Oysters in Virginia:
Progress on the path to recovery

Mark W. Luckenbach

Oyster Summit
Feb. 18, 2016

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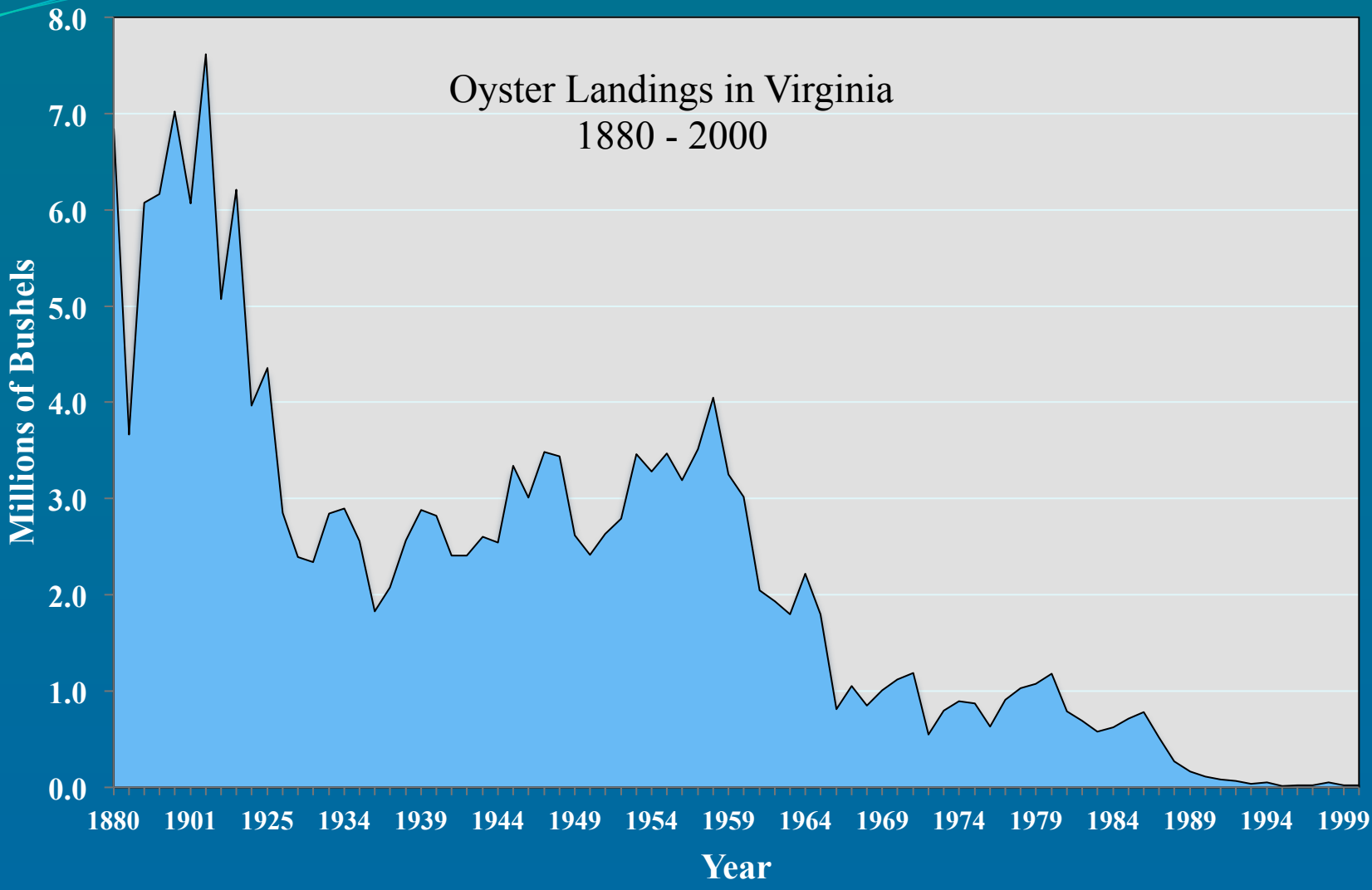
1940-2015 75 Years



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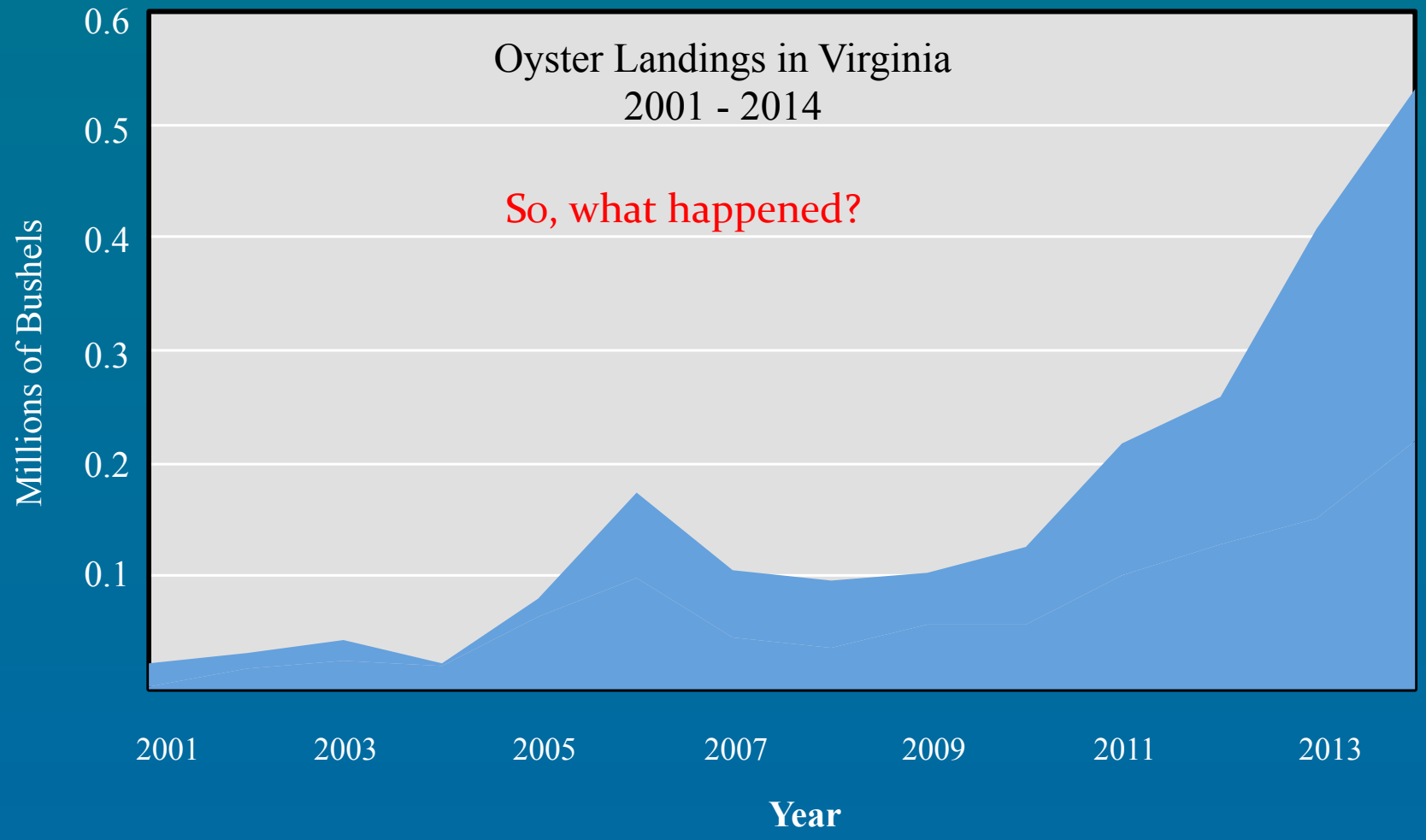

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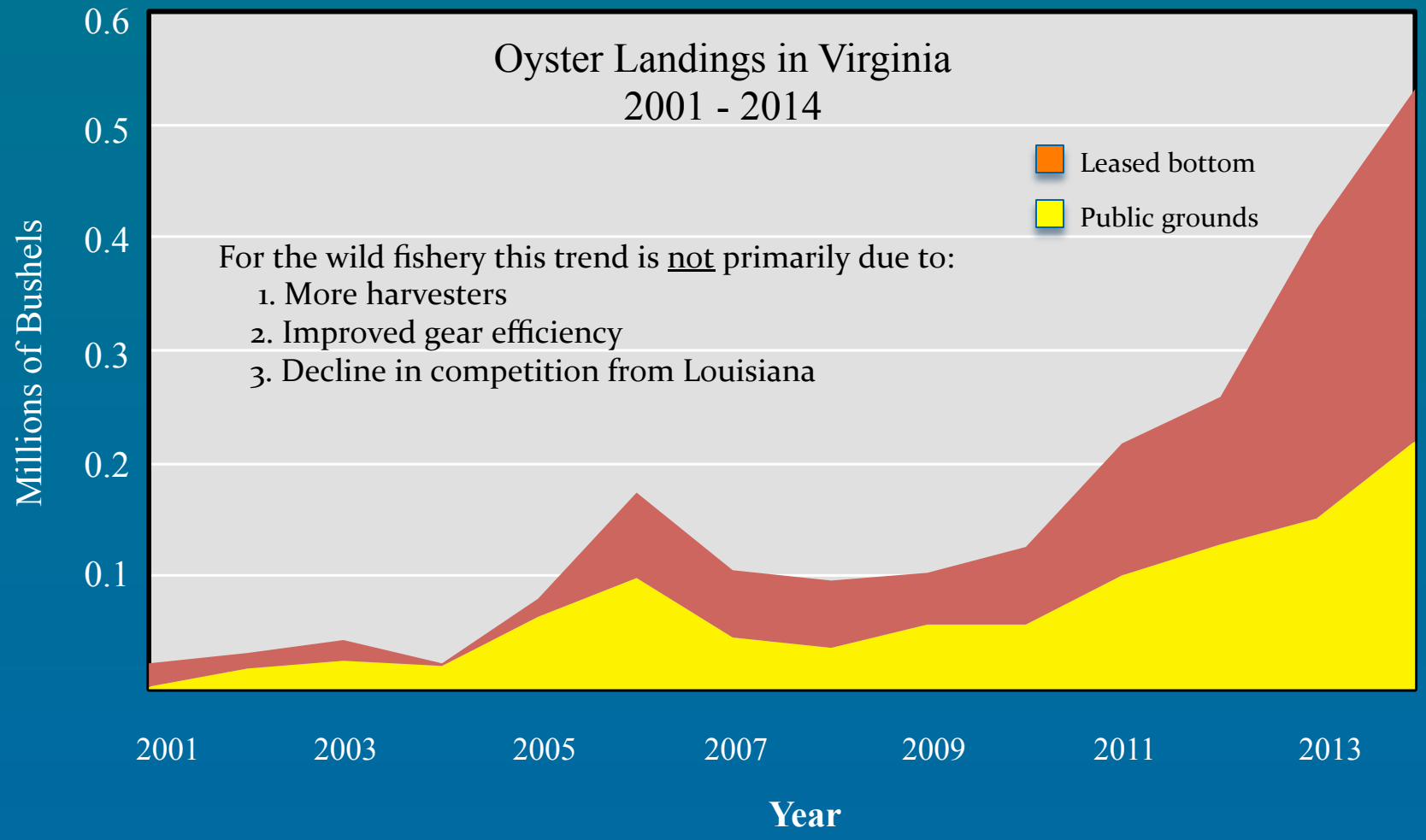

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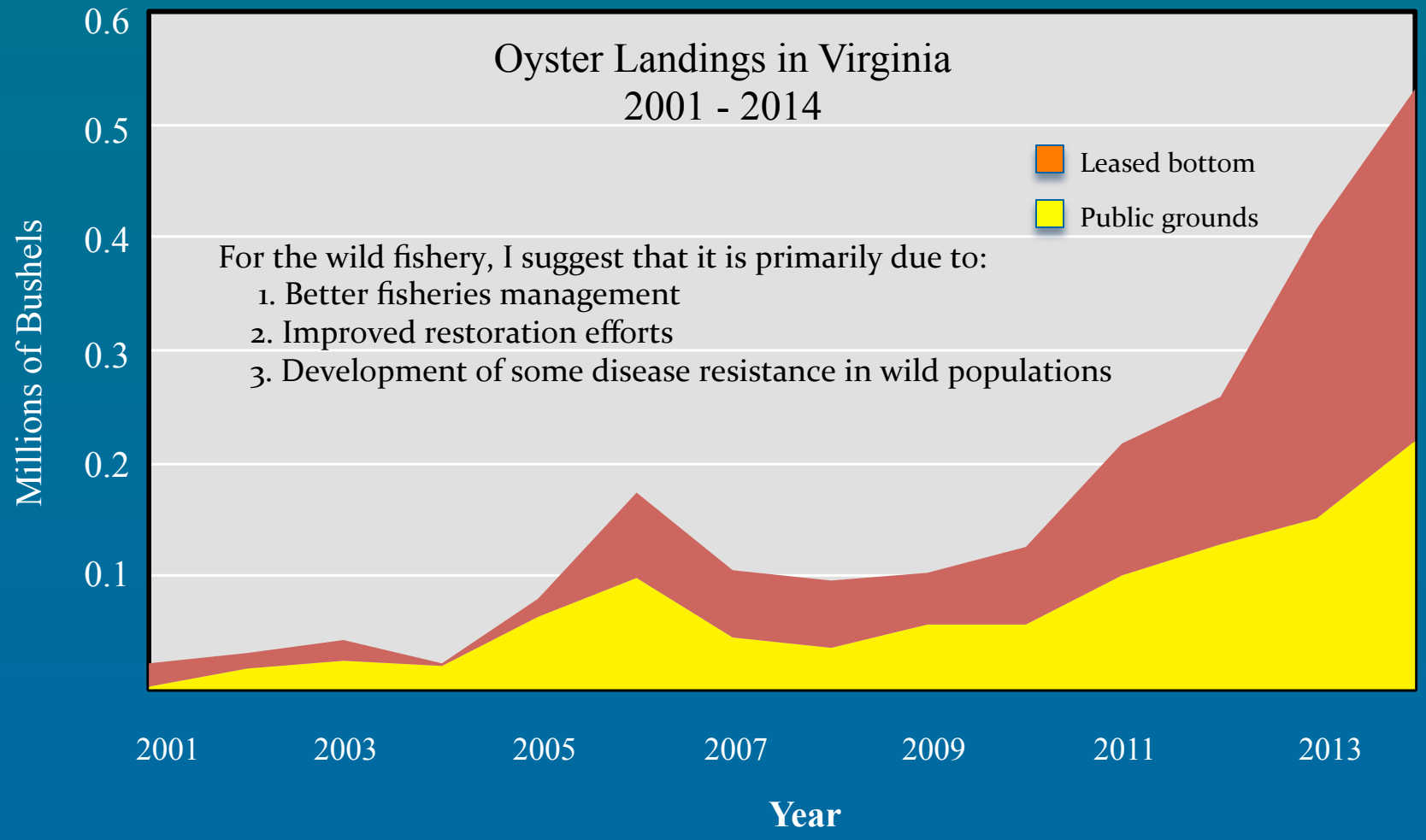

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Restoration: what has worked and what has not?

A decade-long *contemplation* of the efficacy of introducing a non-native oyster species ended in a decision not to do so.

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The Virginian-Pilot

SERVING HAMPTON ROADS AND NORTHEASTERN NORTH CAROLINA

The Army Corps of Engineers has spent millions of dollars trying to bring back Virginia's native oyster. But disputes and delays have plagued the effort. Is it time to unleash a bigger, heartier oyster? Backers of an Asian import think so.

OYSTER SHELL GAME

BY SCOTT HARPER
THE VIRGINIAN-PILOT

NORFOLK — When the Army Corps of Engineers, Norfolk District, joined the fight in 2000 to restore native oysters in the Chesapeake Bay, its leaders were giddy. They compared the effort to reviving the Florida Everglades. They talked about making history.

Today, the talk is more about what has gone wrong than what is going right.

The district has spent more than $8 million on native oyster projects. By its own count, 93 percent of oysters planted under its direction have died before reaching market size.

Corps efforts haven't slowed the long, dramatic decline in the Bay's oyster populations. In fact, stocks have declined – by 28 percent in the past decade, according to the National Academy of Sciences.

But now, the corps w
more experimentation
money. It's pushing fo
term, $500 million blu
that would include ext
work in the James, Eli
and Lynnhaven rivers,

Virginia relaxes rules on oyster harvest. Page A12

other
The
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native oyster.

But internal e-mail
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officials describe how
their projects – in Ta
Pocomoke sounds, in

Continued

Asian oyster
(*crassostrea ariakensis*)
Asian bivalves have grown faster than native oysters, and few die in the face of the diseases MSX and Dermo.

Native oyster
(*crassostrea virginica*)
These mollusks typically succumb to Chesapeake Bay diseases before reaching the minimum harvesting size.

PHOTOS BY HYUNSOO LEO KIM/THE VIRGINIAN-PILOT

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Restoration: what has worked and what has not?

In most, but not necessarily all, locations planting a thin veneer of shells has not been sufficient to promote the development of a sustainable reef.

Recruitment + New shell growth < Shell loss rate

Restoration: what has worked and what has not?

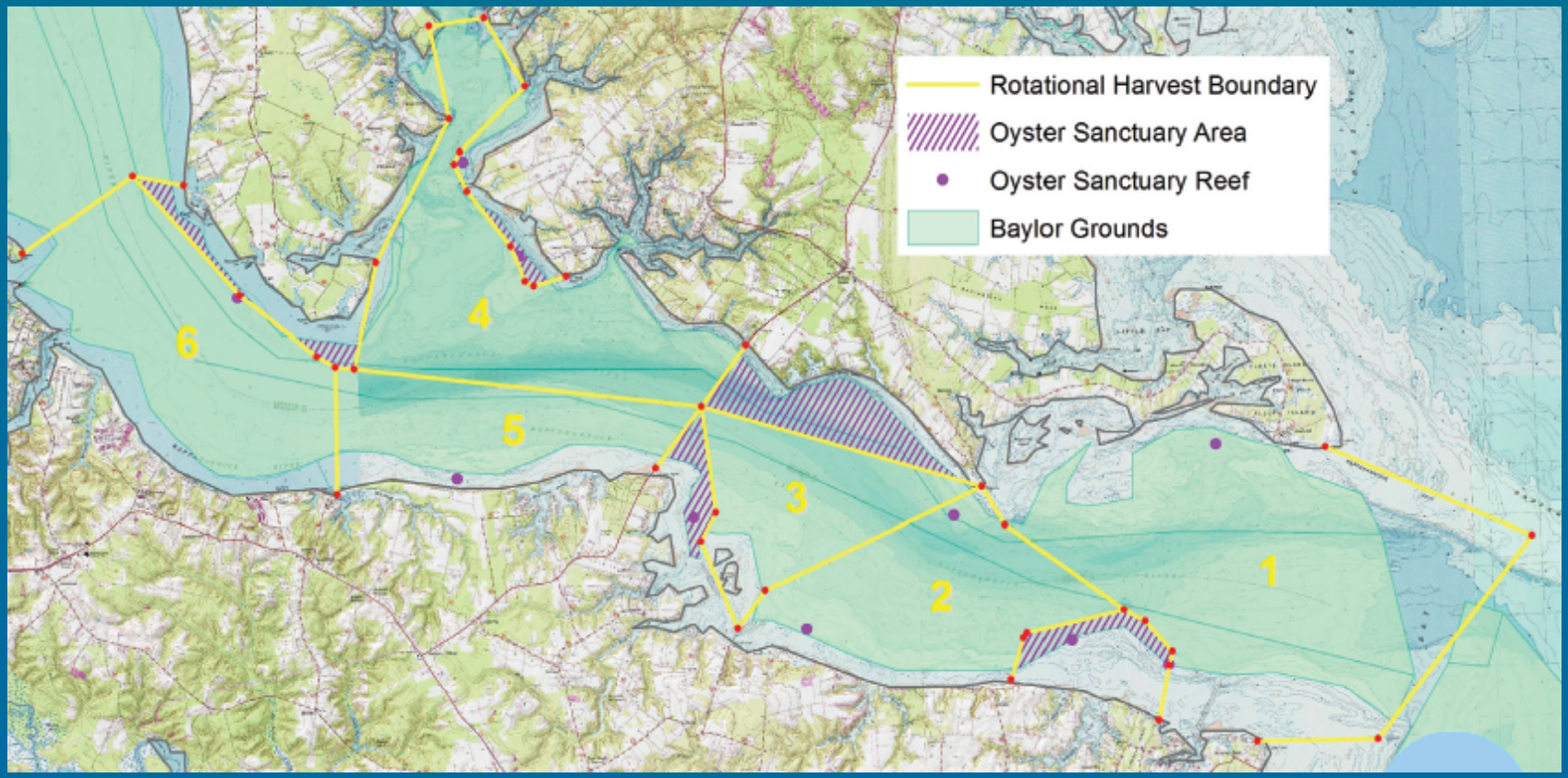
Greater attention to habitat architecture

Sufficient 3-D structure to:

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

Restoration: what has worked and what has not?

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

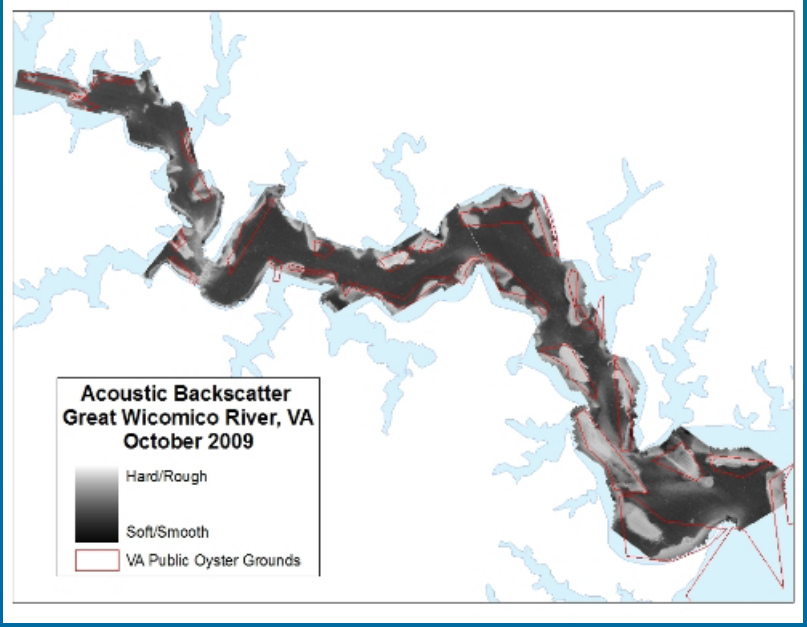


Rappahannock River, Virginia

Restoration: what has worked and what has not?

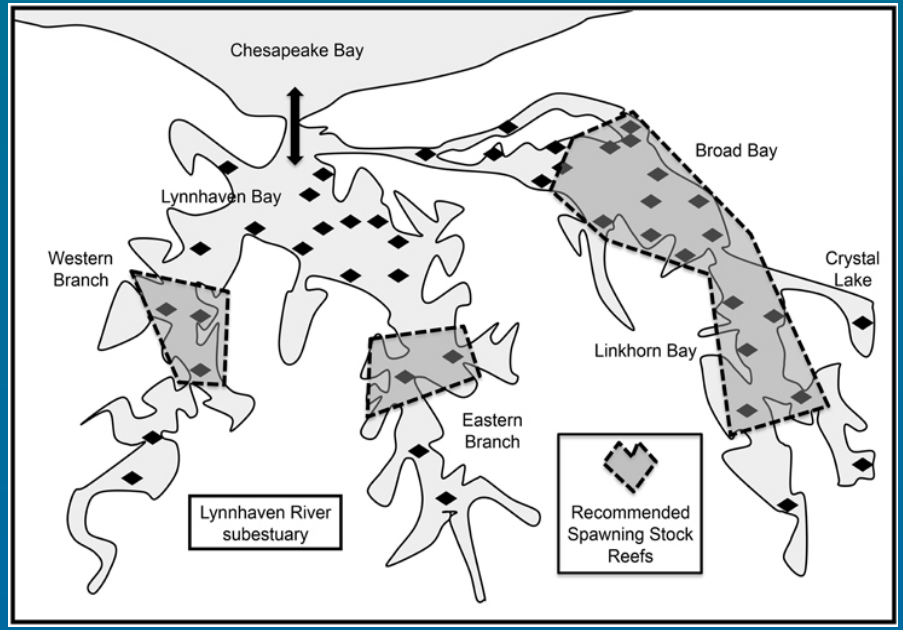
Tributary-scale restoration plans that include:

Detailed bottom mapping



From NOAA Ches. Bay Office

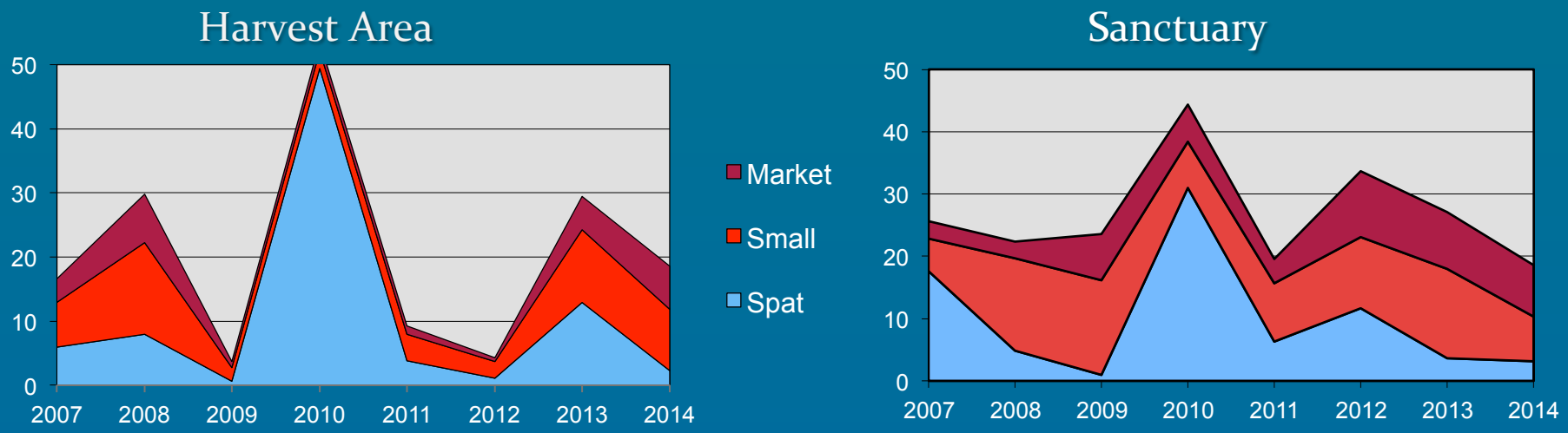
Metapopulation dynamics, Source-sink modeling



From Lipcius et al. 2015. Front. Mar. Sci.

Restoration: what has worked and what has not?

Sanctuary reefs preserve broodstock and do not reduce spatfall



From Jim Wesson, VMRC

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Restoration: what has worked and what has not?

Establishment of sanctuary reefs and improved fisheries management support the evolution of disease tolerance

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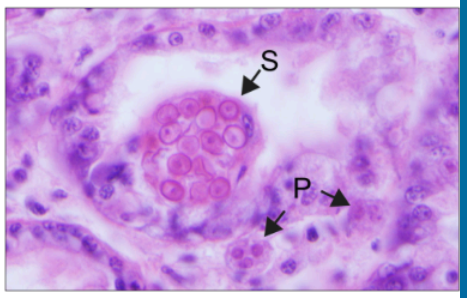
FEATURE ARTICLE:

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

Ryan B. Carnegie*, Eugene M. Burreson

Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, Virginia 23062, USA

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

- Strong evidence for MSX resistance
- Evidence for Dermo resistance

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Restoration: what has worked and what has not?

Widespread public engagement

Including:
CBF
TNC
Lynnhaven River Now
Elizabeth River Project
Many others

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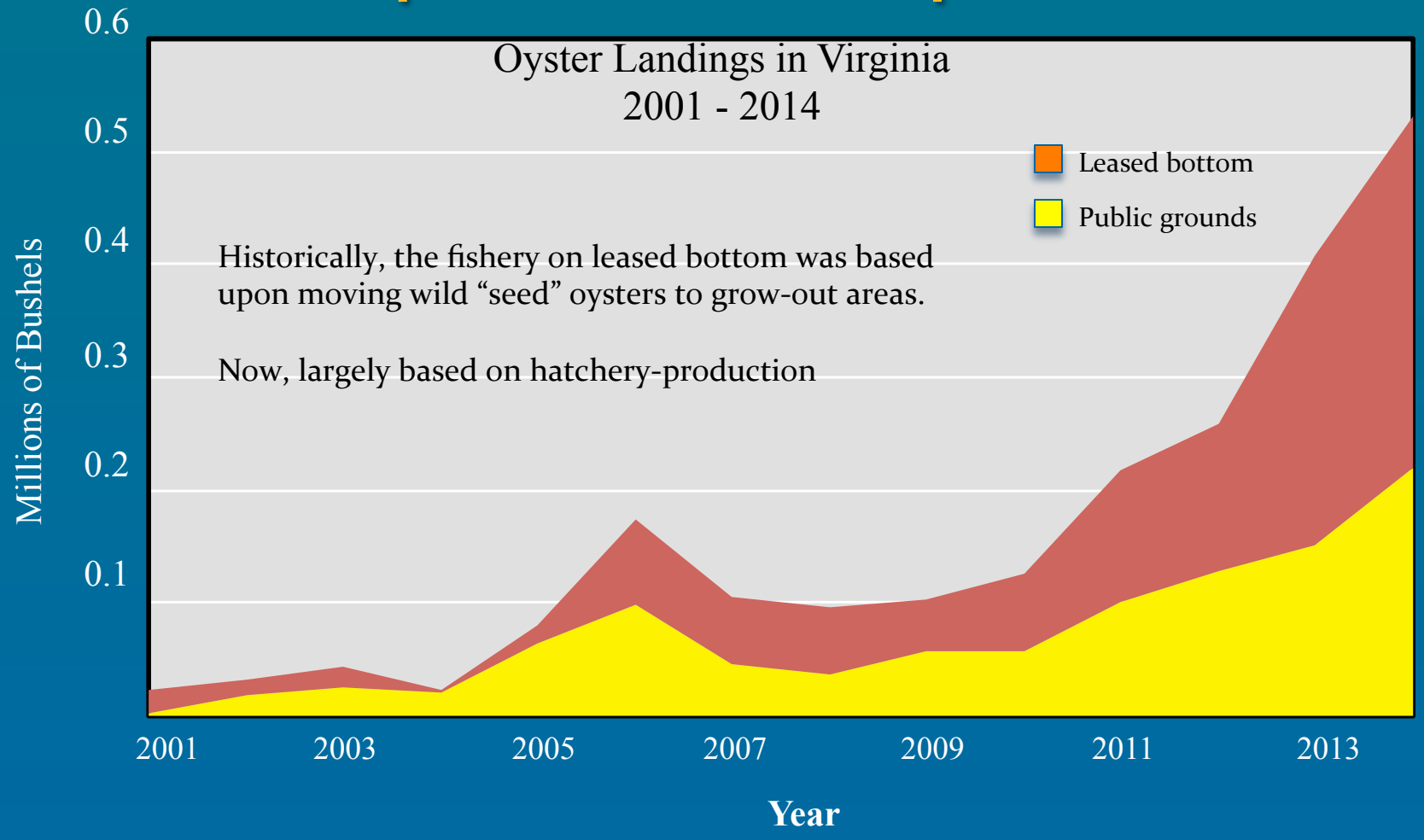
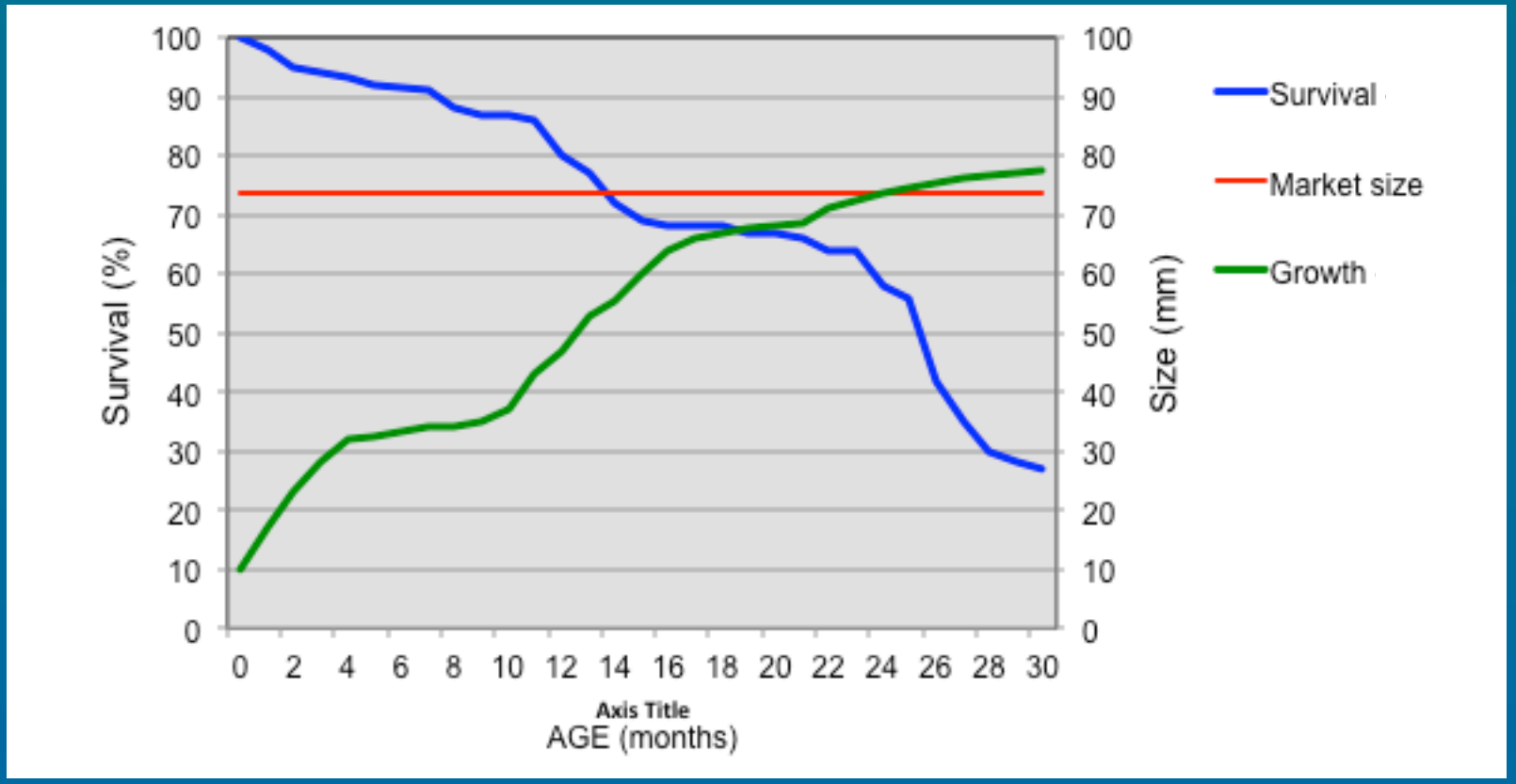
Aquaculture Development



From Jim Wesson, VMRC

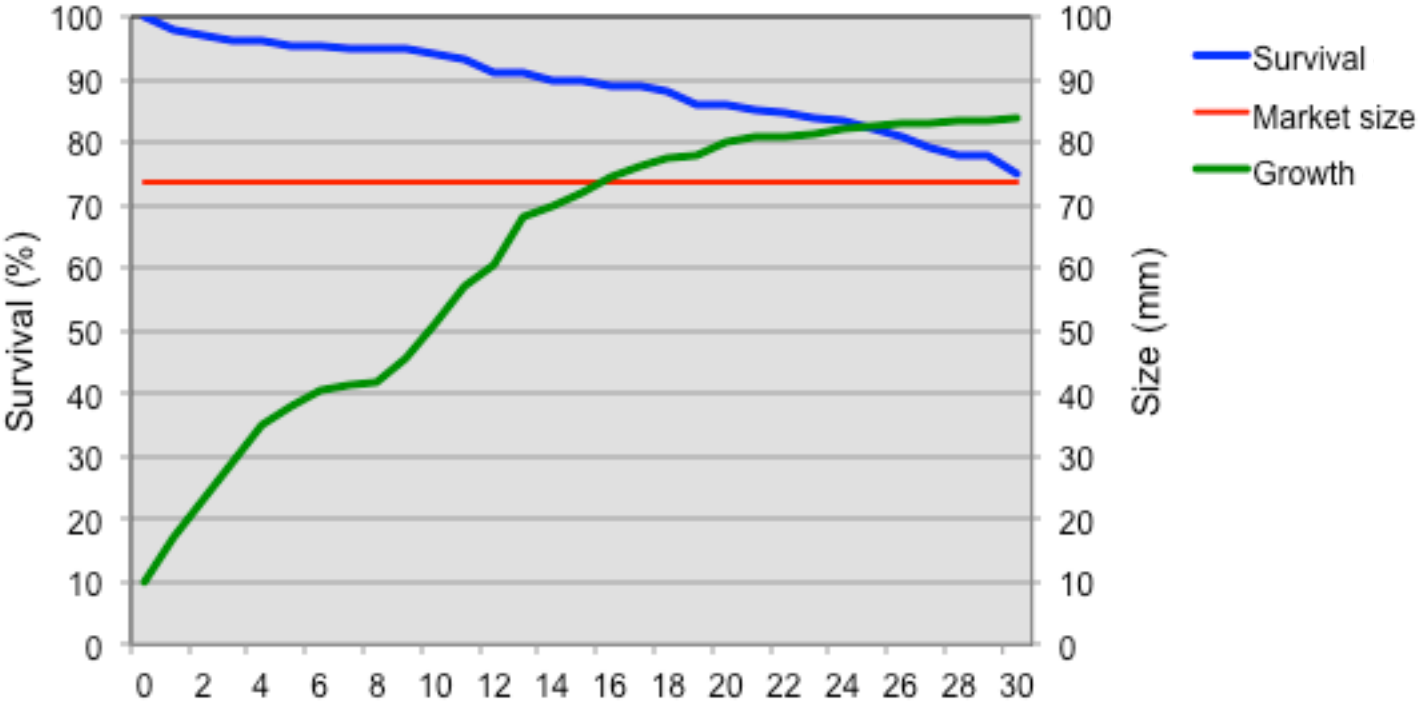
Aquaculture Development

Typical Cultured Oyster Growth and Survival (late 1980's)



Aquaculture Development

Typical Cultured Oyster Growth and Survival (now)



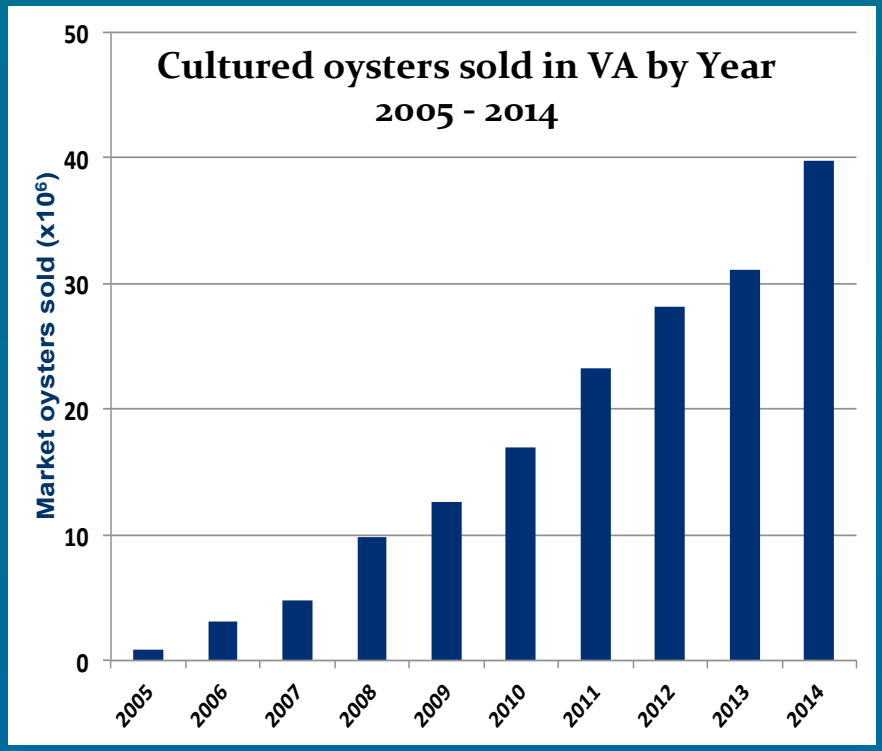
Selection for (1) disease resistance/ tolerance and (2) rapid growth, and (3) production of triploid oysters.

Aquaculture Development

This development has been enabled by:

- Favorable leasing laws
- 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

Aquaculture Development



From Hudson and Murray 2015

In 2014:

107.1 M single oyster seed planted

39.8 M aquacultured oysters sold

$17.1 M farm gate value

U.S. East Coast leader in oyster aquaculture production

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Where is this going and how do we sustain it?

Ecological Restoration

- Working in some places, but not others
- Emergence of natural disease resistance
- Currently limited by the availability of shell – need alternatives

Wild Fishery Enhancement

- Dependent on success of above restoration
- Will need to reduce latent capacity in the fishery – limited entry
- Develop & enforce quotas that are coupled to oyster abundance

Aquaculture

- Market would appear to support further growth
- Need to manage use conflicts in our coastal waters
- Must maintain a strong science-based development programs – selective breeding, disease diagnostics & public health

Thank you

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