'The Role of Science in Oyster Restoration and Aquaculture in Virginia

Mark W. Luckenbach

Sound Economic Development:
Creating a Rising Tide for the NC Coastal Summit
Raleigh, NC
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Role of Science in Restoration

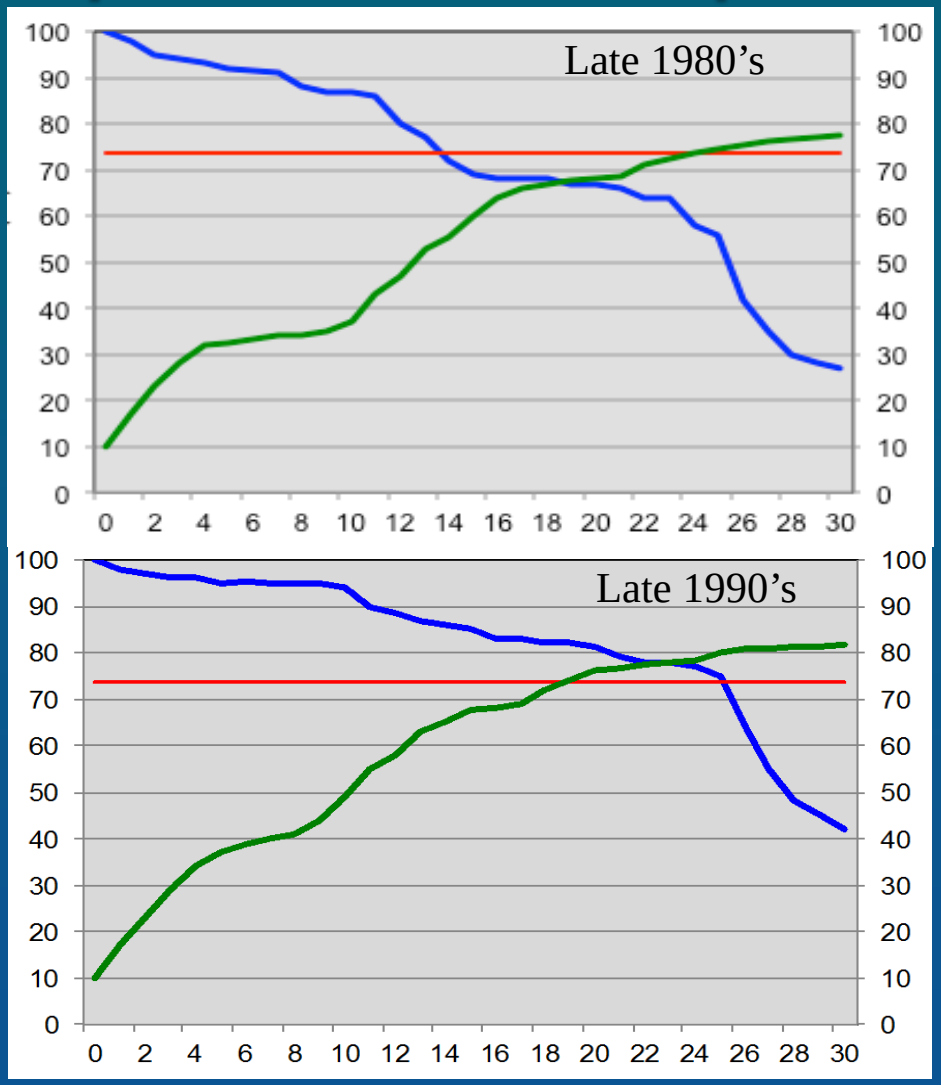
Ecological Value of Oyster Reefs

Greater attention to habitat architecture

Tributary scale restoration plans that include detailed bottom mapping.

A better understanding of the evolution of disease resistance.

Aquaculture Development



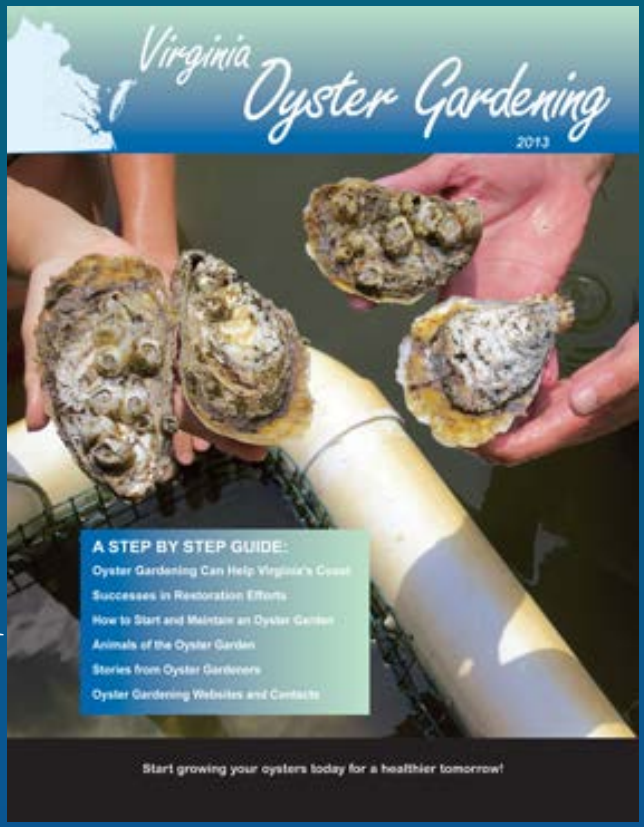
Early aquaculture progress

Growth and survival improvements

Worked mostly with non-commercial people *Oyster Gardeners*

1994 Published the first Oyster Gardening manual

Largely dismissed by the oyster industry as being too expensive for anything but a limited boutique market



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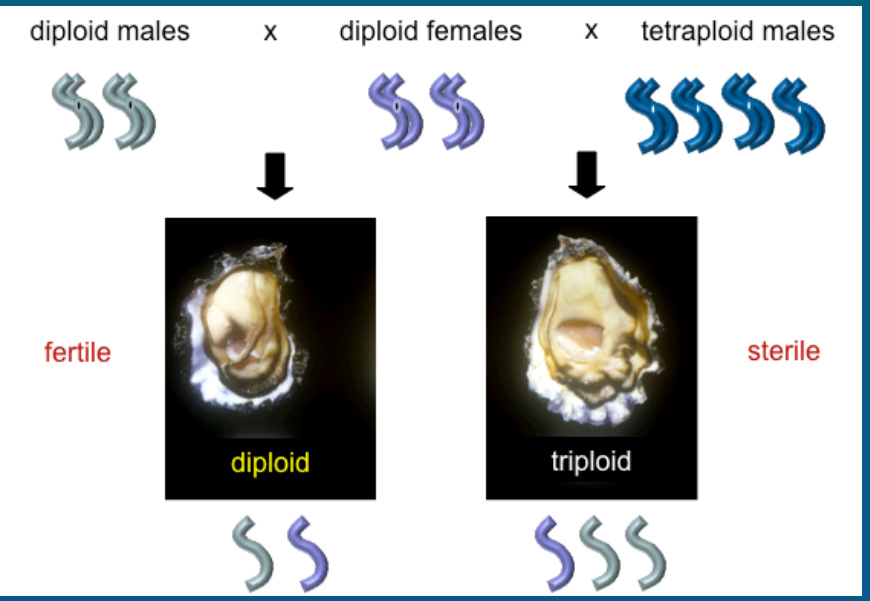
1940-2015 75 Years

Aquaculture Development



VIMS Shellfish Aquaculture

Family-based selective breeding

Triploid production

Disease diagnostics

Outreach

Industry training programs

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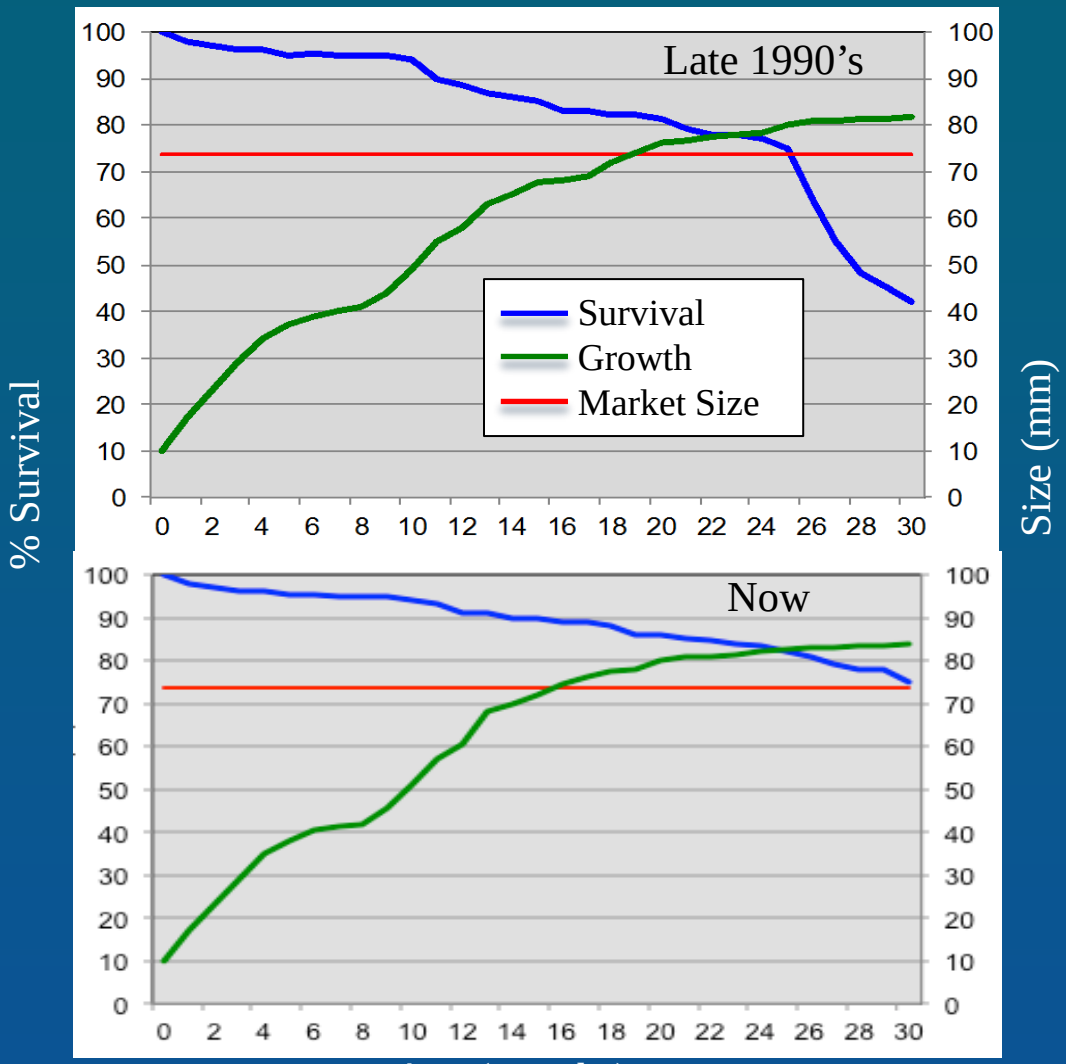
Aquaculture Development



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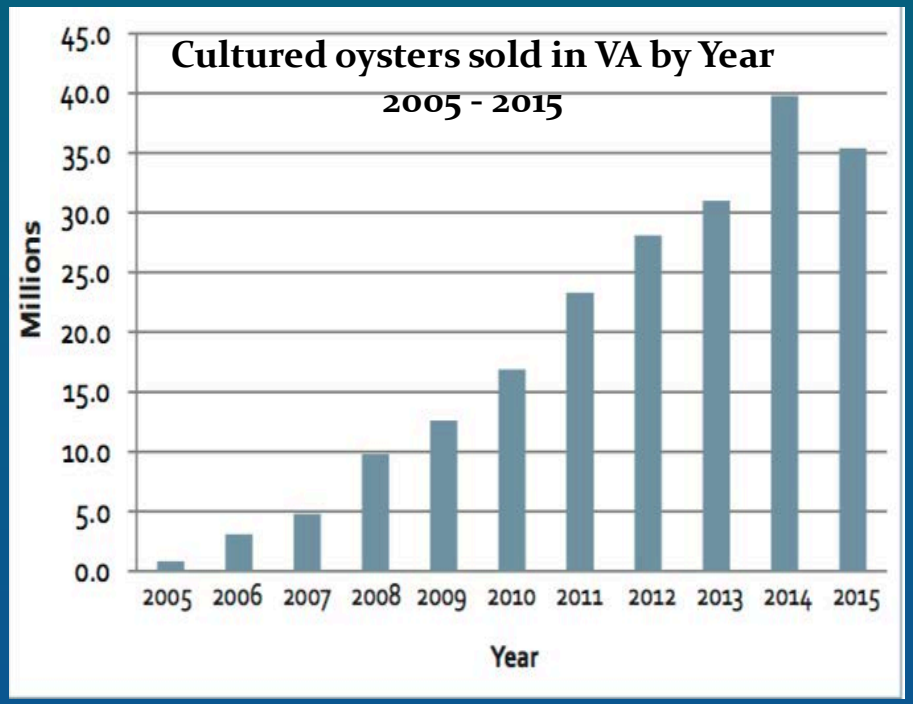

From Hudson and Murray 2016

In 2015:

135.6 M single oyster seed planted

35.4 M aquacultured oysters sold

$14.5 M farm gate value

U.S. East Coast leader in oyster aquaculture production

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Spat-on-shell (*using eyed-larvae*)

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Industry innovation

Aquaculture Development

This development has been enabled by:

- Favorable leasing laws in VA
- Selective breeding for disease resistance and rapid growth
- Triploid development and production
- Formal and informal training programs
- Private investment and innovation
- Strong supporting science—breeding, genetics, disease diagnostics, water quality monitoring

Where is this going and how do we sustain it?

- Market would appear to support further growth
- Need to manage use conflicts with other water-dependent uses
- Must maintain a strong science-based development programs – selective breeding, disease diagnostics & public health

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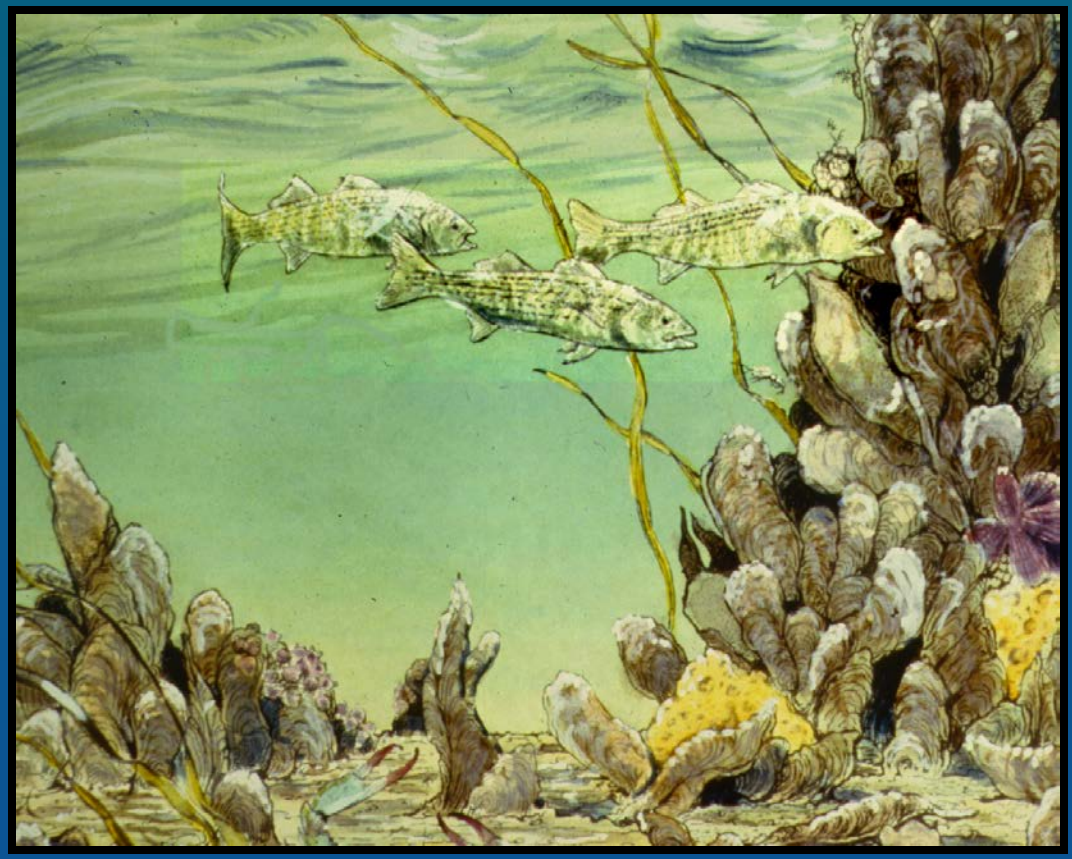
Role of Science in Restoration

Ecological Value of Oyster Reefs

Extractive value
- Food (oysters)
- Building material
- Agriculture

Habitat value
- Fisheries production
- Biodiversity

Filtration
- Water quality
- Benthic-pelagic coupling



Role of Science in Restoration

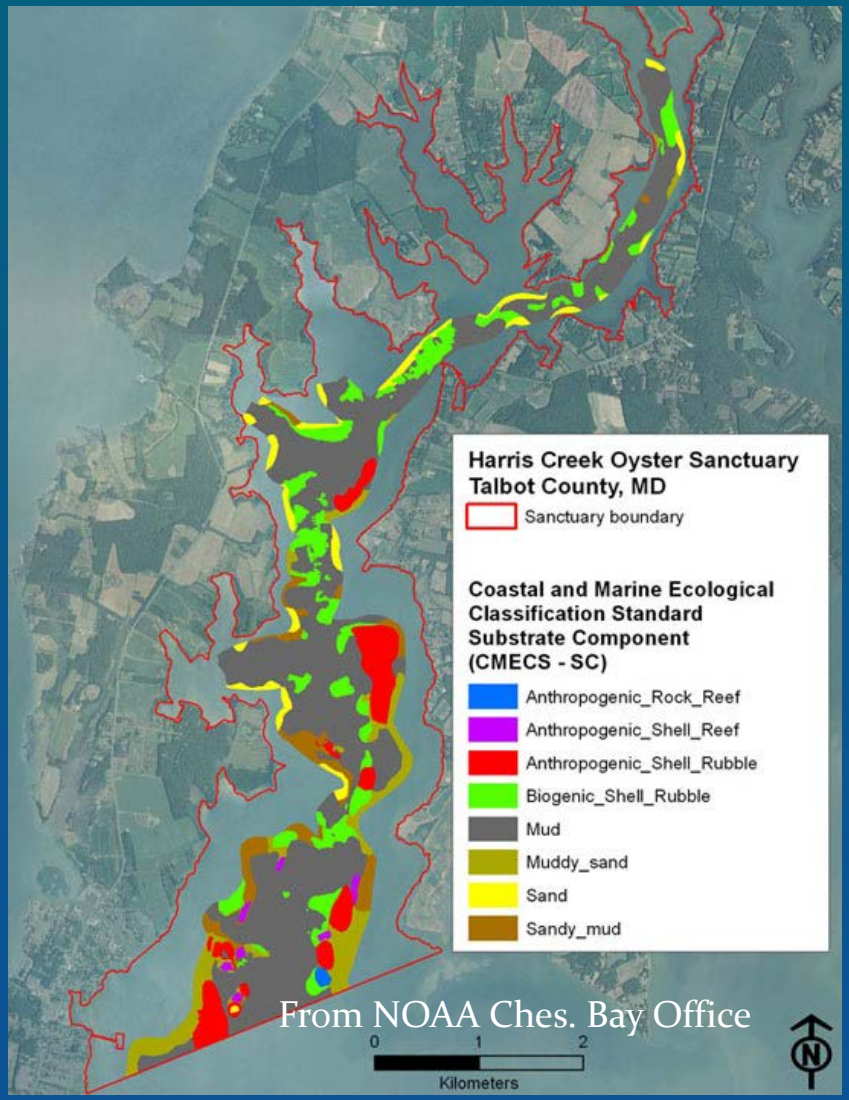
Greater attention to habitat architecture

Sufficient 3-D structure to:

- **Enhance growth and survival**
- **Provide persistence of shell substrate**

What has worked and what has not?

Tributary-scale restoration plans that include:



From NOAA Ches. Bay Office

Detailed bottom mapping

Understanding connections between reefs

Pre- and post restoration monitoring

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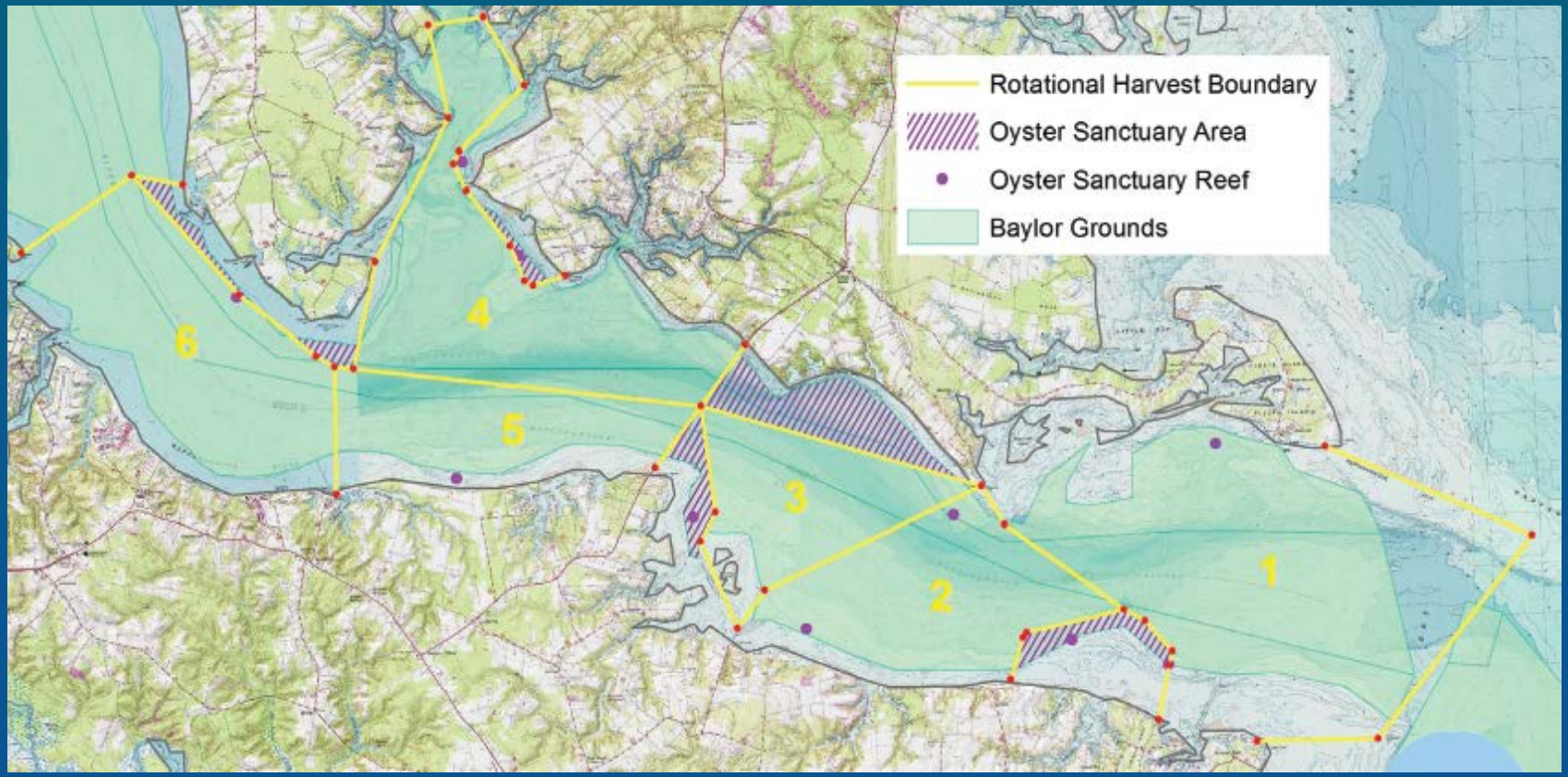
What has worked and what has not?

Fisheries management: Holistic approach which includes, harvest targets based on recent surveys, rotational harvest, and sanctuary reefs.



Rappahannock River, Virginia

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What has worked and what has not?

Sanctuary reefs and improved fisheries management support the evolution of disease tolerance

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FEATURE ARTICLE:

Declining impact of an introduced pathogen: *Haplosporidium nelsoni* in the oyster *Crassostrea virginica* in Chesapeake Bay

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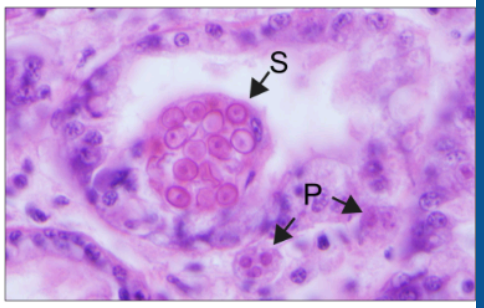
ABSTRACT: Disease caused by the parasite *Haplosporidium nelsoni* has devastated *Crassostrea virginica* in Chesapeake Bay, exacerbating effects of overharvesting and adversely impacting the ecology of the bay. *H. nelsoni* is thought to persist as an impediment to oyster restoration because strong reproductive contributions from oysters in low-salinity refugia from parasitism have prevented development of disease resistance. On the contrary, long-term data indicate that while infection pressure on naïve sentinels has grown, *H. nelsoni* levels in wild oysters have fallen, with prevalence typically below 20% and advanced infections uncommon. A transplant experiment comparing naïve sentinels with oysters from disease-enzootic populations indicated that these observations represent true disease resistance, and its geographical distribution was revealed by annual fall surveys, and by intensive sampling in 2007 and 2008. Resistance is best de-



Haplosporidium nelsoni spores (S) and plasmodia (P) in a rare heavy infection of an oyster, *Crassostrea virginica*, from lower Chesapeake Bay

Image: Ryan Carnegie

In Virginia

- Strong evidence for MSX resistance
- Evidence for Dermo resistance

In Maryland

- Low disease mortality
- Salinity related

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