Achieving Water Quality Goals in the Chesapeake Bay: A Comprehensive Evaluation of System Response (CESR)

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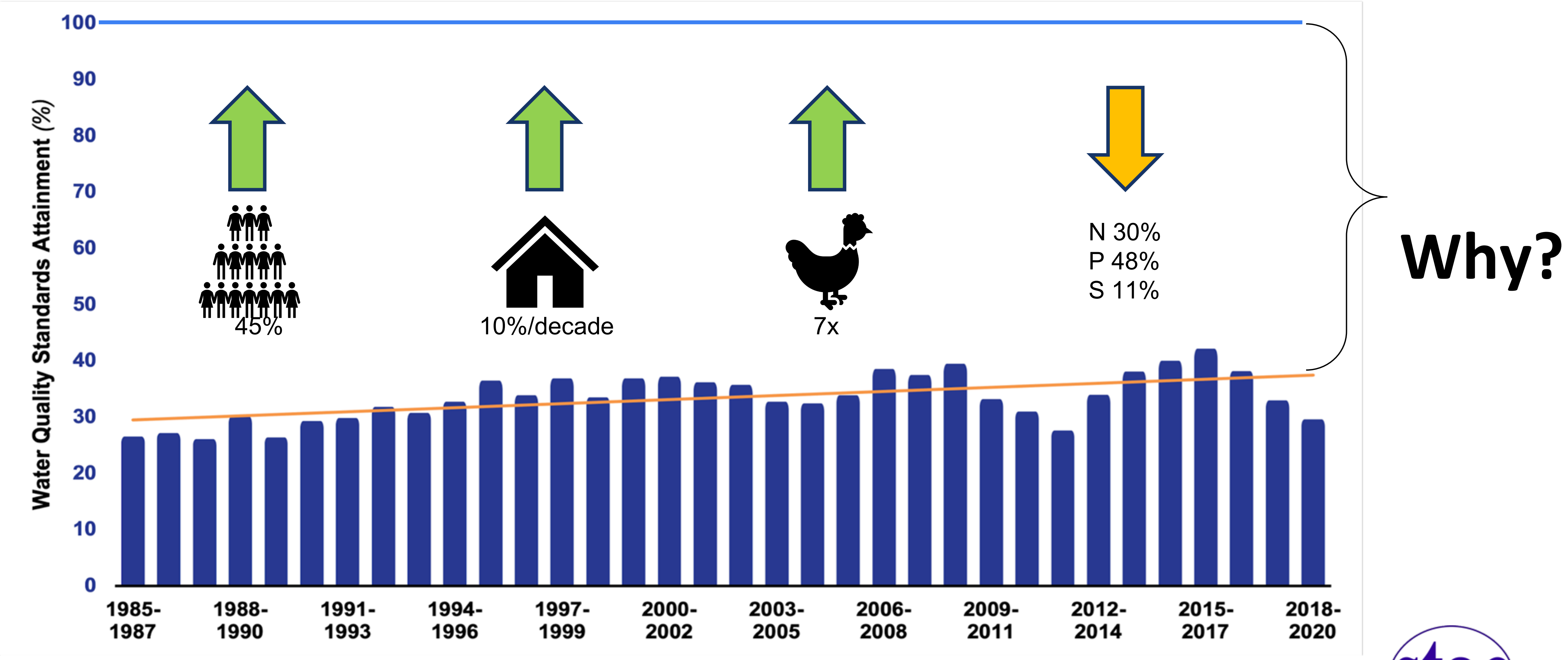
January 15, 2024

stac

Why this report, at this time, by these people?



Water Quality Policy Summary for the Chesapeake Bay

Chesapeake Bay Agreement → **Water Quality Goal** → **Measurement of the Goal** → **Achieving the Goal**

<u>Restoration Goals</u>
Sustainable Fisheries
Vital Habitat
Water Quality
Toxic Contaminants
Heathy Watershed
Climate Resiliency
Land Conservation
Stewardship
Public Access
Environmental Literacy

Protect aquatic living resources

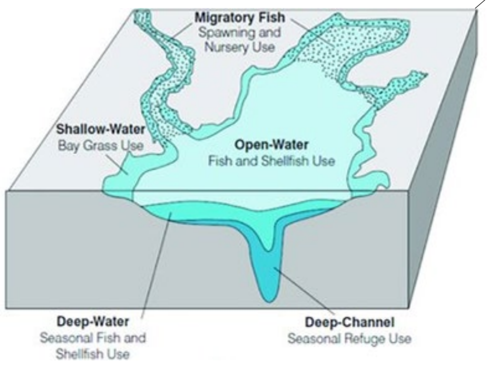
Numeric Criteria

Dissolved Oxygen (DO) (30 day avg, 7 day avg, instantaneous):

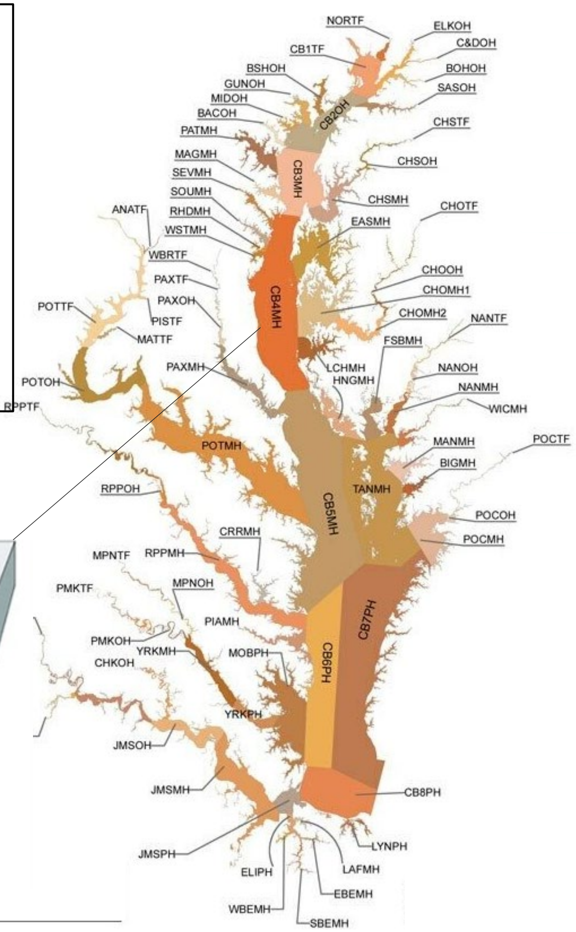
Water Clarity/Aquatic Vegetation

Chlorophyll a

Criteria in 5 habitats



92 "segments"



= 1092 assessment points

TMDL
N, P, sediment targets to meet goal
↑
Pollutant Control Programs
↑
Accountability

CESR Summary

1. Achieving pollutant load reductions for the Bay

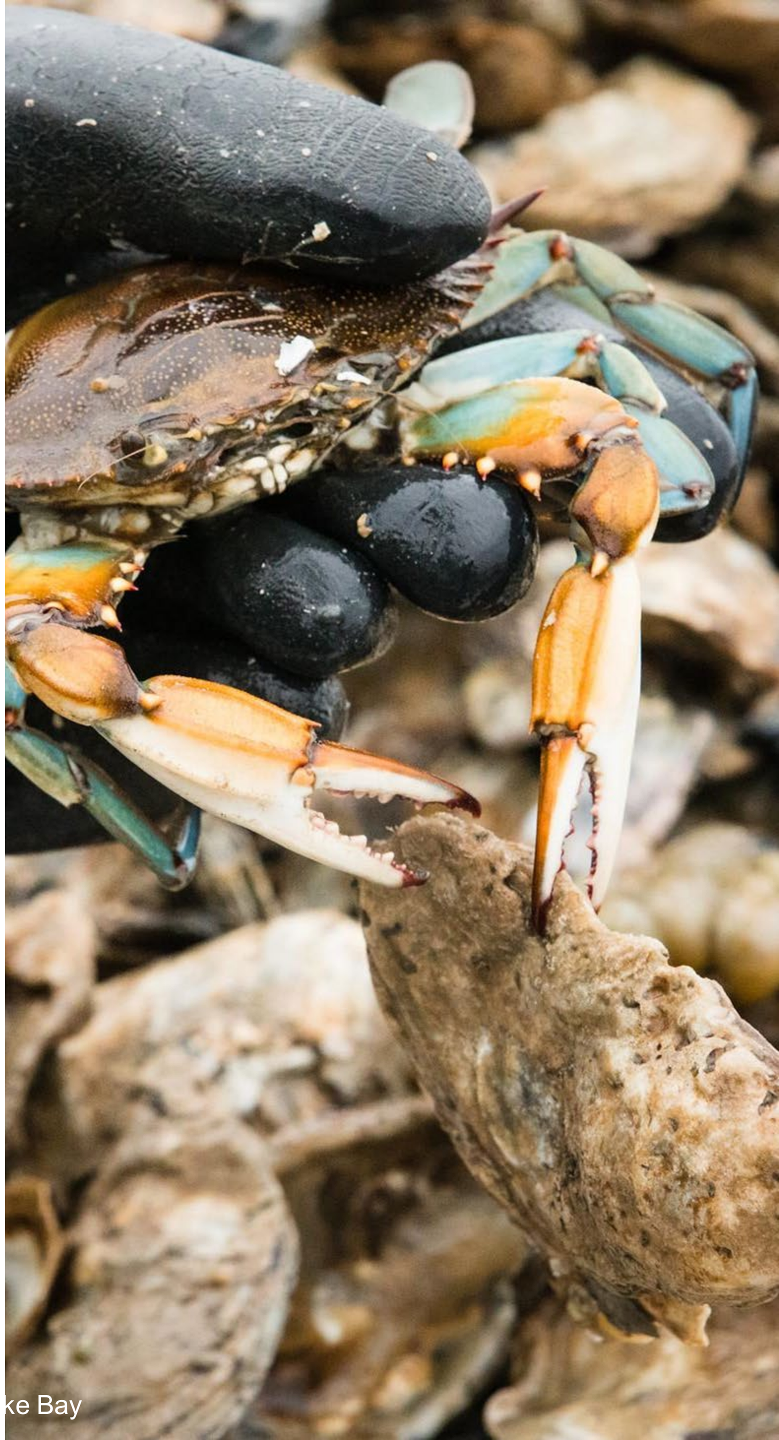
FINDING: Agricultural and urban nonpoint sources programs are not generating sufficient reductions to achieve Bay pollutant reduction targets.

OPPORTUNITIES: Reforms and new programs have potential to improve nonpoint source program effectiveness

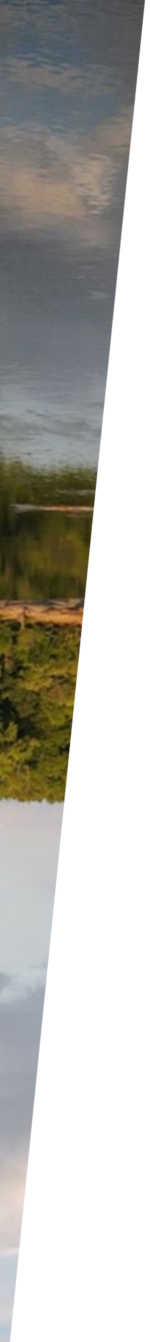
2. Achieving Bay Water Quality Goals

FINDING: Bay water quality is improving but the magnitude of the change unlikely to achieve all water quality criteria

OPPORTUNITIES: Focus on potential impact on Bay living resources



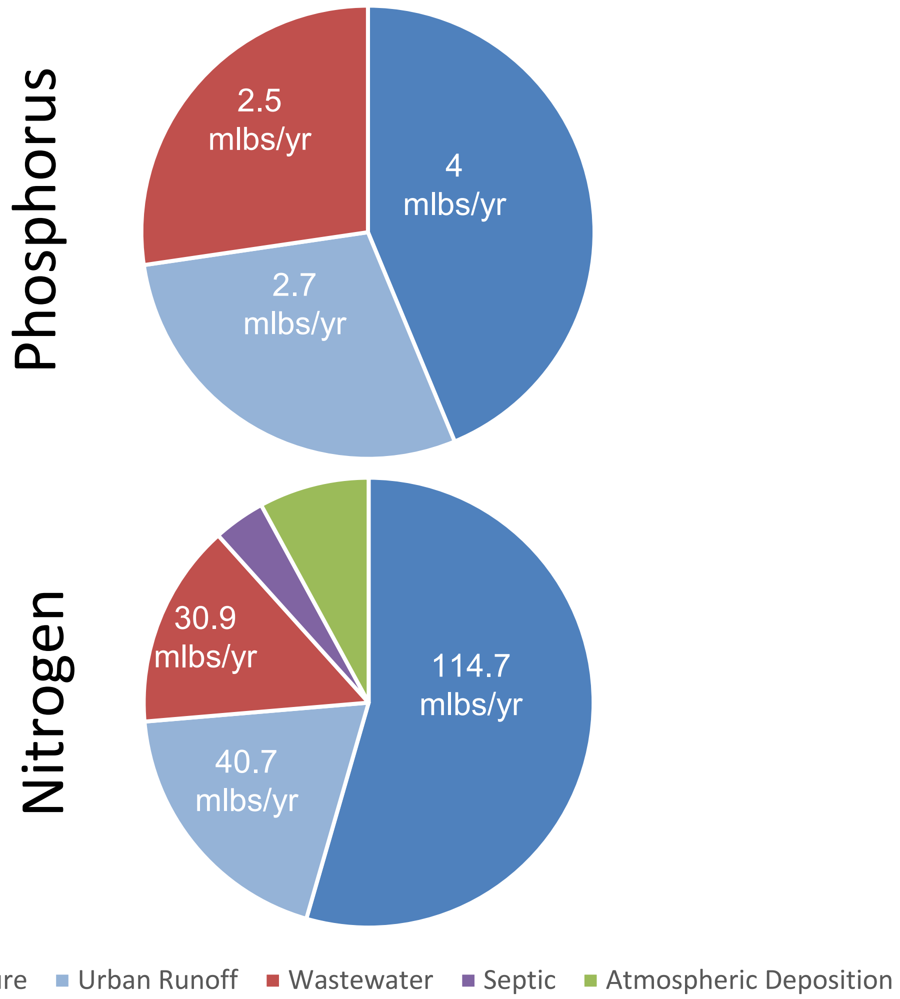
ke Bay



Achieving pollutant load reductions for the Bay

Findings: Achieving Pollutant Reductions

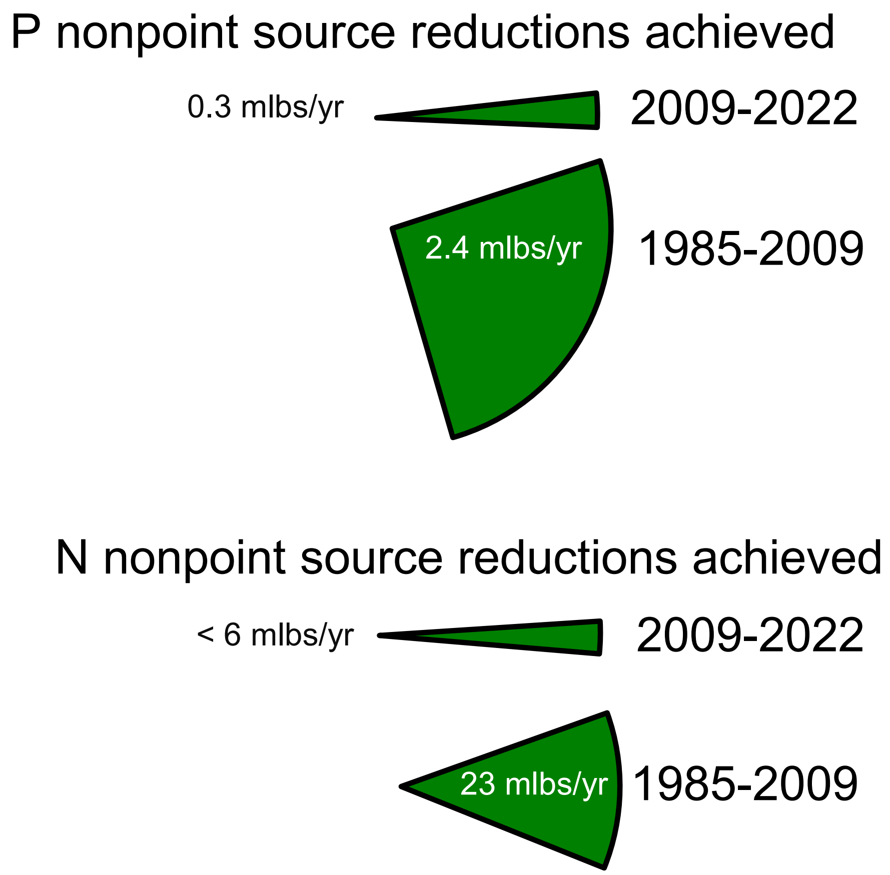
Distribution of pollutant loads to Bay, 2022



Additional pollutant load reductions needed to meet TMDL targets…

… but NPS programs not generating enough reductions

(according to CBP model)

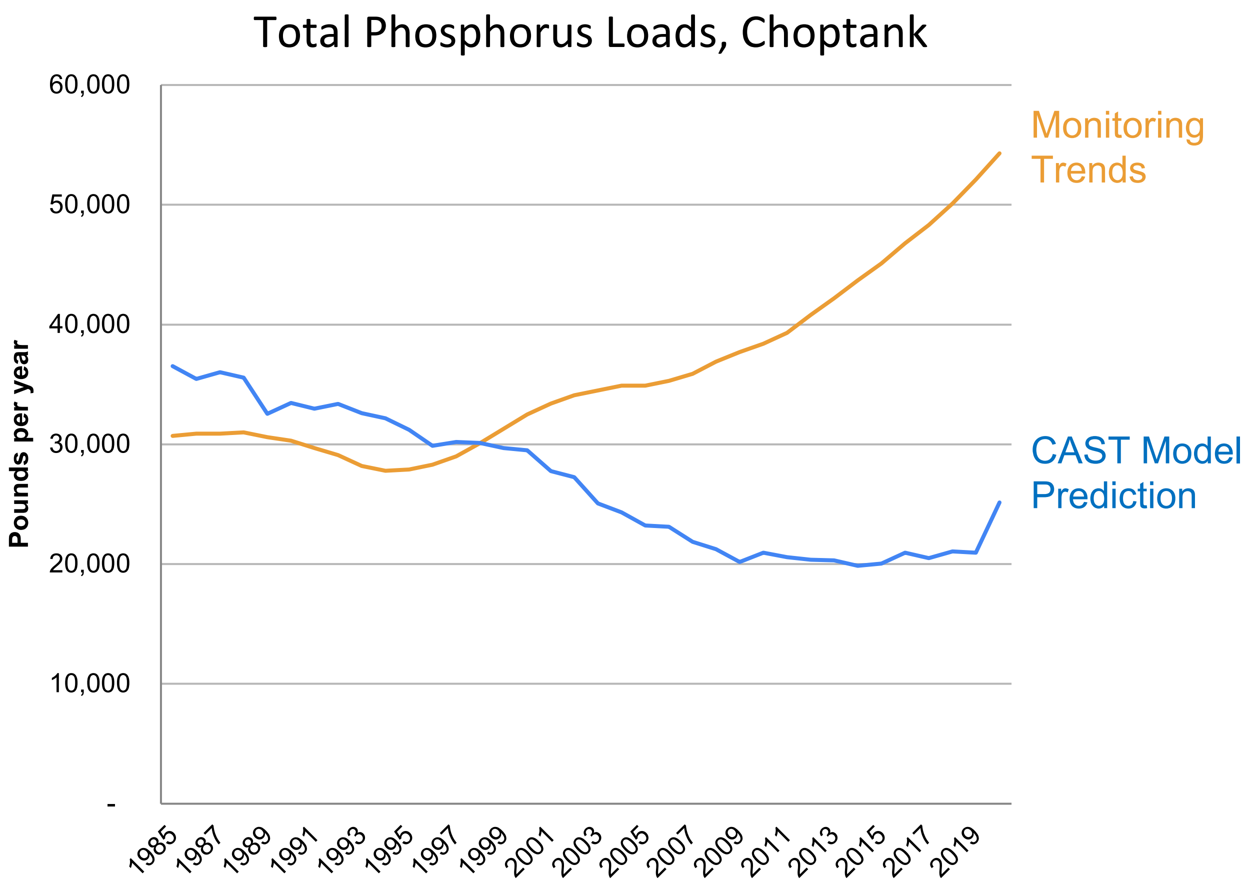


Findings: Achieving Pollutant Reductions

Nonpoint source programs may not be as effective as expected

Long term Trends in Total Phosphorus Loads

Rivers	Monitoring Observations	CAST model
Susquehanna	—	↓
Potomac	↓	↓
Choptank	↑	↓
Patuxent	↓	↓
Rappahannock	↑	↓
Mattaponi	—	↑
Pamunkey	↑	↓
James	↓	↓
Appomattox	↑	↓

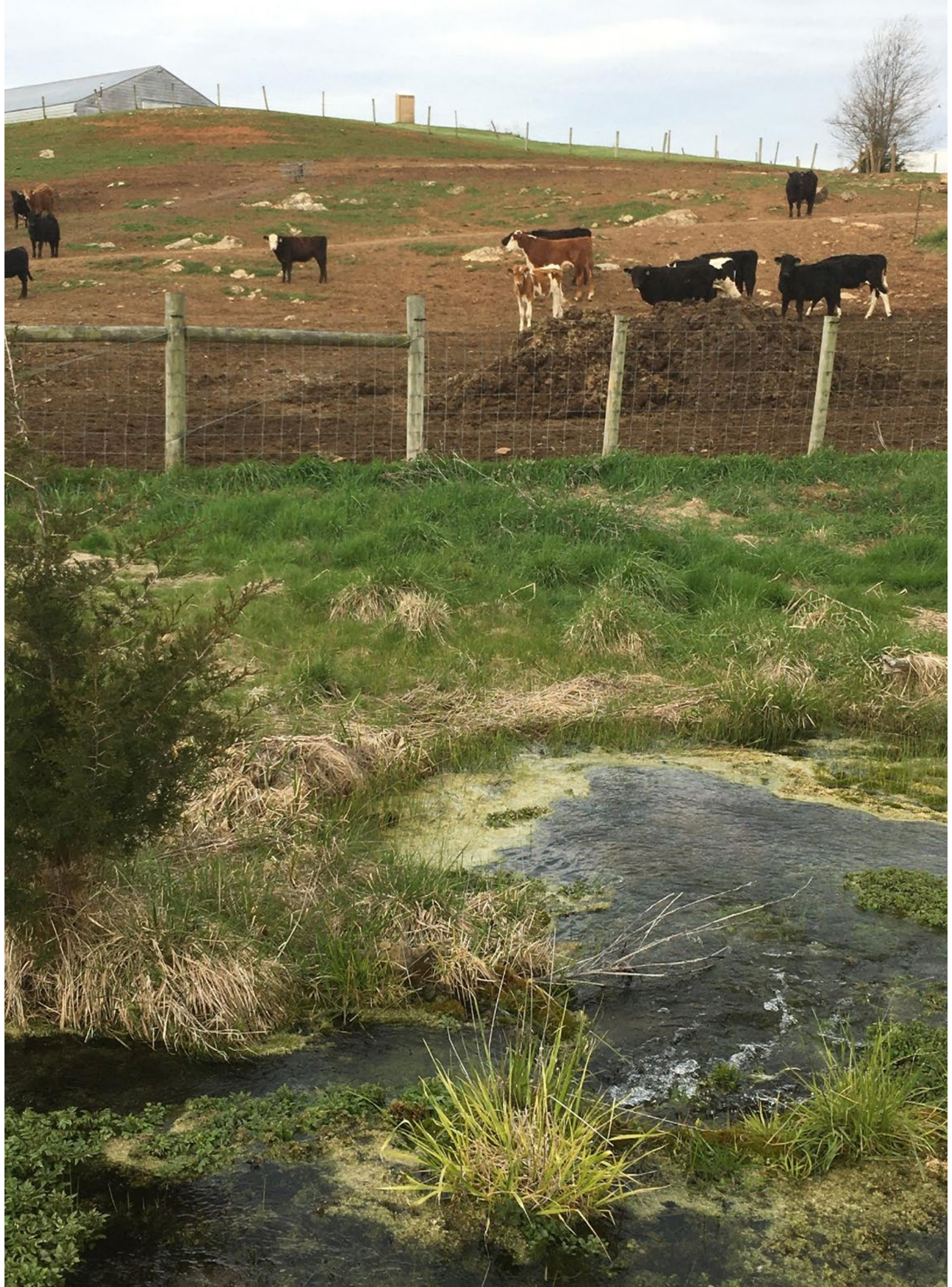


Achieving pollutant load reductions for the Bay: Opportunities for Nonpoint Sources

Improve approaches to address nutrient mass balance

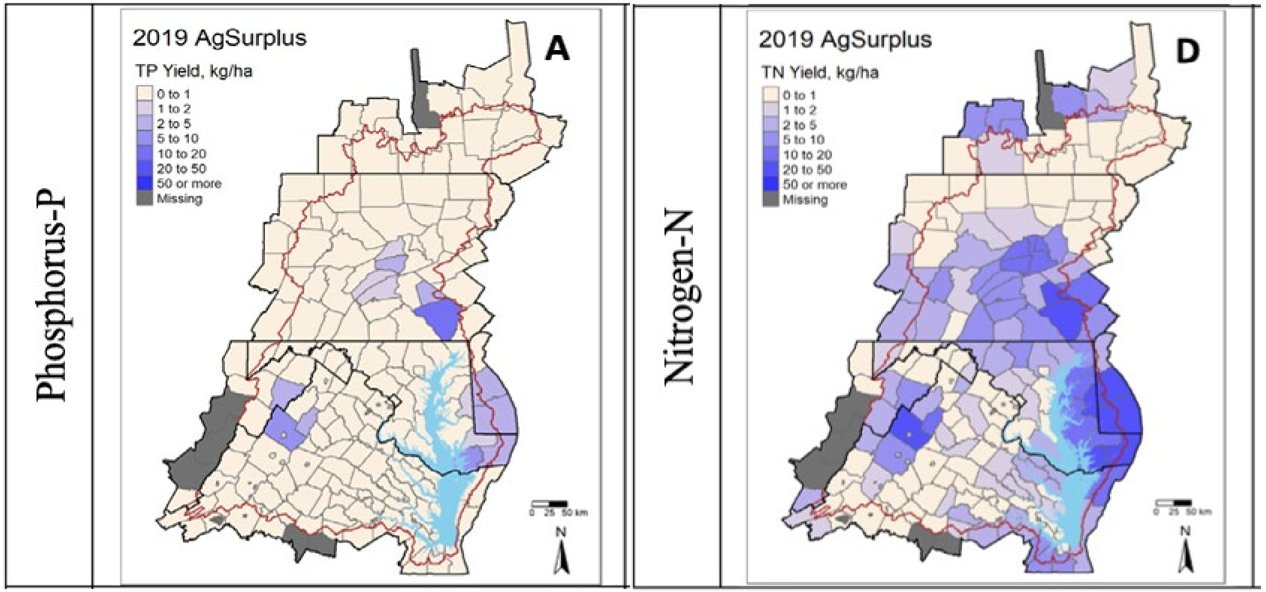
Additional Focus on Outcomes:

- Improved targeting of conservation investments
- New incentive programs (behavior change)
- Attention/tools on local waters (monitoring, other modeling tools)
- Encourage policy innovation (and permission to fail)



3x increase in
animal numbers

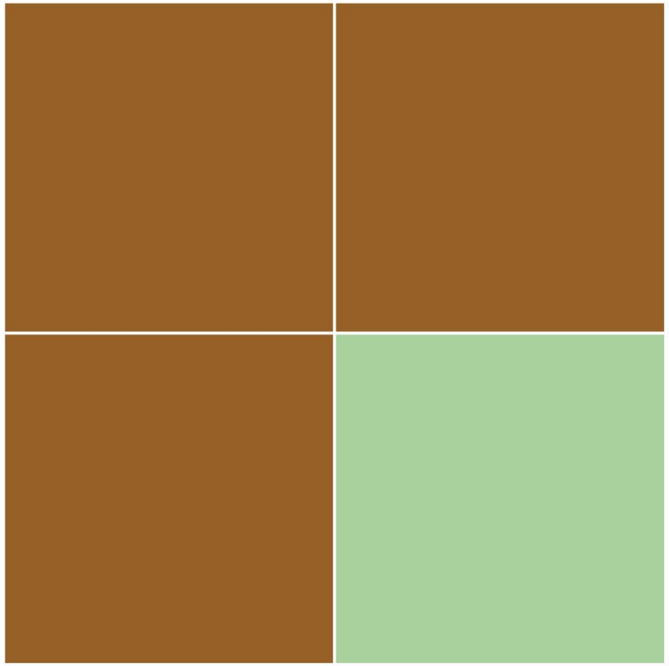
Mass Balance

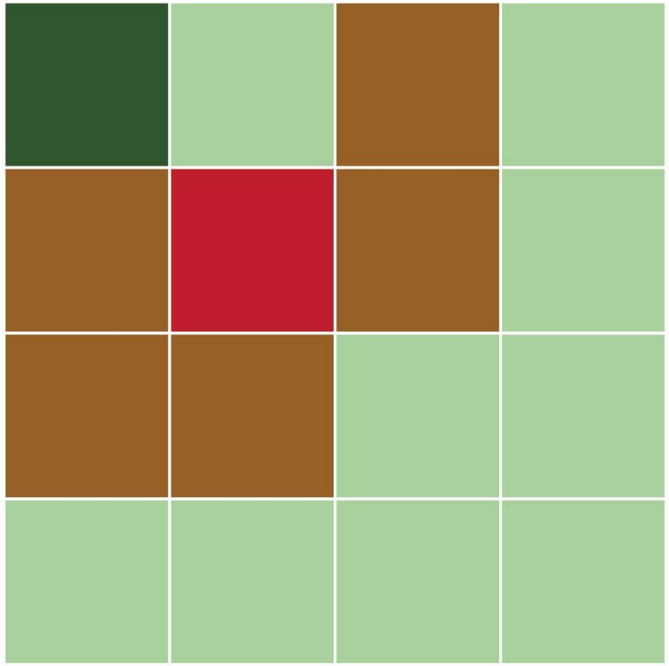


4x increase
in BMPs

Sabo et al. 2021

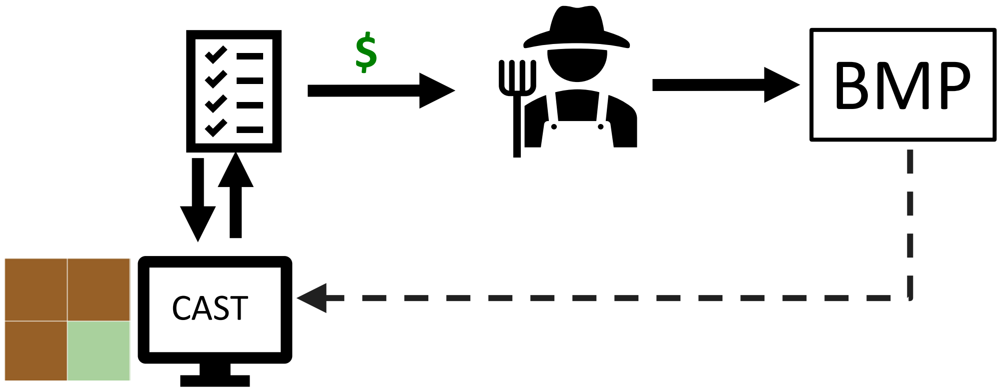
Targeting Conservation



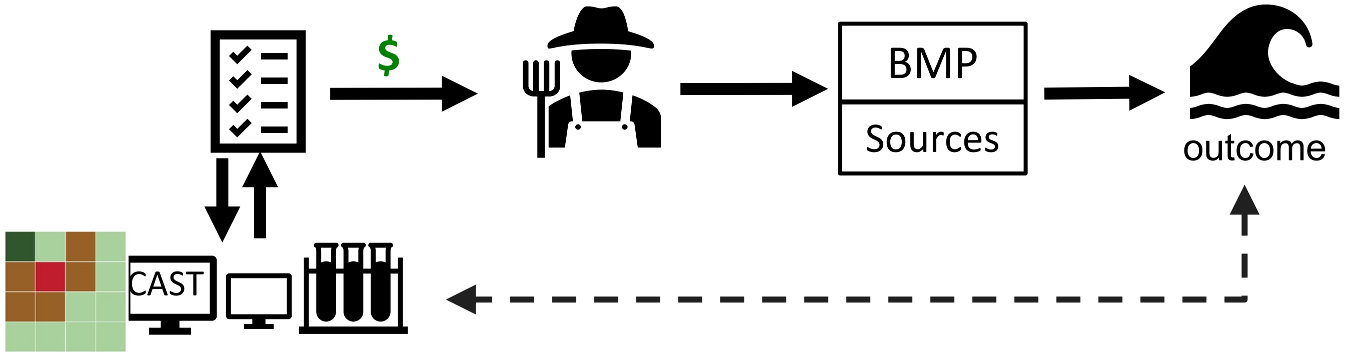


Larger scale makes it more difficult to pinpoint the problem
Targeting helps identify problem areas (red square)

Incentives, Behavior, and Outcomes



Practice Based Incentives

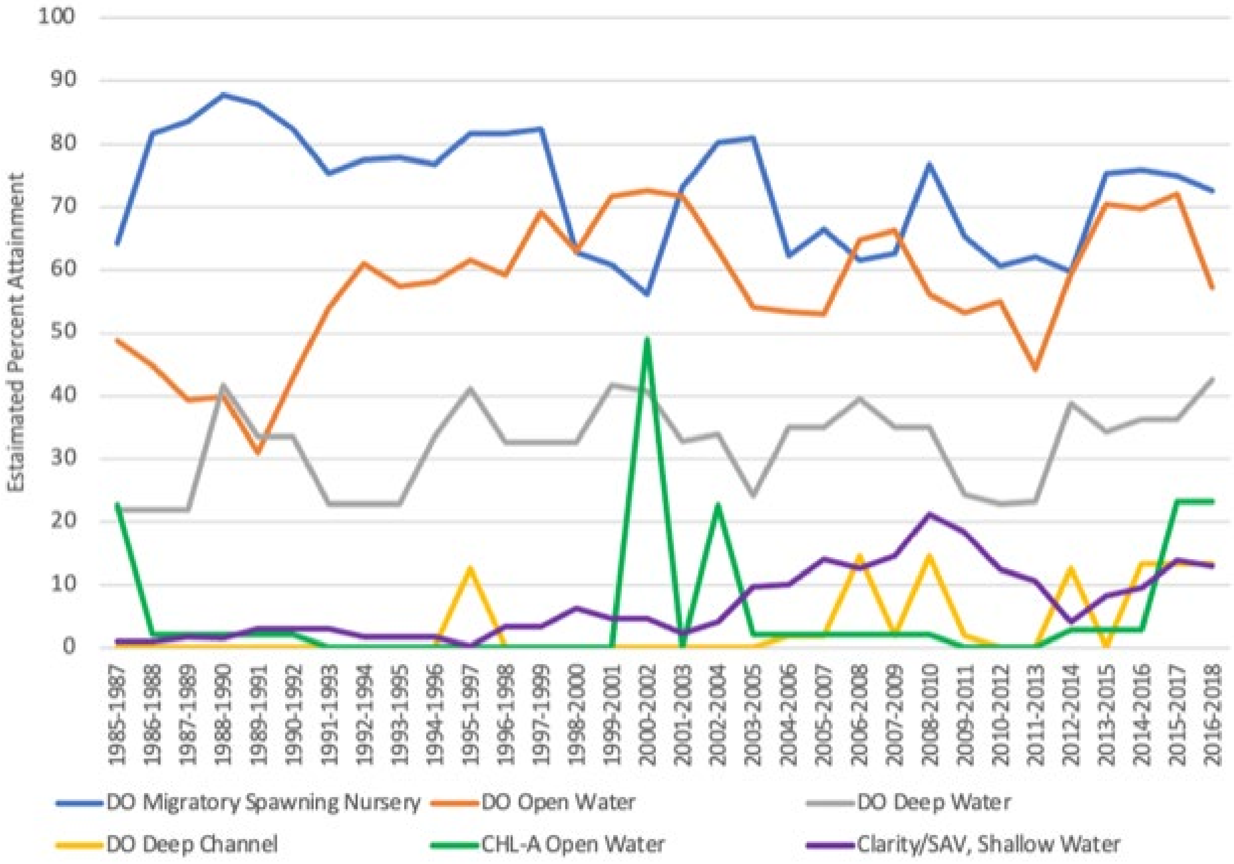


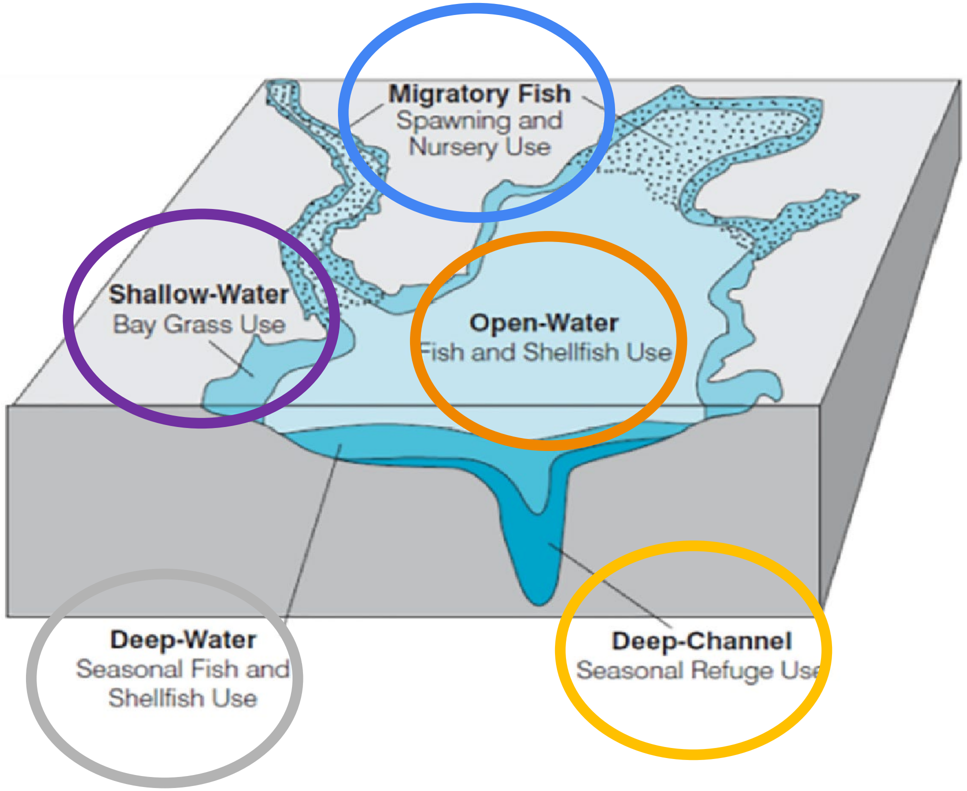
Outcome-Based Incentives

- Payments
- Accounting
- Design Innovations

Achieving Bay water quality goals

Finding: Bay water quality is improving but the magnitude of the change unlikely to achieve all water quality criteria



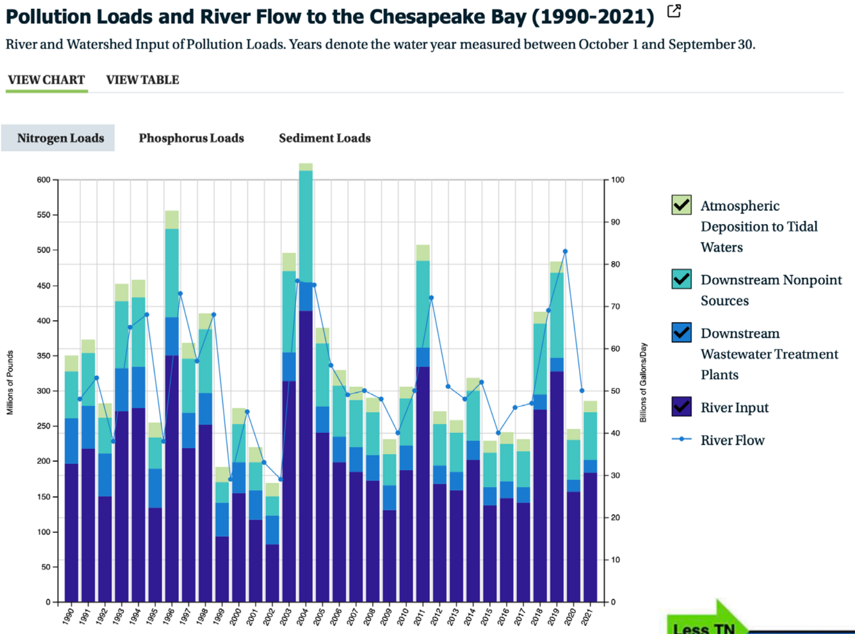


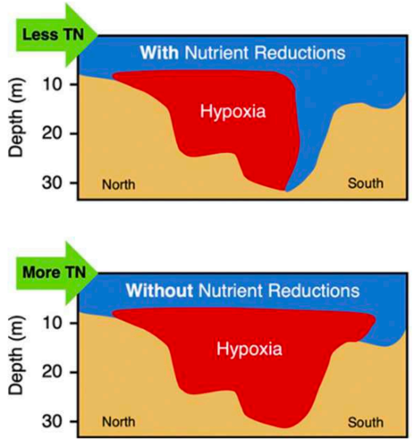
Source: Zhang et al. 2018 (with updated data)

Finding: Bay water quality is improving but the magnitude of the change unlikely to achieve all water quality criteria

Why?

- Water quality improvements are not sufficiently large
- Climate change, especially warming of Bay waters, has dampened the response that we expected from load reductions.
- Imperfect understanding of conditions and the way that the ecosystem works





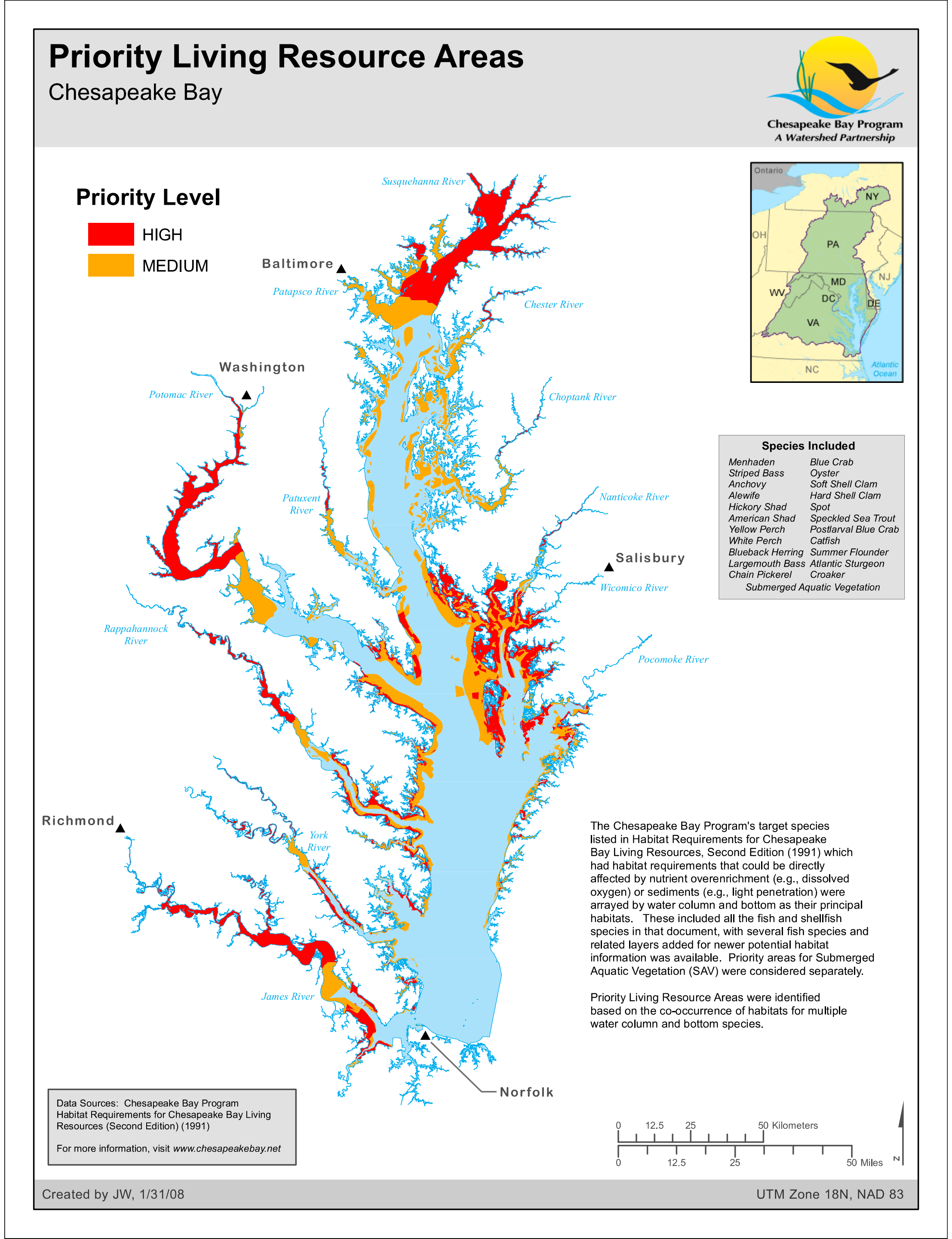
If 35 years of nutrient reductions had not occurred, hypoxia would have:

- Been **20-120% larger** for $O_2 < 3$ mg L^{-1}
- Been **30-280% larger** for $O_2 < 1$ mg L^{-1}
- Extended **further south** in the Bay
- Lasted **longer** during dry years

Achieving Bay water quality goals: Opportunities

Prioritize and focus WQ and restoration investments around living resources

Don’t allow water quality investments to leave Living Resource benefits on the table



Achieving Bay Water Quality Goals

Opportunity: Prioritize our efforts to attain water quality standards so that we can achieve the largest possible benefit to living resources (example: tiered TMDL)

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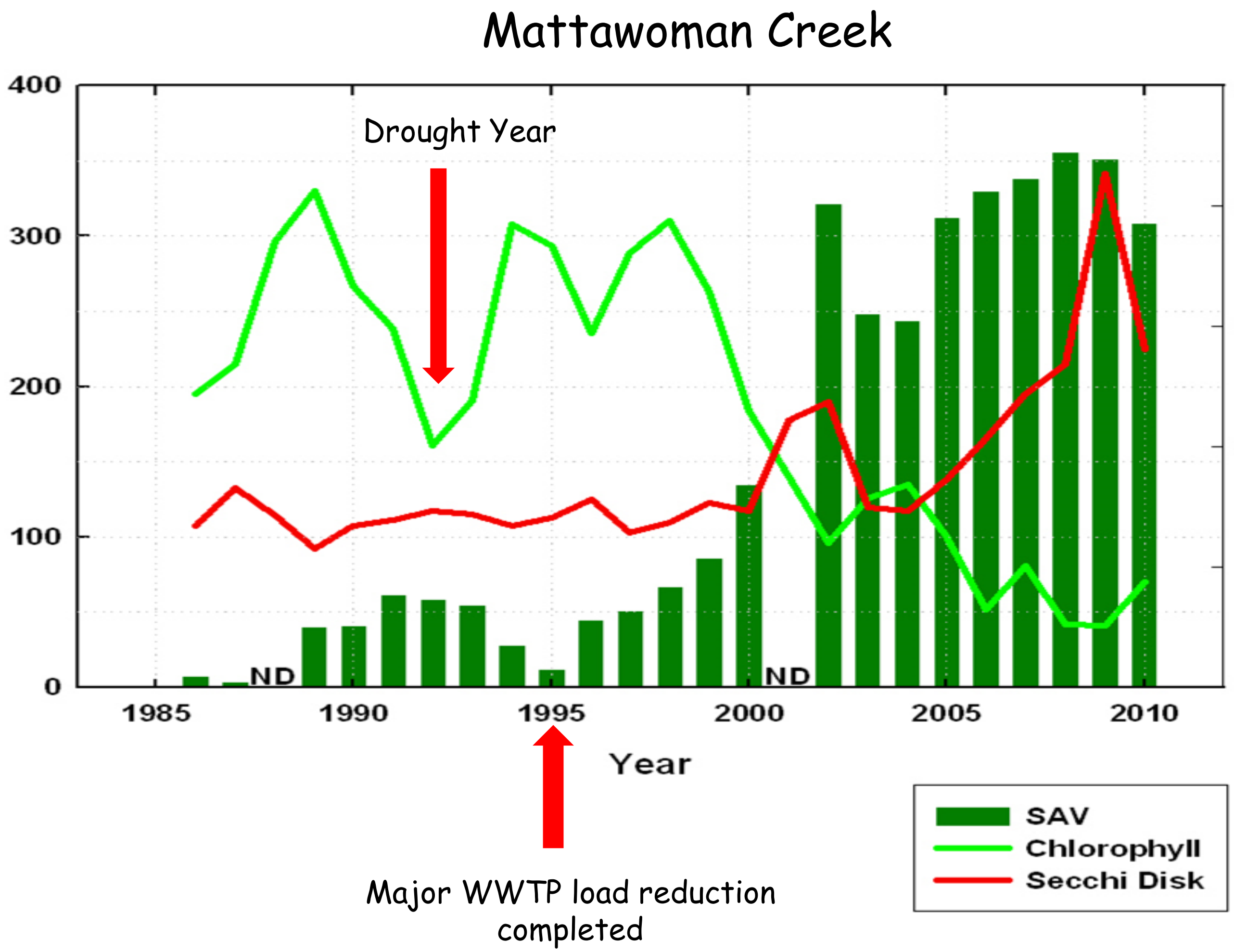
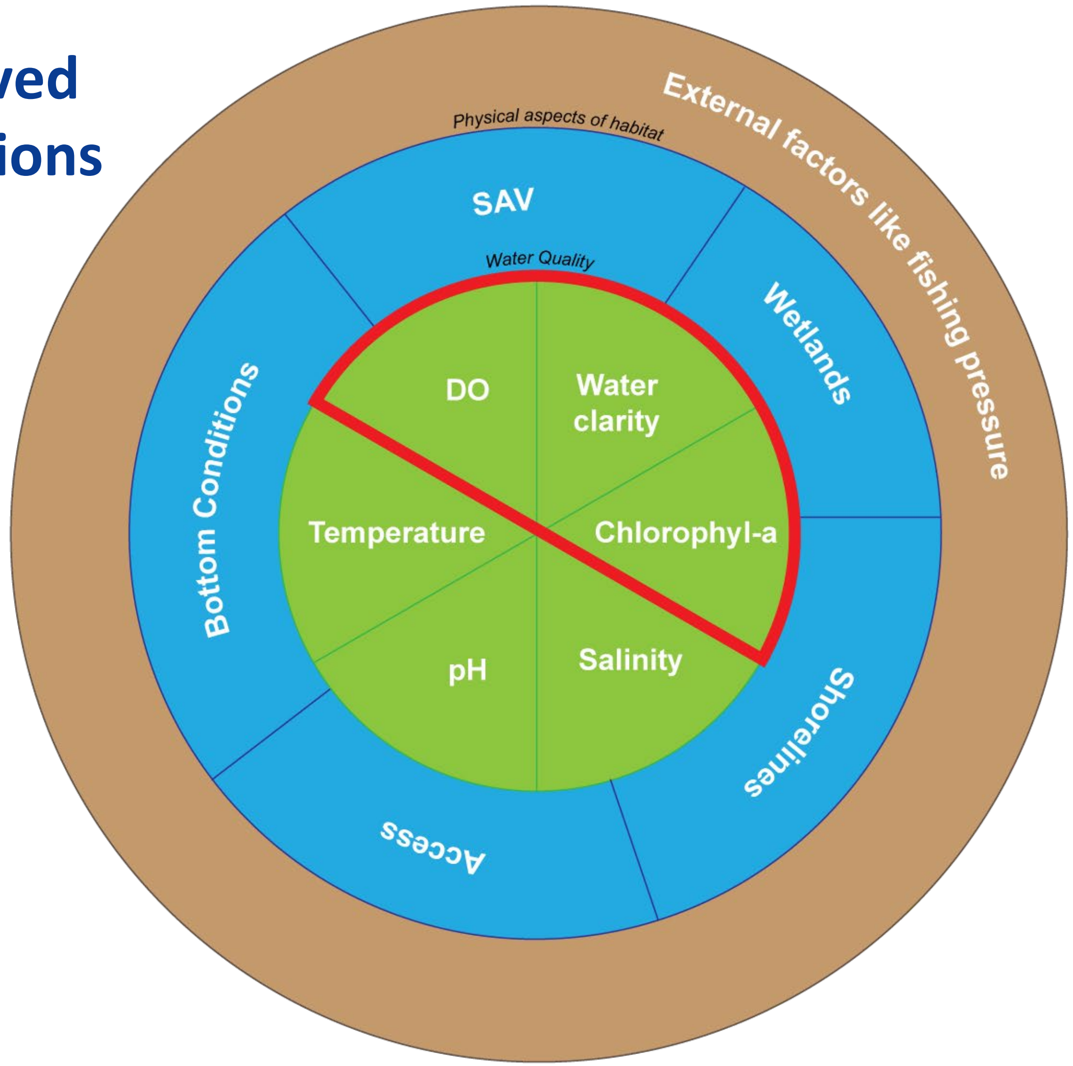


Achieving Bay Water Quality Standards/Living Resource Response

Opportunity: Significant enhancement of LR can be achieved with additional management actions without complete attainment of water quality goals



Managed by Bay water quality standards

Achieving Bay Water Quality Standards/LR Response

Opportunity: Don't leave benefits to Living Resources on the table

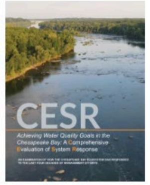
Jane Hawkey, Integration and Application Network (ian.umces.edu/media-library)

Credit: Center for Coastal Resources Management; Kelsey Broich, Network for Engineering with Nature, University of Georgia; Integration and Application Network (ian.umces.edu/media-library)

Achieving Water Quality Goals in the Chesapeake Bay: A Comprehensive Evaluation of System Response (CESR)

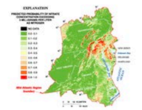
https://www.chesapeake.org/stac/cesr/

The Report

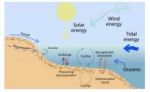


CESR Executive Summary

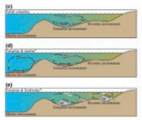
Achieving Water Quality Goals in the Chesapeake Bay: A Comprehensive Evaluation of System Response



Resource Document: Evaluation of Management Efforts to Reduce Nutrient and Sediment Contributions to the Chesapeake Bay Estuary



Resource Document: Knowledge Gaps, Uncertainties, and Opportunities Regarding the Response of the Chesapeake Bay Estuary to Restoration Efforts



Resource Document: A Proposed Framework for Analyzing Water Quality and Habitat Effects on the Living Resources of Chesapeake Bay

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