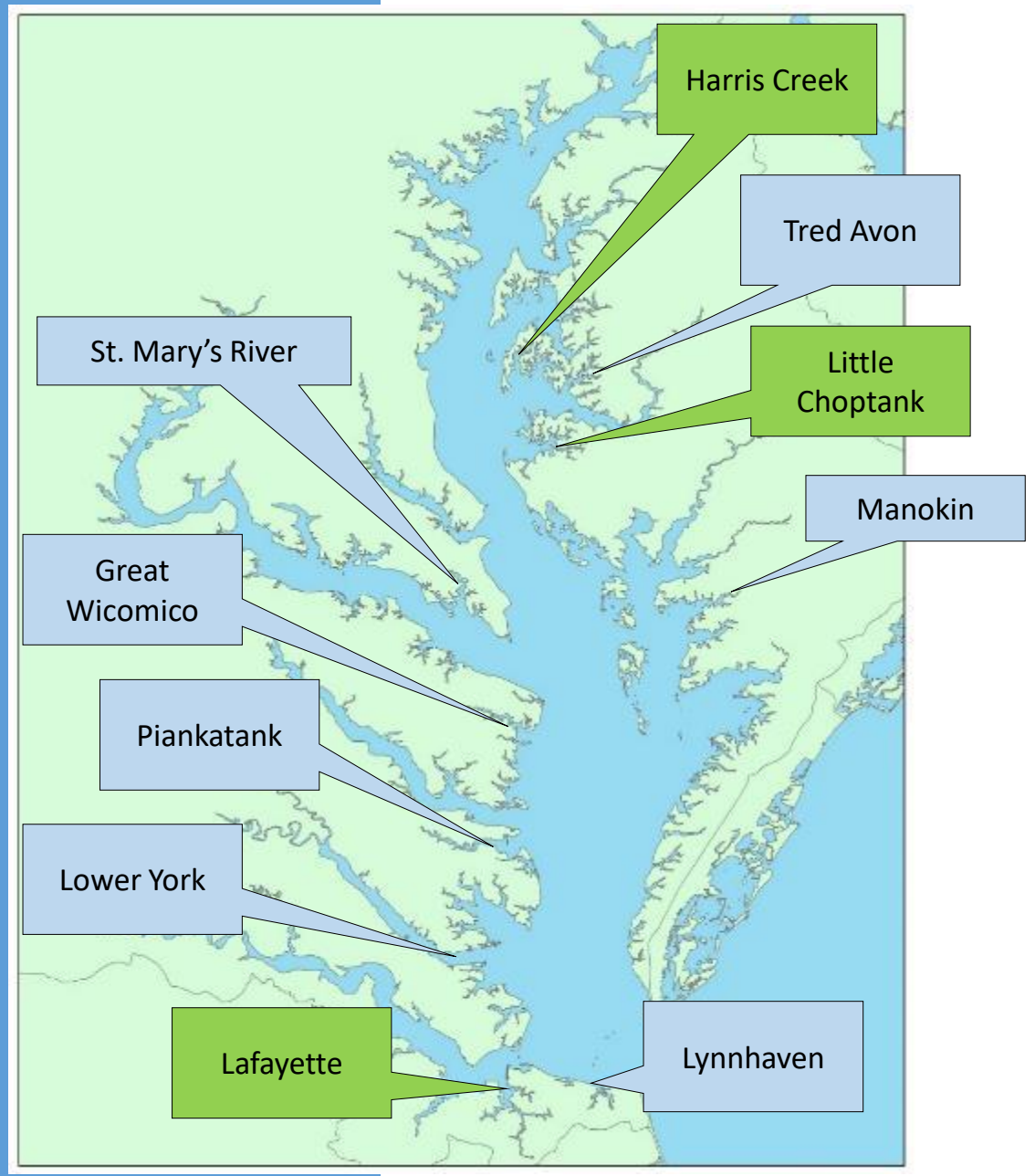
- Fully mature reefs (10 years post restoration), relative to pre-restoration status, are predicted to[2]:
  - Generate 160% increase in blue crab harvest
  - Increase annual dockside fisheries by $11 million annually ('direct effect')
  - Increase annual total regional economic impact by $23 million annually ('direct + indirect + induced effects')
  - Restoration cost to date: $55 million



1. M.L. Kellogg, M.J. Brush, J.C. Cornwell. 2018. An Updated Model for Estimating the TMDL Related Benefits of Oyster Reef Restoration. Virginia Institute Marine Science and University of Maryland (funded by NOAA, Nature conservancy, Oyster Recovery Partnership)

2. S. Knoche et al. 2019. Final Report, Morgan State University PEARL (funded by NOAA)

Progress toward restoring oysters in 10 Chesapeake Bay tributaries



- Three tributaries complete
- 390 hectares restored
- Cost: US$62 million

Process

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What have we learned?

Oyster restoration is expensive.

- …and the ecosystem services value may make it a good investment.
- …and conserving what you have is probably better and less expensive.

Oysters do well on stone reefs

- People, however, don't always like stone reefs.
- …especially when your contractor piles it too high and boats run aground on it.

Pre-established success criteria, common goals, extensive partnerships, and planning are difficult but seem to be worthwhile.

Not everyone loves this. (What?!?)

Thank you,
and thank you to our many partners.

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NOAA Restoration Center
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Photo: Oyster Recovery Partnership

Partners

…and many more

Outline

- Map
- Issue
- Background/ policy drivers