VIMS Coastal Bays Restoration

CAWG Workshop August 2022

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VIMS | William & Mary
Virginia Institute of Marine Science
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Estuaries and Coasts (2017) 40:1744–1756
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CrossMark

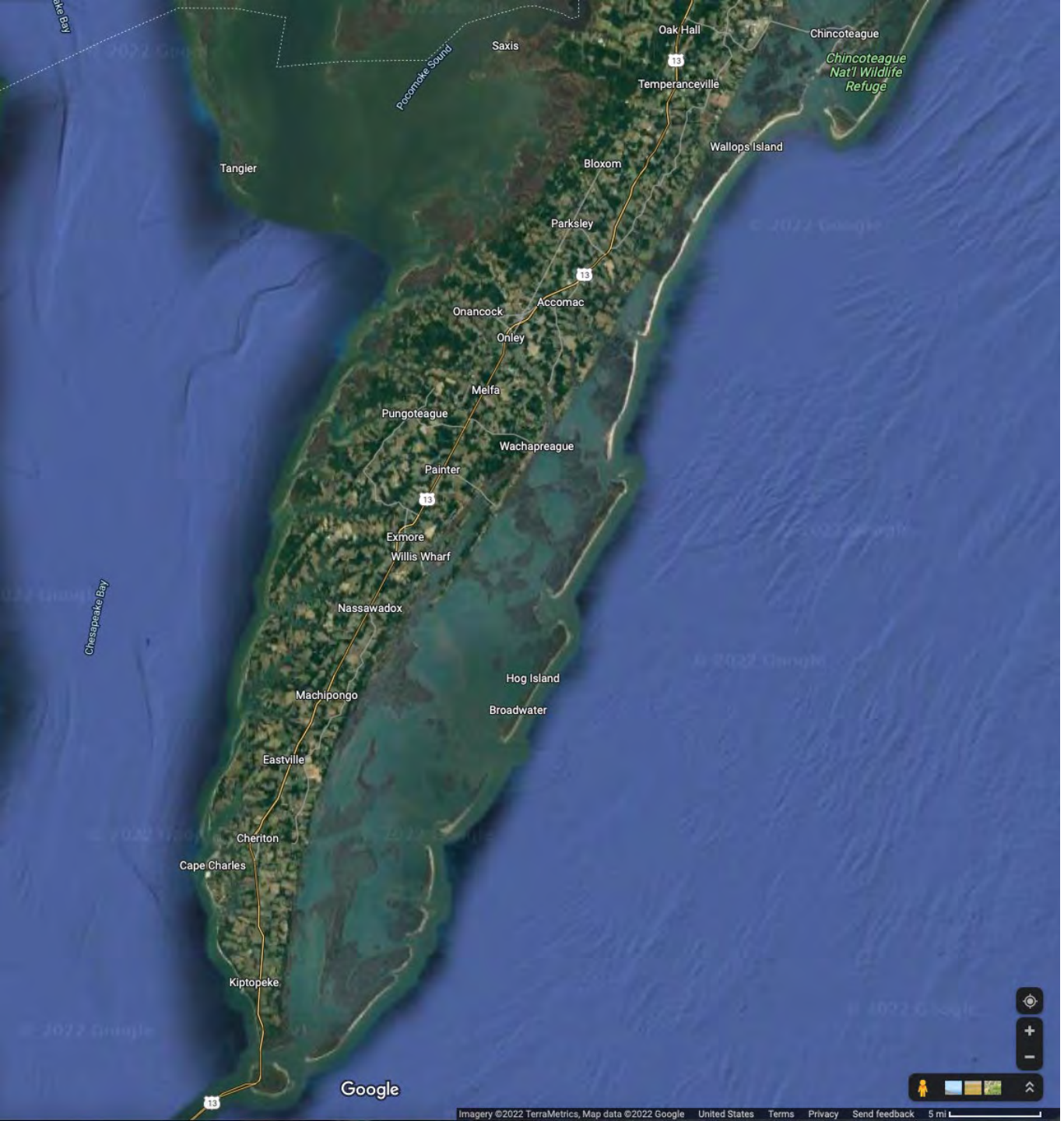
Subtidal Benthic Invertebrates Shifting Northward Along the US Atlantic Coast

Stephen S. Hale[1] · Henry W. Buffum[2] · John A. Kiddon[1] · Melissa M. Hughes[2]

ESVA is a boundary and mixing zone between the Virginian and Carolinian biogeographical provinces

Warm summers
Cold winters

Hard clam genetics
Blue mussels
Penaeid Shrimp
Pinfish



Eastern Shore of Virginia (ESVA)

Undeveloped barrier island system
TNC Volgenau Virginia Coast Reserve
State, Federal lands

Economy
Agriculture, Fisheries, and Aquaculture
High unemployment and poverty rates

<u>Seagrass and Scallop Restoration</u>

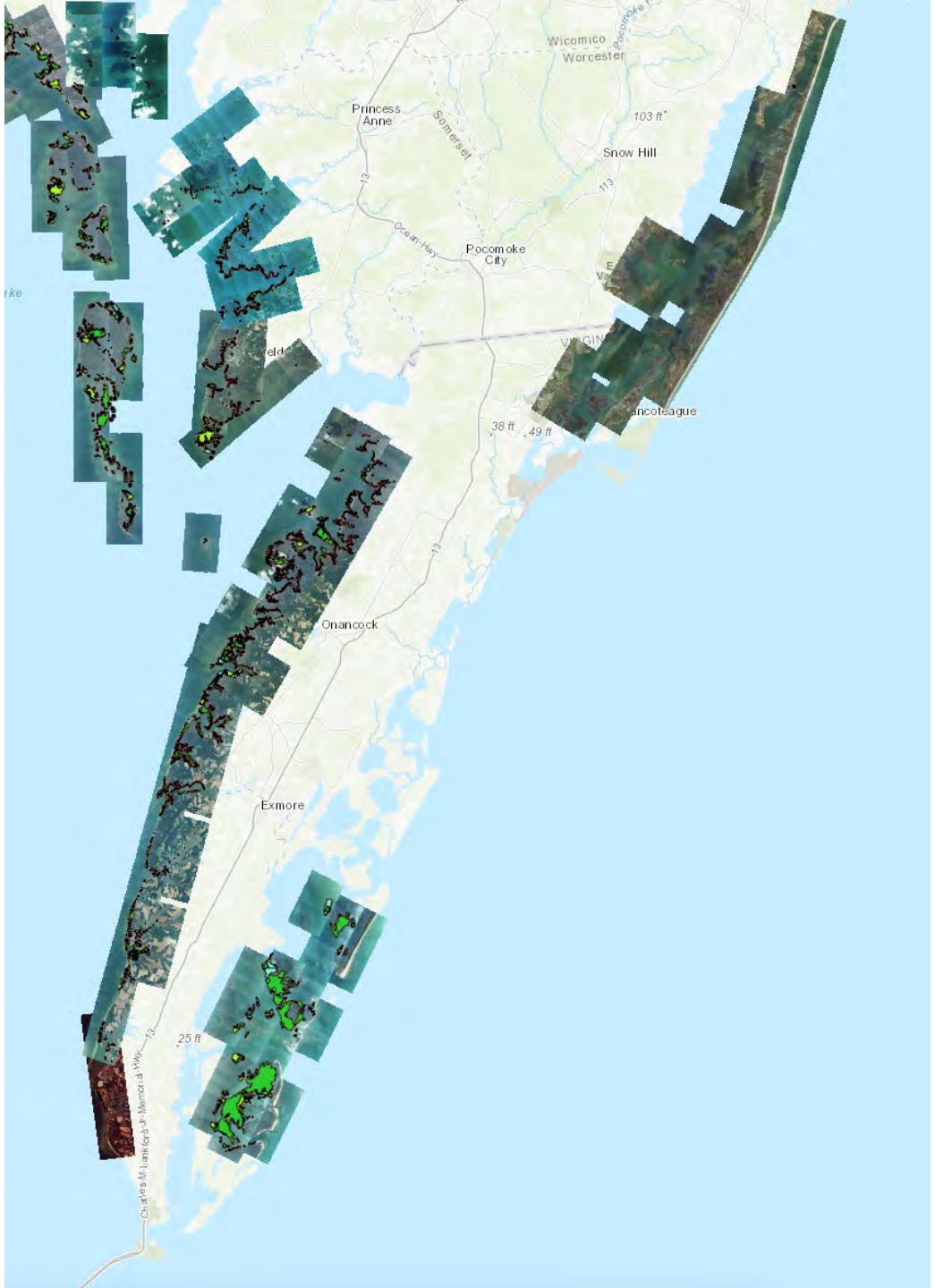
J.J. Orth, VIMS
Bo Lusk, The Nature Conservancy
Mark Luckenbach, VIMS
Richard Snyder, VIMS ESL
Chris Patrick, VIMS

ecological, economic, heritage resilience

Seagrass Restoration

1. Collecting seed shoots
2. Holding in tanks till seeds drop
3. Harvesting and quantifying seeds
4. Manual seeding of plots

Photos by The Nature Conservancy staff



VIMS Annual Aerial Surveys for seagrasses covers the Chesapeake Bay
and
Coastal Maryland + Virginia

Coupled with ground truth surveys
Annual reports on VIMS SAV Program website:
https://www.vims.edu/research/units/programs/sav/index.php

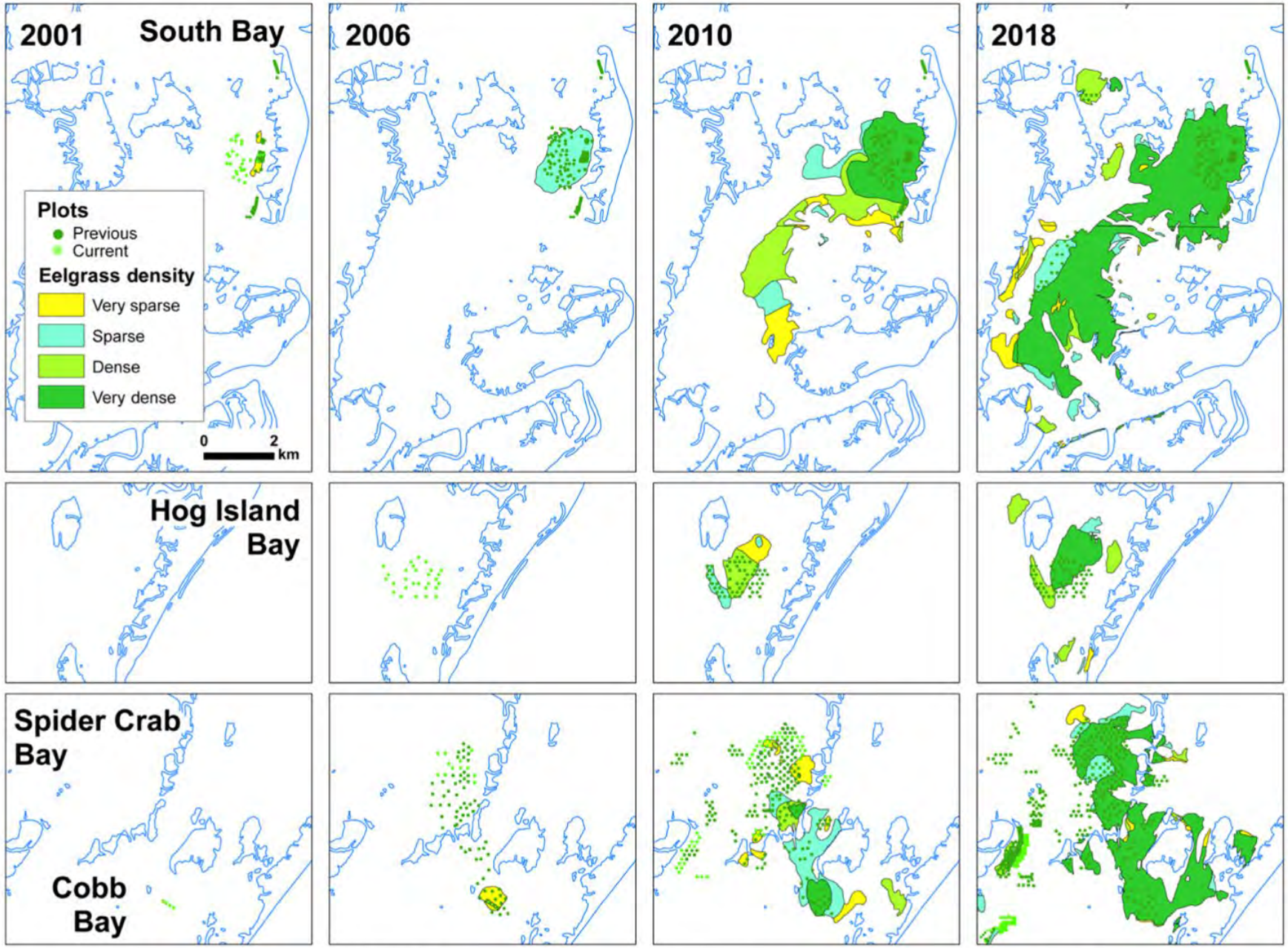
SCIENCE ADVANCES | RESEARCH ARTICLE

APPLIED ECOLOGY

Restoration of seagrass habitat leads to rapid recovery of coastal ecosystem services

Robert J. Orth[1]*, Jonathan S. Lefcheck[2], Karen S. McGlathery[3], Lillian Aoki[3], Mark W. Luckenbach[1], Kenneth A. Moore[1], Matthew P. J. Oreska[3], Richard Snyder[1], David J. Wilcox[1], Bo Lusk[4]

There have been increasing attempts to reverse habitat degradation through active restoration, but few large-scale successes are reported to guide these efforts. Here, we report outcomes from a unique and very successful seagrass restoration project: Since 1999, over 70 million seeds of a marine angiosperm, eelgrass (*Zostera marina*), have been broadcast into mid-western Atlantic coastal lagoons, leading to recovery of 3612 ha of seagrass. Well-developed meadows now foster productive and diverse animal communities, sequester substantial stocks of carbon and nitrogen, and have prompted a parallel restoration for bay scallops (*Argopecten irradians*). Restored ecosystem services are approaching historic levels, but we also note that managers value services differently today than they did nine decades ago, emphasizing regulating in addition to provisioning services. Thus, this study serves as a blueprint for restoring and maintaining healthy ecosystems to safeguard multiple benefits, including co-benefits that may emerge as management priorities over time.



~24:1 ratio
Planted to Grow out

Fig. 2. Seagrass cover in the four bays for four time periods: 2001, 2006, 2010, and 2018. Cover estimates (very sparse, 1 to 10%; sparse, 11 to 40%; moderate, 41 to 70%; dense, 70 to 100%) indicated by color in each polygon. Small squares in each box represent restoration plots (light green are plots done that year; dark green are plots done in previous years).

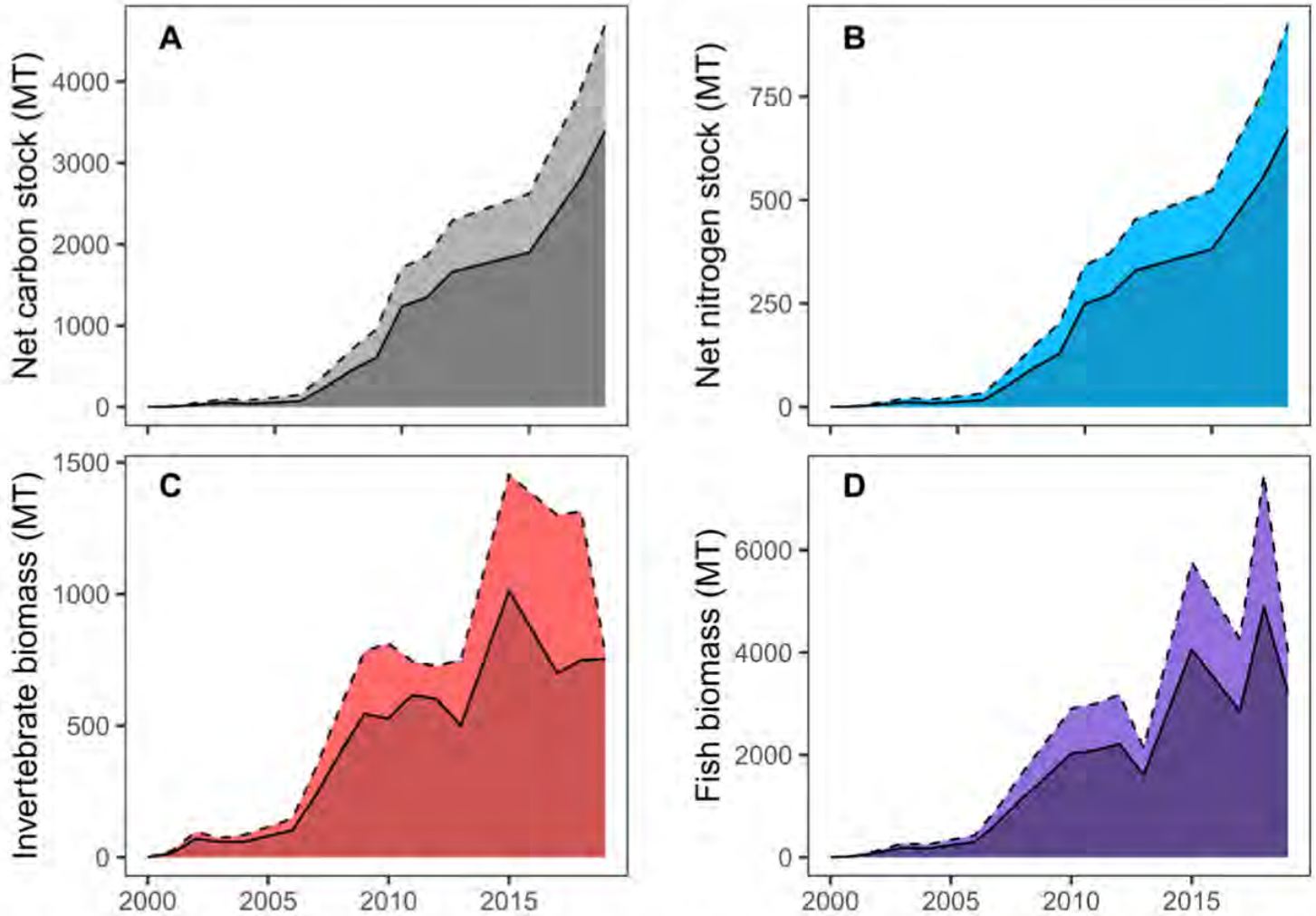
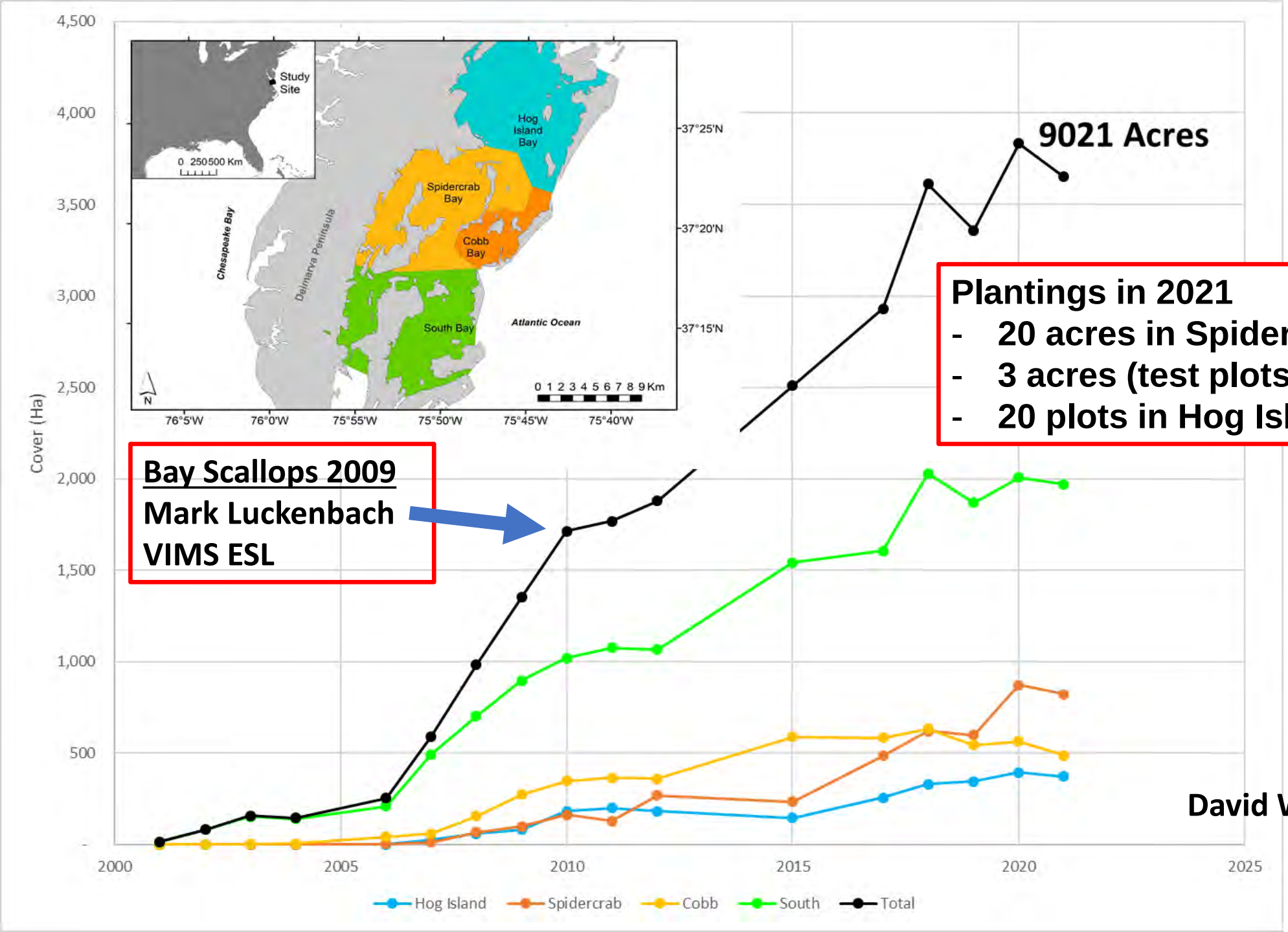


Fig. 5. Ecosystem services associated with the restoration of eelgrass over time. Mean (solid lines) and 95% confidence intervals (dotted lines) over time (mT = metric tons). (**A**) Net sediment carbon stocks. (**B**) Net sediment nitrogen stocks (net stock = seagrass sediment stock − unvegetated sediment stock). For sediment nutrient stocks, measurements were taken in beds of varying ages and these values were matched with the corresponding year since the beginning of the restoration. (**C**) Total invertebrates. (**D**) Total fish biomass. For faunal communities, data were collected in various years, and averages/standard deviations were used to interpolate values for years in which no data were available. Both measurements were expressed per unit area and extrapolated to the total bed area for each year.



Plantings in 2021

- 20 acres in Spidercrab Bay
- 3 acres (test plots) near Wachapreague
- 20 plots in Hog Island Bay

Bay Scallops 2009
Mark Luckenbach
VIMS ESL

David Wilcox graphics, VIMS

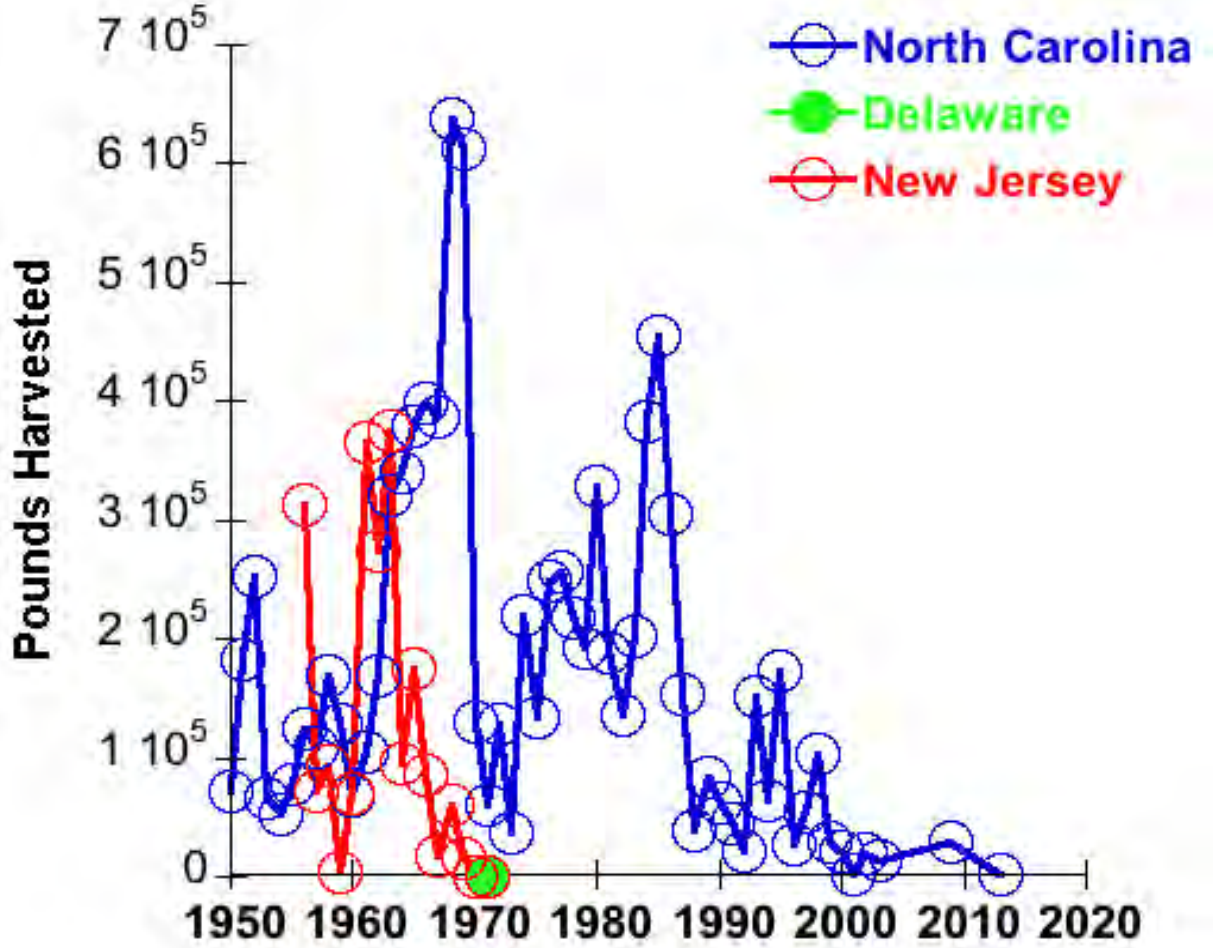
Bay Scallops

<u>Seagrass is critical habitat</u>
Eel grass. *Zostera marina*
Turtle grass *Thalassia testudinum*

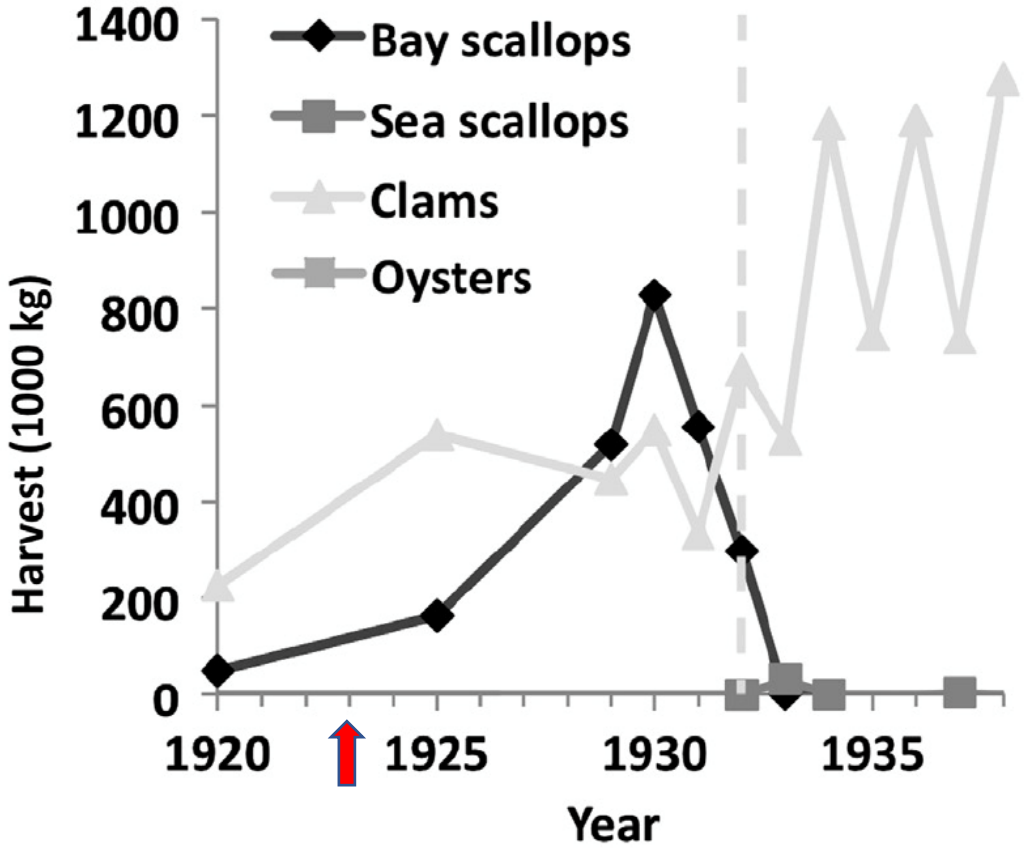
Mobile, swimming! but benthic
Voracious filter feeders
Short – lived: 1.5 - 2 years

VIMS After Hours Lecture 22 Feb 2022:
https://www.youtube.com/watch?v=CSLlcuI9p9w

Regional losses of bay scallop harvests



NOAA FISHERIES
National Oceanic and Atmospheric Administration



Annual bay scallop, hard clam and oyster harvests in Virginia. Dashed line is the the 1933 hurricane. Red arrow indicates when regulations were established for scape harvest.

Oreska, PJ, B Truitt, RJ Orth, and MW Luckenbach. 2017. The bay scallop (*Argopecten irradians*) industry collapse in Virginia and its implications for the successful management of scallop-seagrass habitats. *Marine Policy* 75: 116-124.

ESL Scallop Rearing

Ripe bay scallop!

Hemaphrodites
Both sperm and eggs

Spring and fall spawns

ESL work with bay scallops since the 1960s

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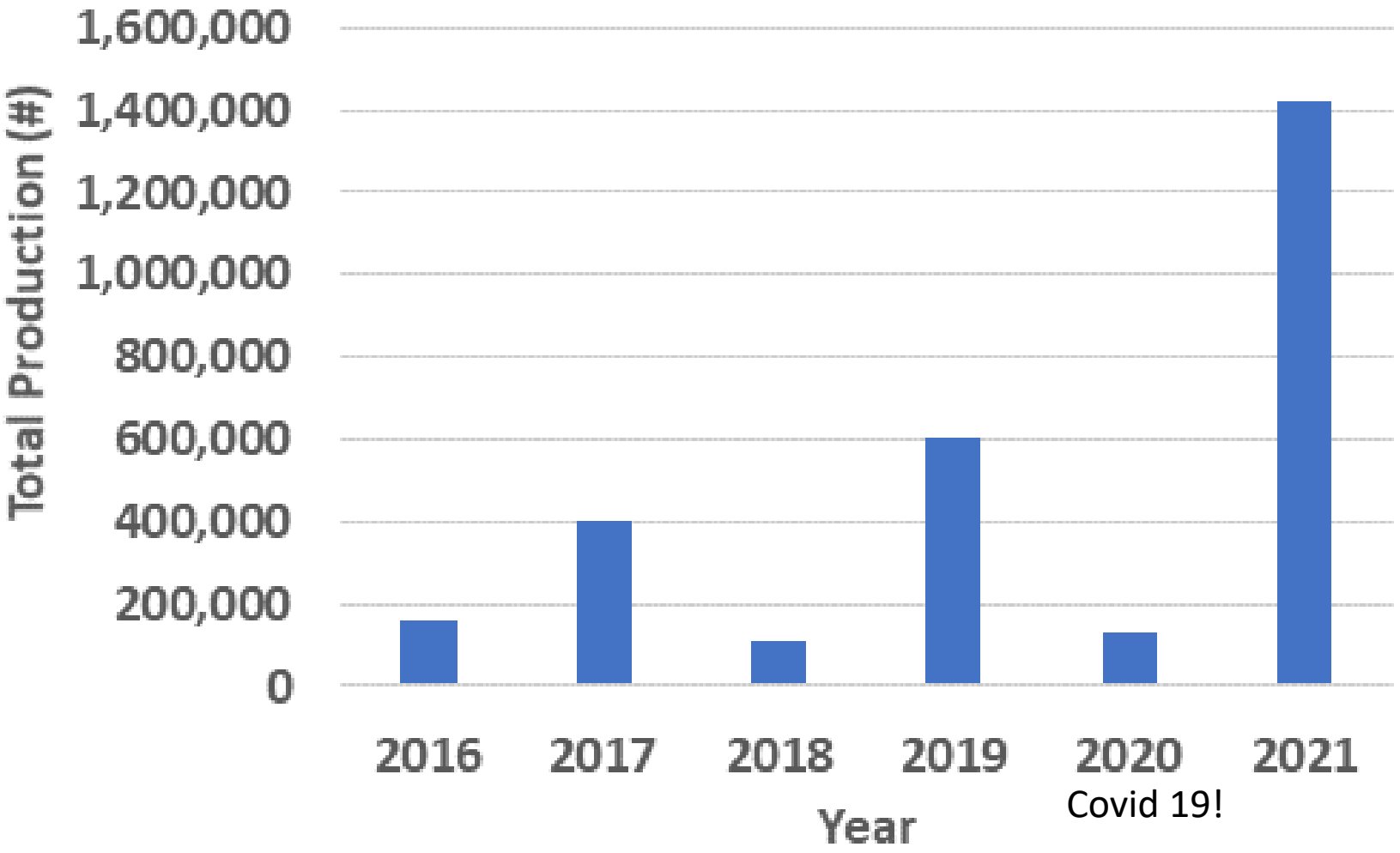
VIMS ESL Scallop Production.



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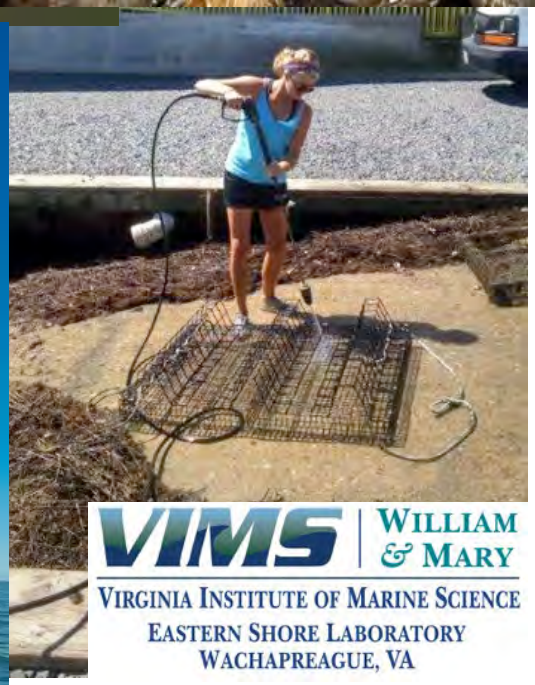
VIMS ESL South Bay

Sorting, splitting with growth

Grow out and in situ spawning



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Bay Scallop Releases

Pediveliger Larvae, Juveniles, and Adults

In situ spawning

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Annual Scallop Survey

2-3 Days, 5 boats, 4-5 persons/boat

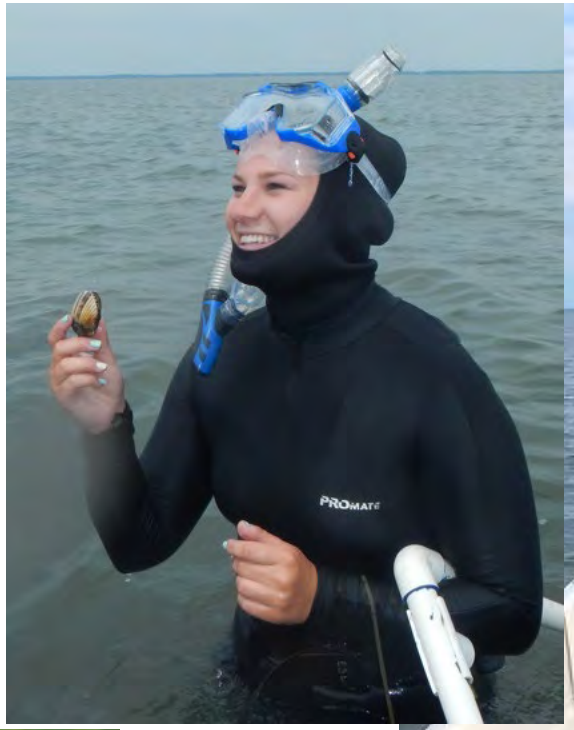
50 m^2 of seagrass per station

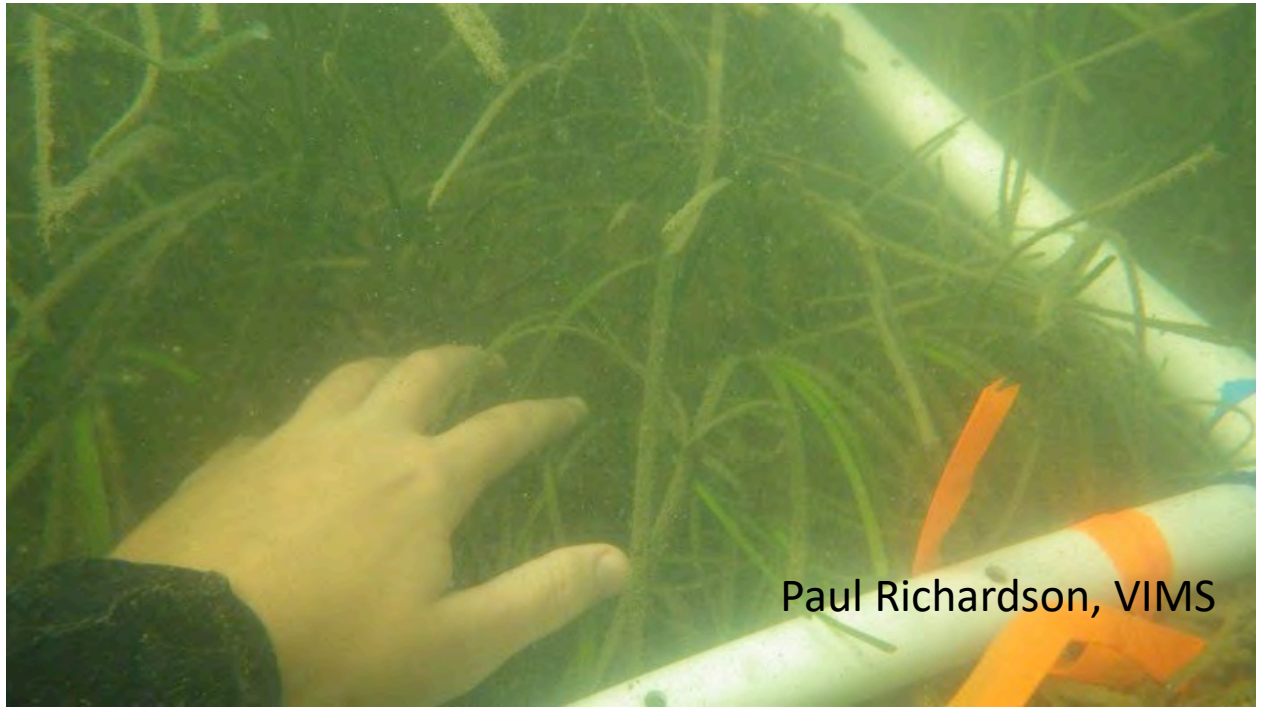
6,000 m^2 of bottom

VIMS ESL, VIMS,

& Nature Conservancy

Sizes, DNA samples, Broodstock





Paul Richardson, VIMS

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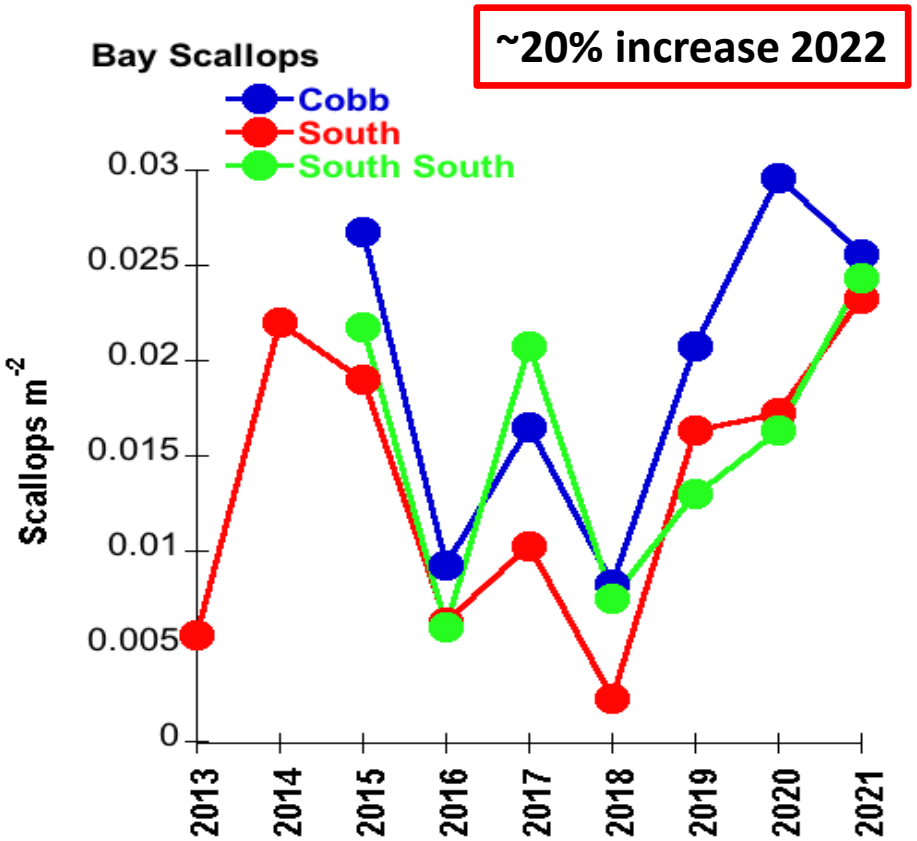

~20% increase 2022

Florida Gulf Coast (FL FWCC)
Population assessment thresholds

0 – 0.01 /m² = Collapsed
0.01 – 0.1/m² = Vulnerable
0.1 – 1/m² = Stable
>1/m² = sustainable

Paul Richardson graphics, VIMS

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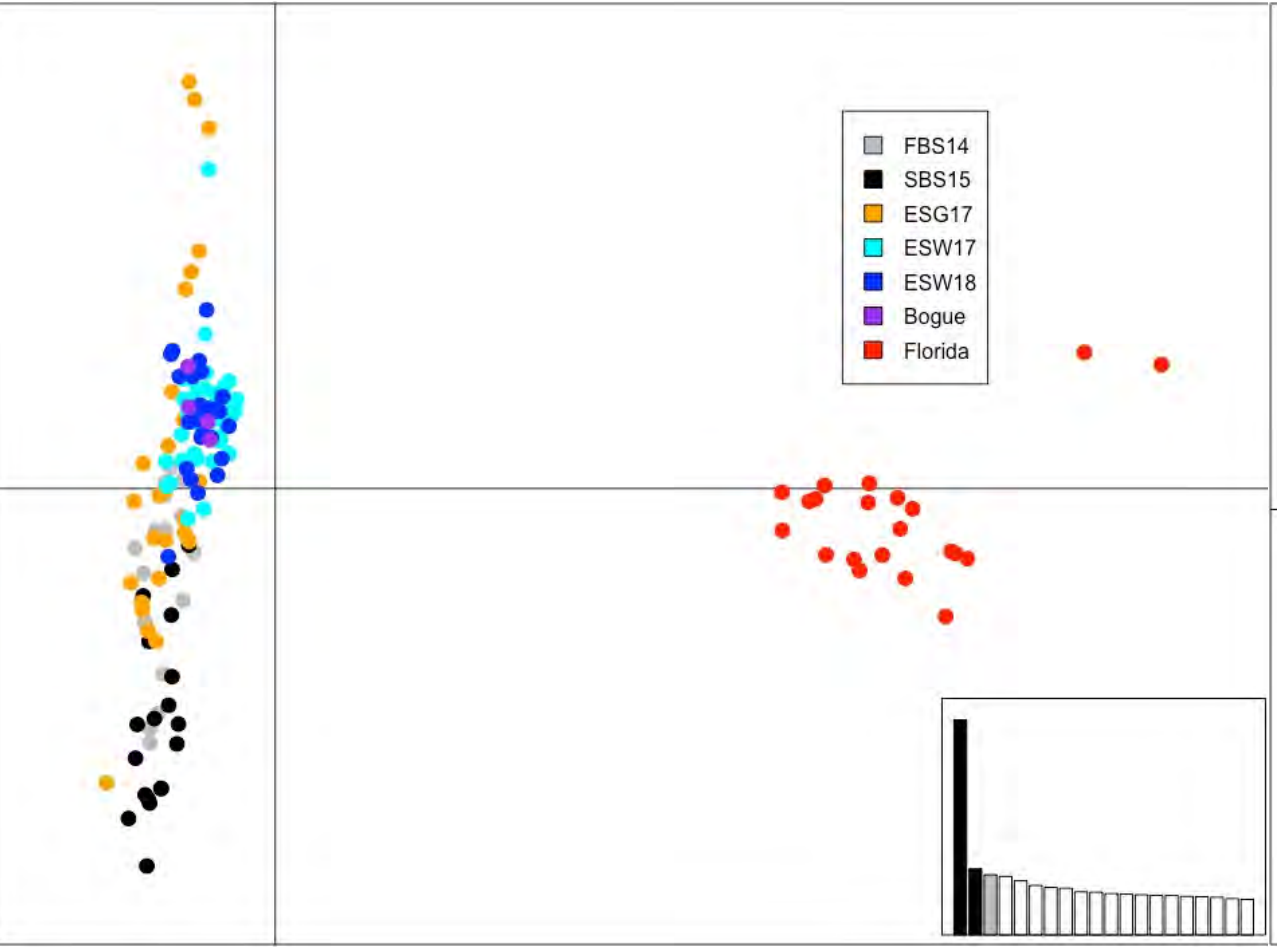
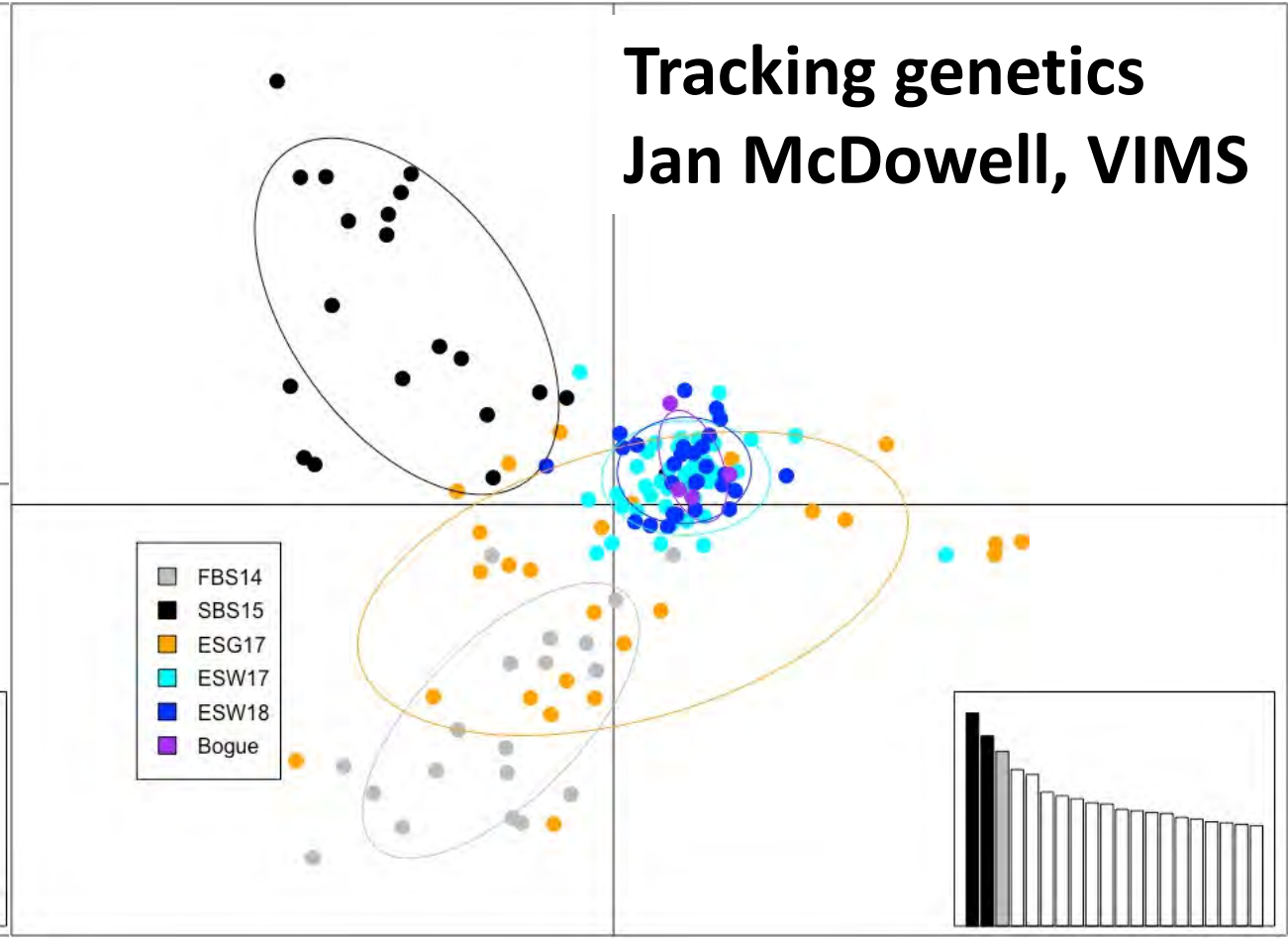
Tracking genetics
Jan McDowell, VIMS

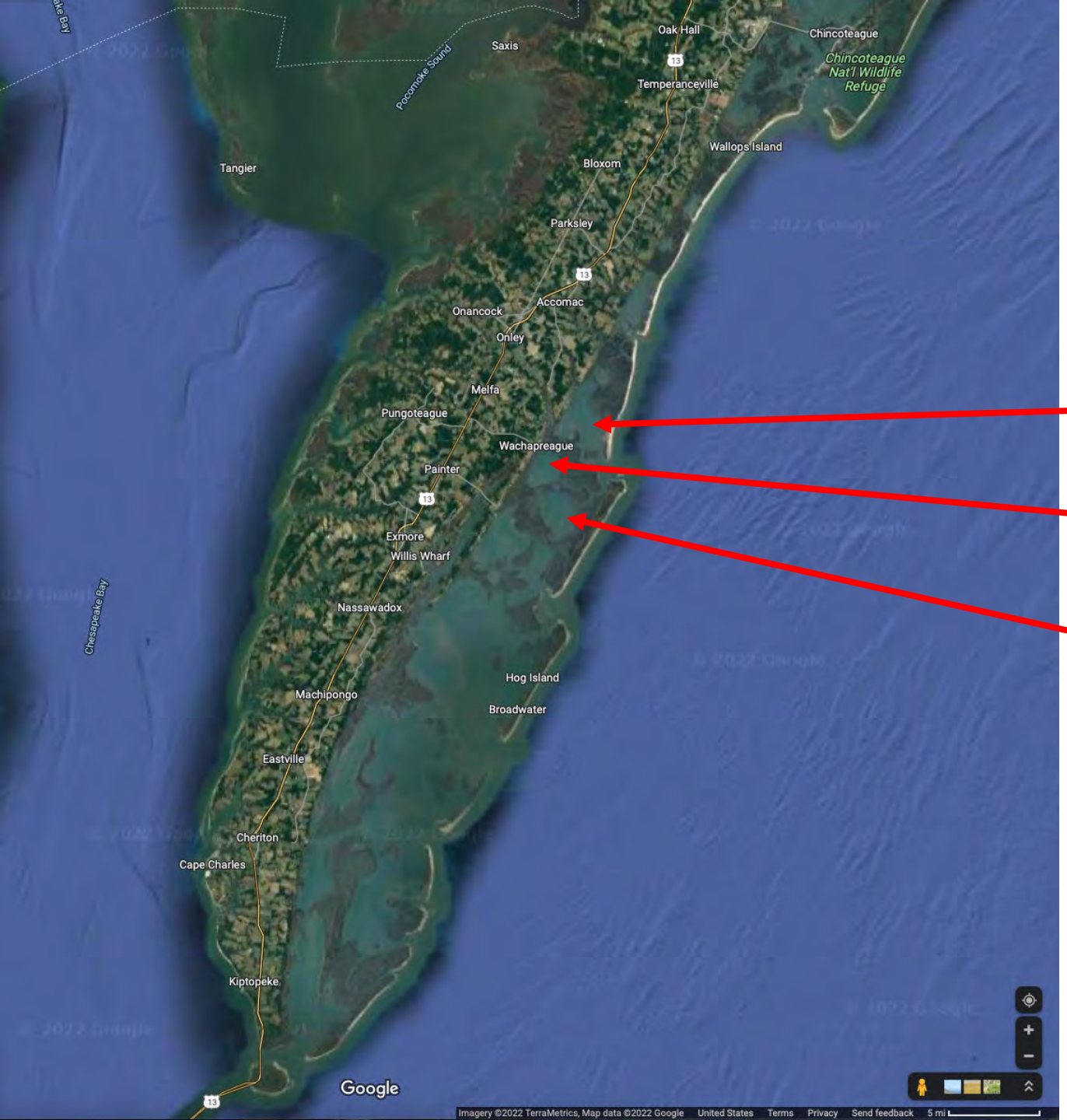




Fall 2014 ESL Broodstock: FBS14
Spring 2014 ESL Broodstock: SBS15
2017 ESL Growout: ESG17
2017 ESL Wild Collected: ESW17
2018 ESL Wild Collected: ESW18
Bogue Sound NC 2018: Bogue
West Coast Florida 2018: Florida

Aquaculture Potential

Next phase of seaside restoration



Burton's Bay

Bradford Bay

Swash Bay

Virginia Coastal Zone
MANAGEMENT PROGRAM
DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

THE CAMPBELL FOUNDATION

The Nature Conservancy

Rebecca Turner-Smith
Darian Kelley
Edward Smith
Sean Fate
Chris Bentley
PG Ross
John Lewis
Glen Brundage
Justin Paul
ESL Interns
Mark Luckenbach
JJ Orth
Chris Patrick
Corey Holbert
John Richardson
David Wilcox
Bo Lusk
Wade Jeffrey & crew
Will Patterson & crew

NOAA FISHERIES
National Oceanic and Atmospheric Administration

The Saltonstall-Kennedy Grant Program

Sea Grant
Virginia

VMRC

VIRGINIA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES

Virginia Agriculture Council

Private Donors
Thank you!