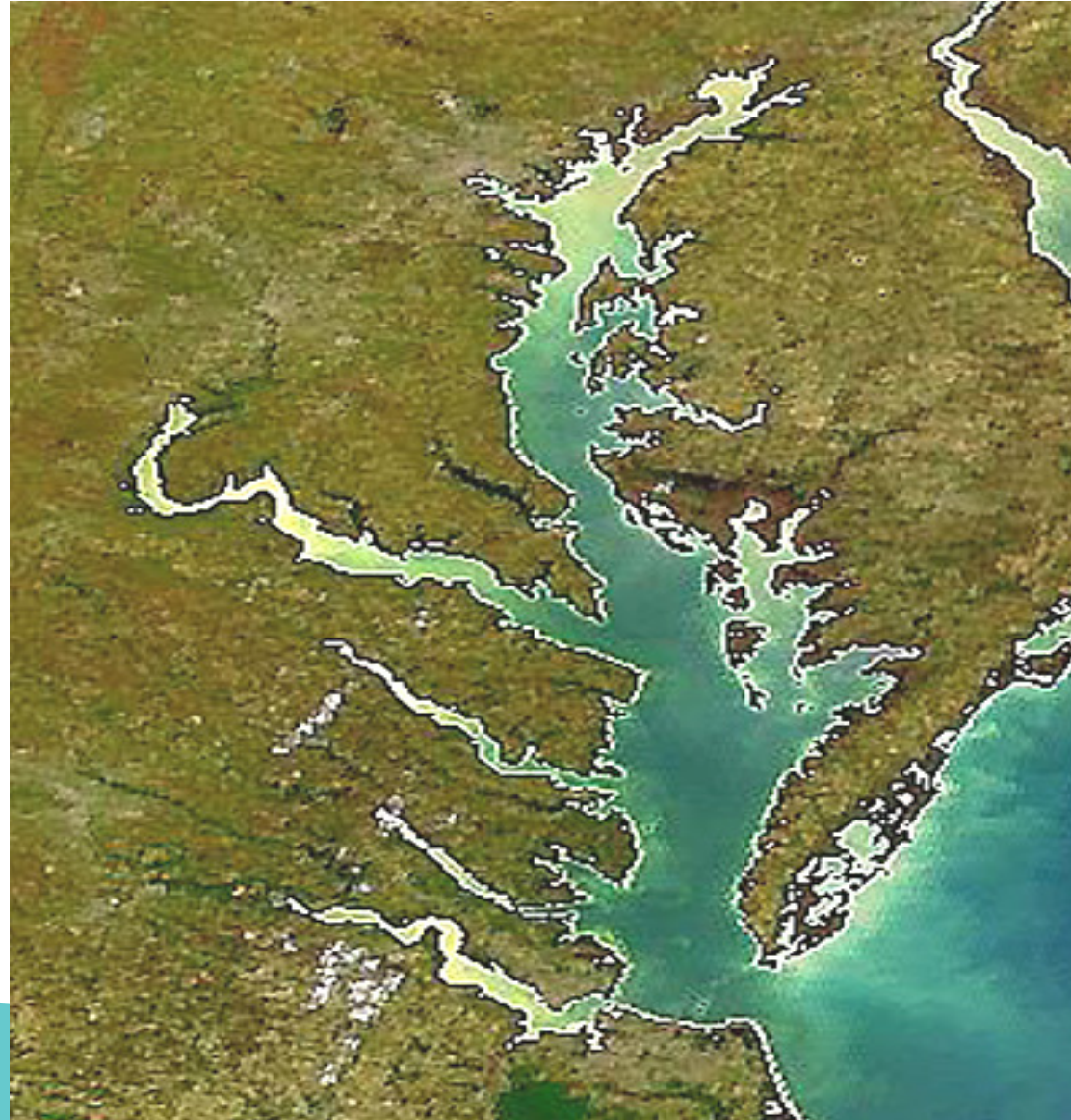


# Introduction to Chesapeake Bay

William C. Dennison  
21 Mar 2023



# Chesapeake Bay is a drowned river valley

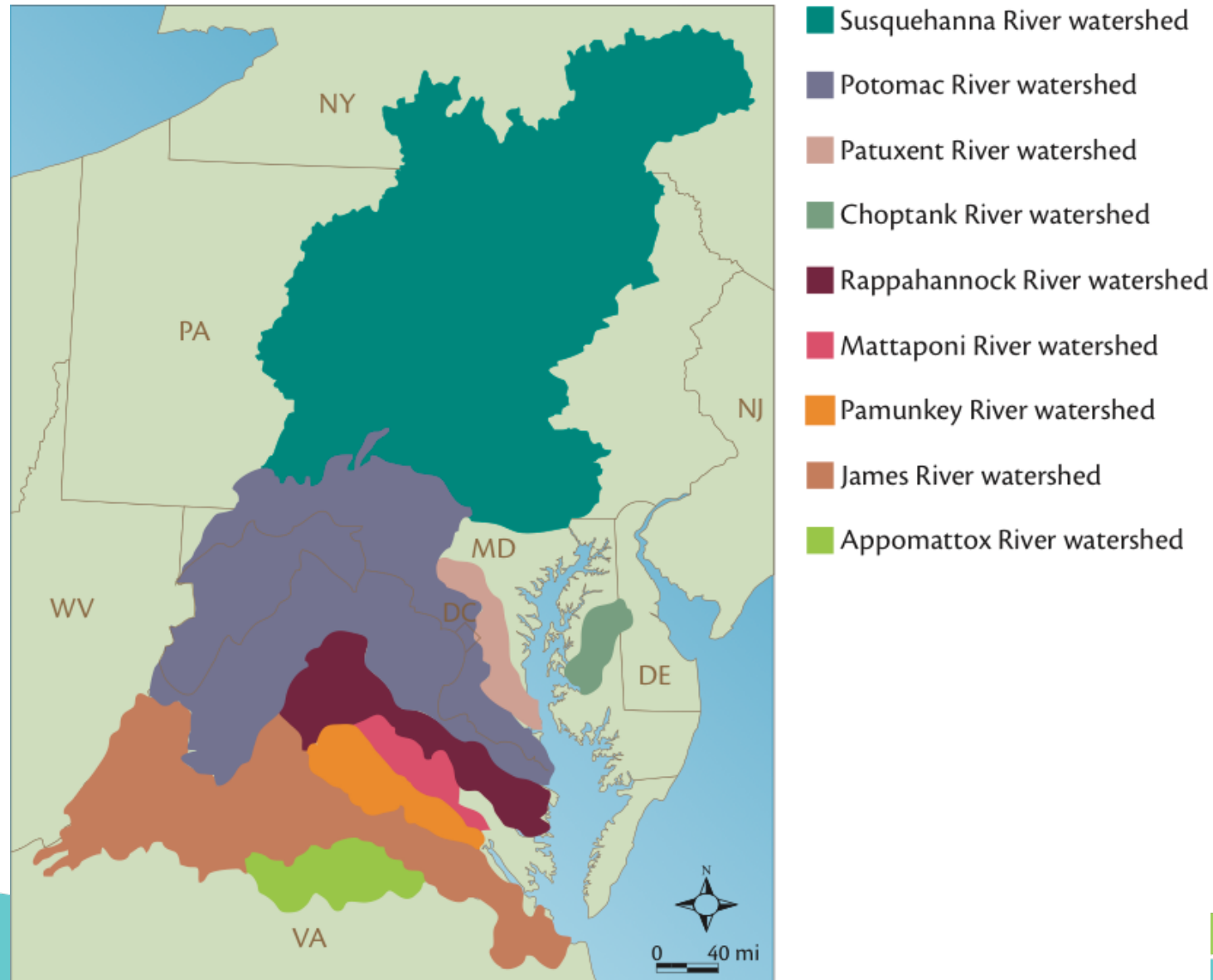




# Chesapeake Bay has an extensive watershed

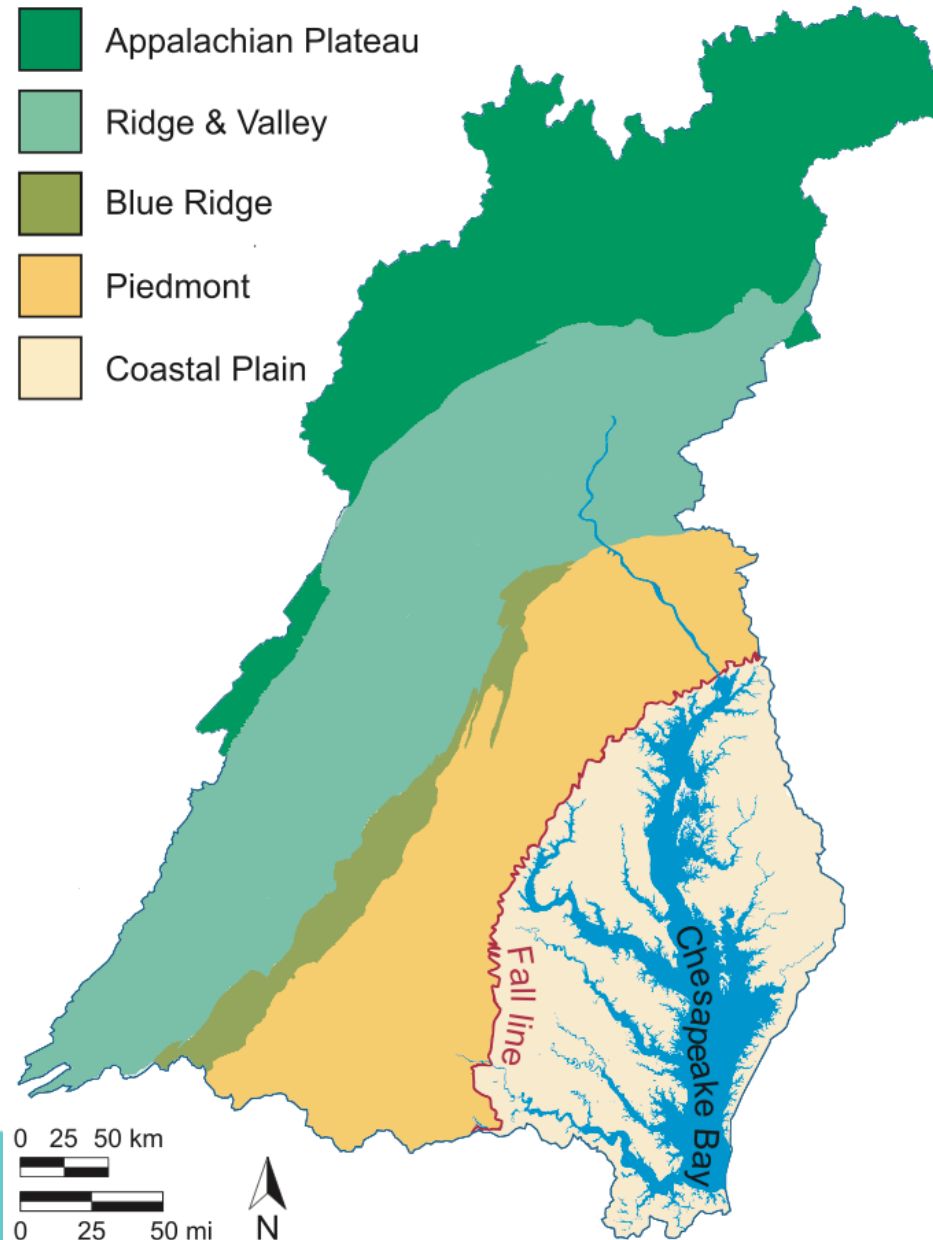


# Several large river basins

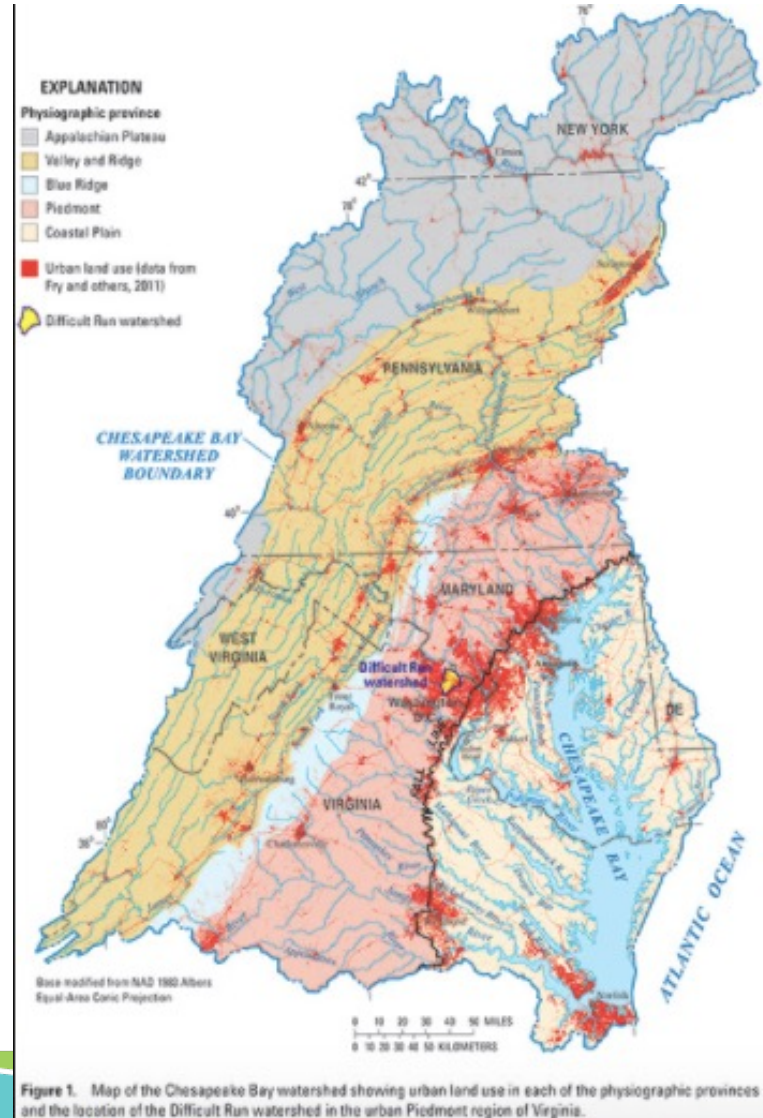




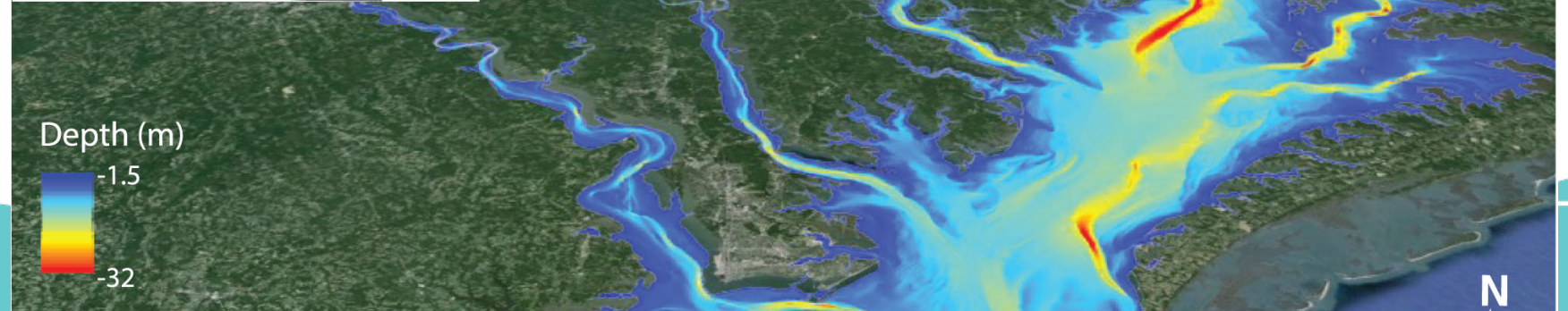
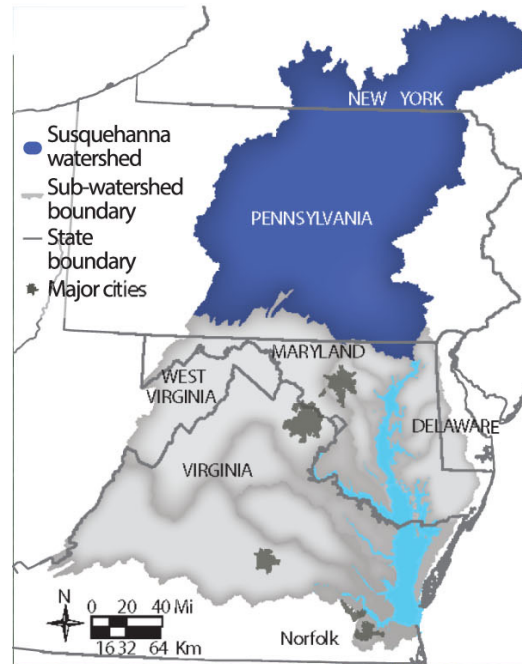
# Geographic provinces of the Chesapeake watershed



# Impacts focused along 'fall line' and piedmont

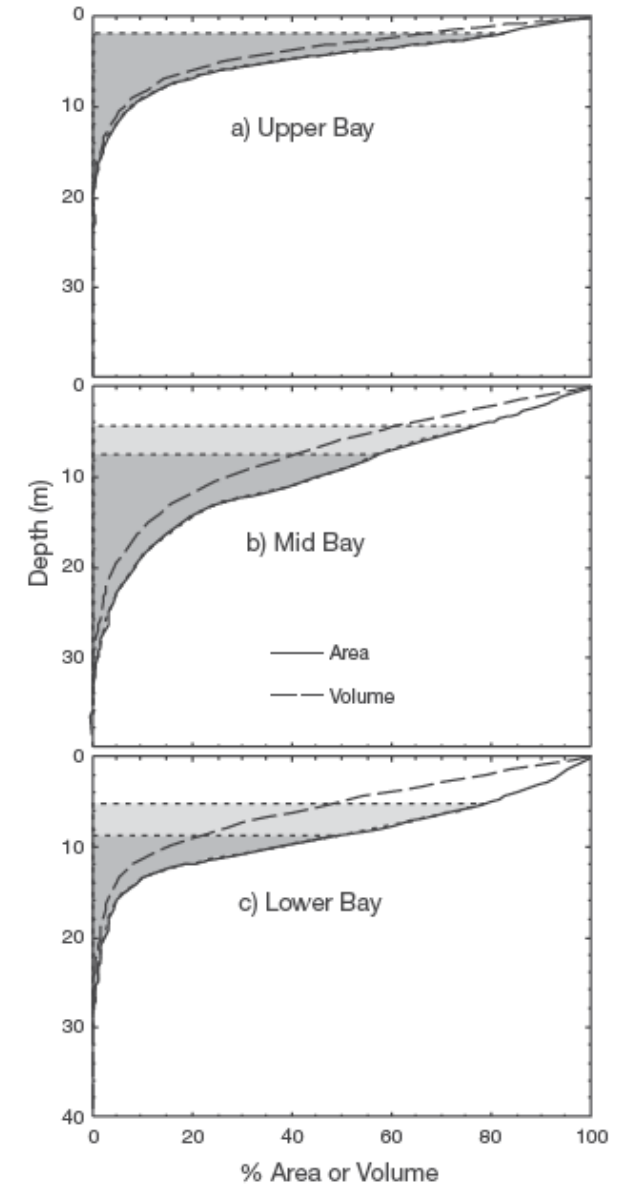
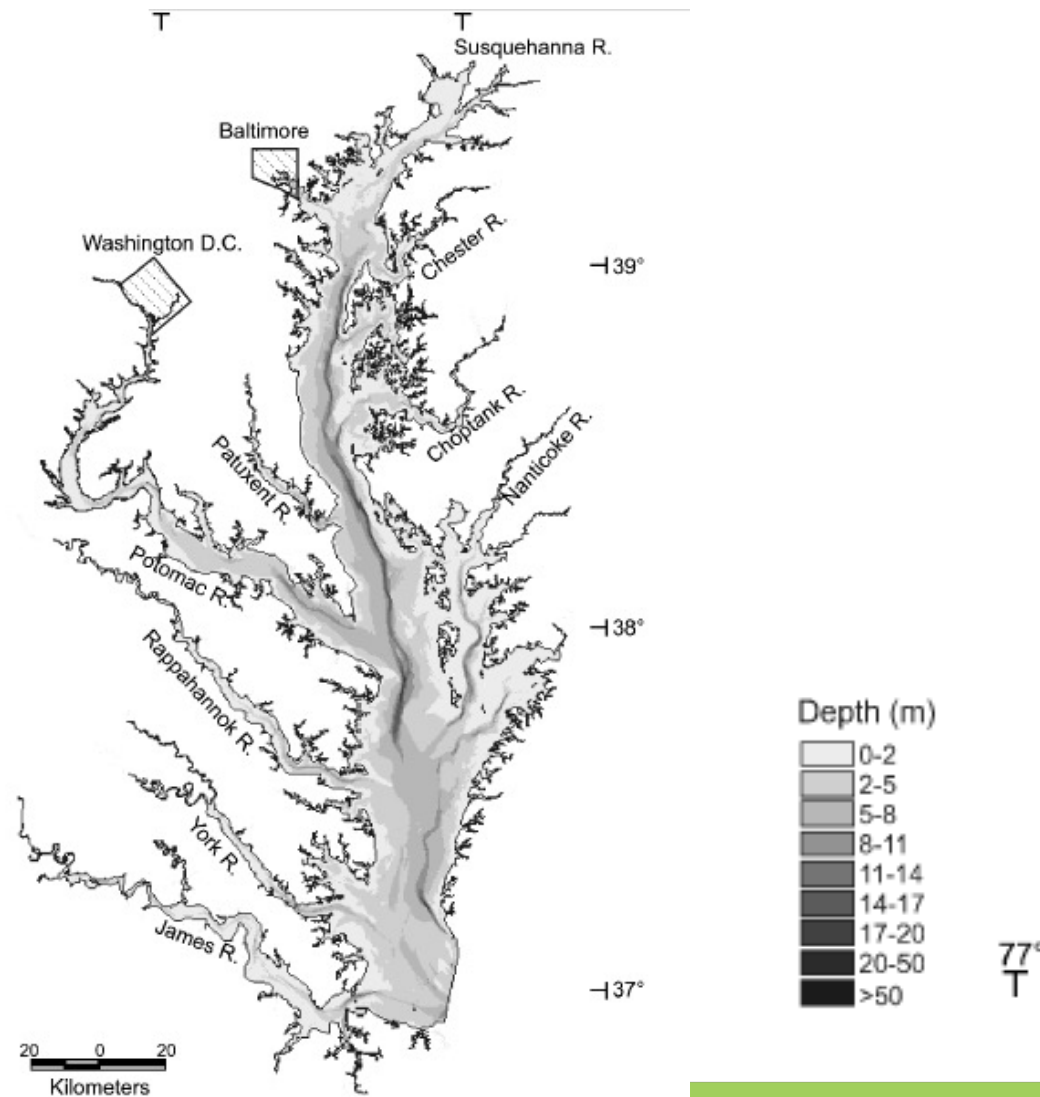


# Hypoxia (low oxygen) in deep channel

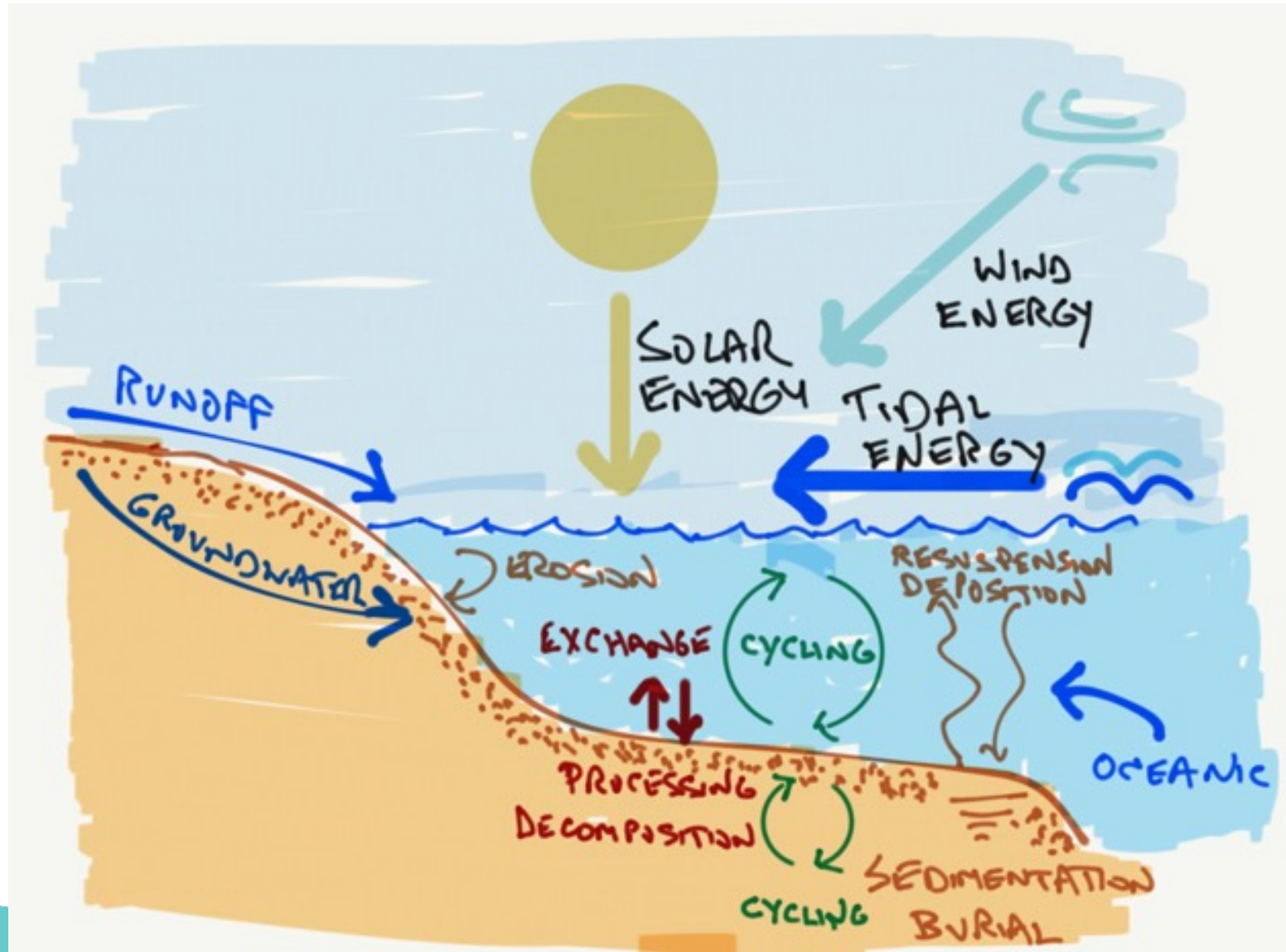




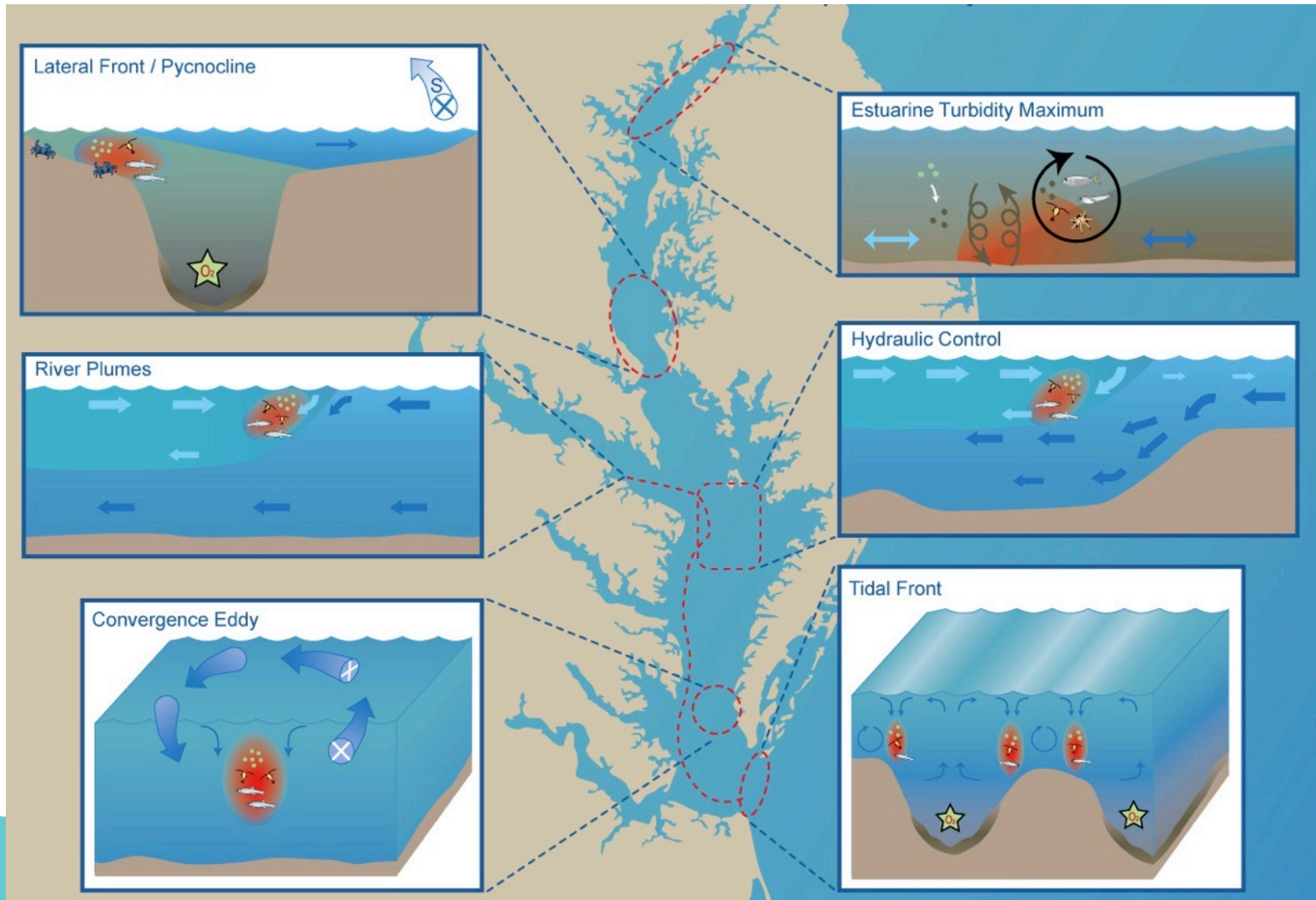
# The Bay is very shallow



Shallow waters are very productive

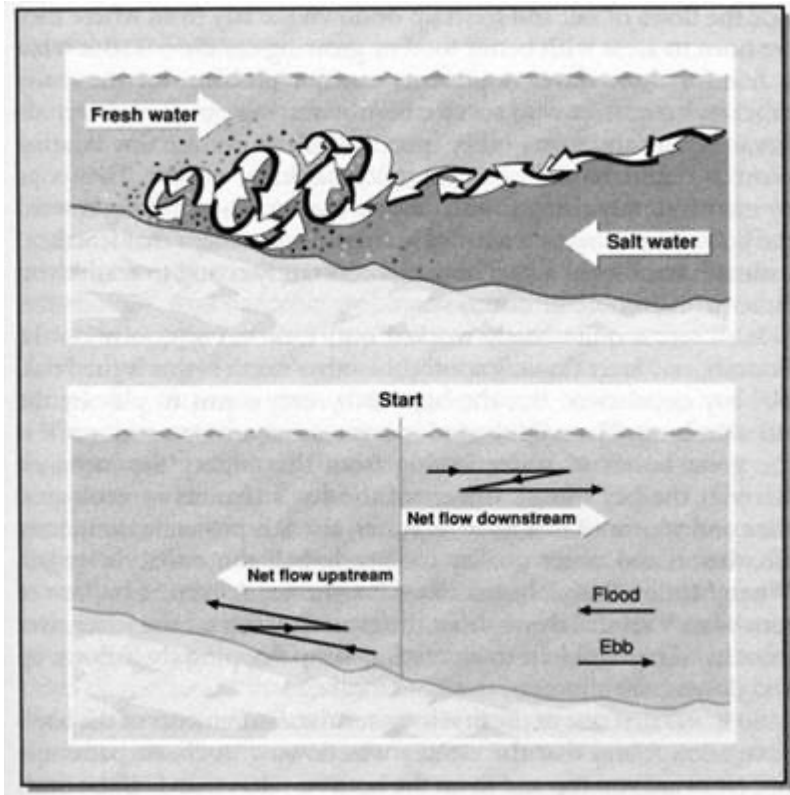


# Nutrient retentive processes make the Bay productive and vulnerable





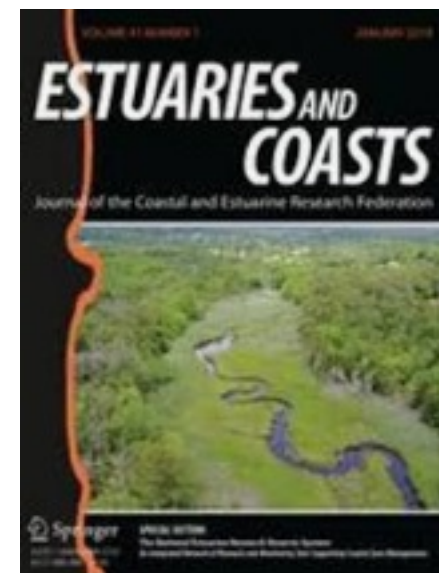
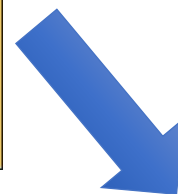
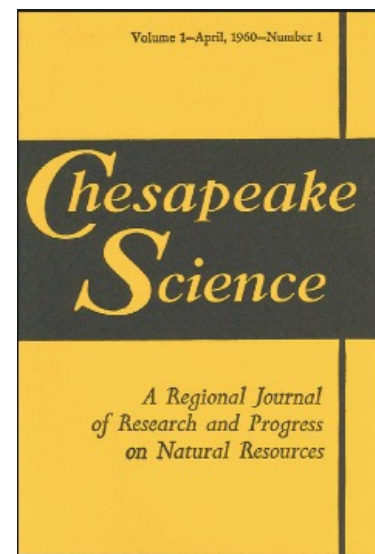
# Estuarine science developed in Chesapeake



# Chesapeake scientists were trailblazers for international estuarine science



**COASTAL & ESTUARINE  
RESEARCH FEDERATION®**



# Hurricane Agnes in 1972 brought scientists together

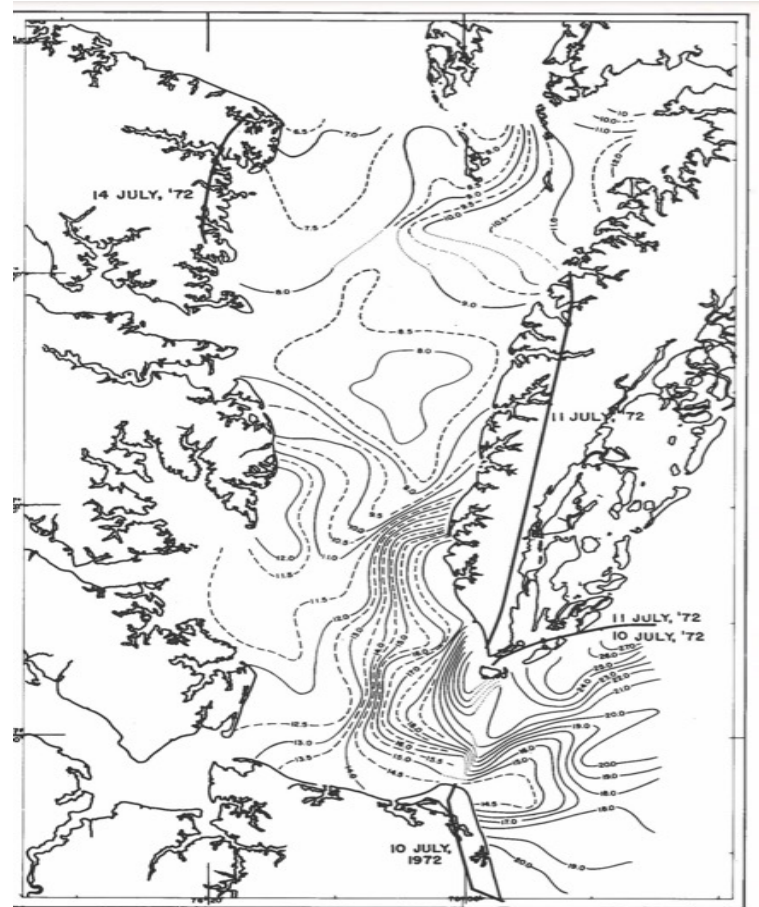
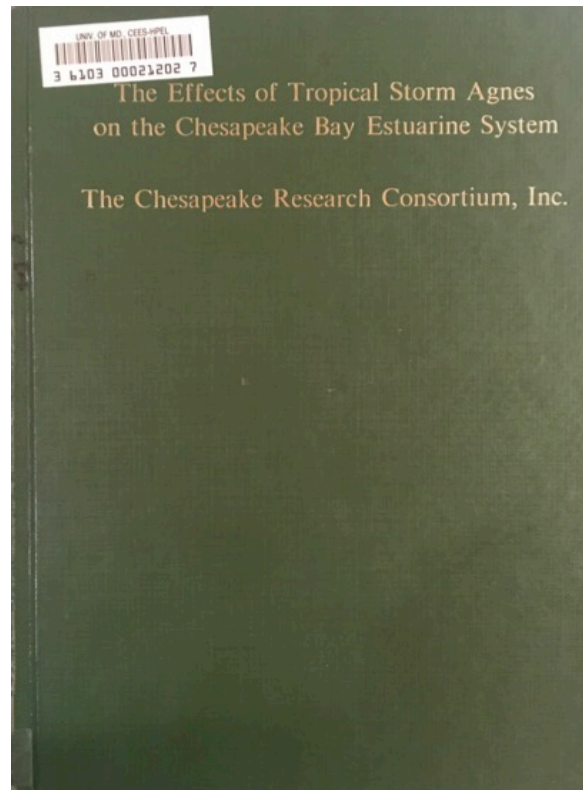


Figure 7. Surface salinities for lower Chesapeake Bay during the period 10 - 14 July 1972.

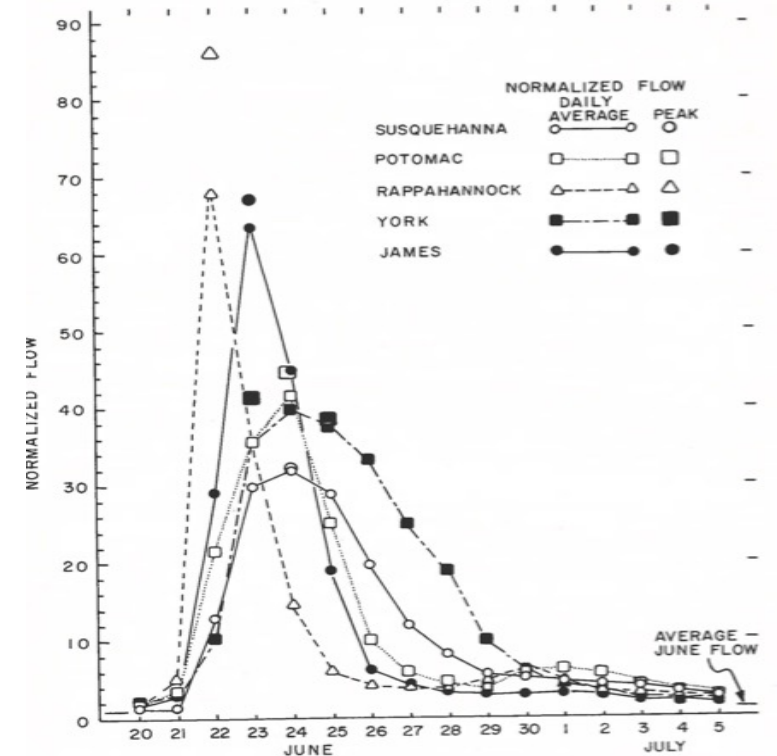


Figure 4. Normalized daily flows for major tributaries to Chesapeake Bay during flooding from Tropical Storm Agnes, June-July 1972.



# Eutrophication symptoms investigated



# Regional management partnership set up in 1983



**Chesapeake Bay Program**

*Science. Restoration. Partnership.*

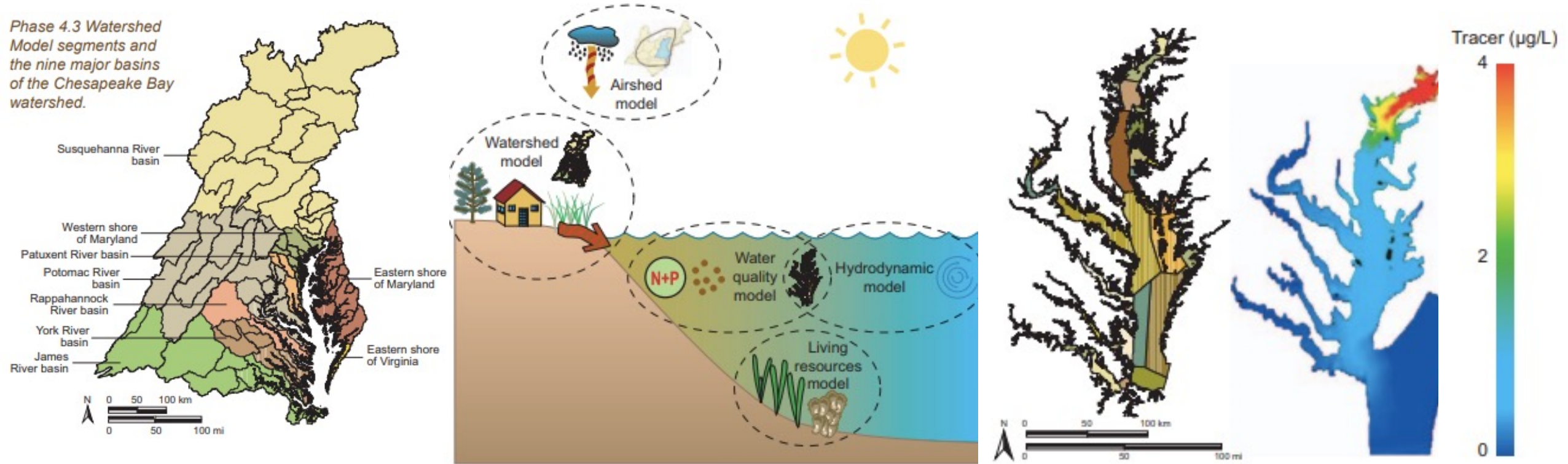


# Initial model was a physical model

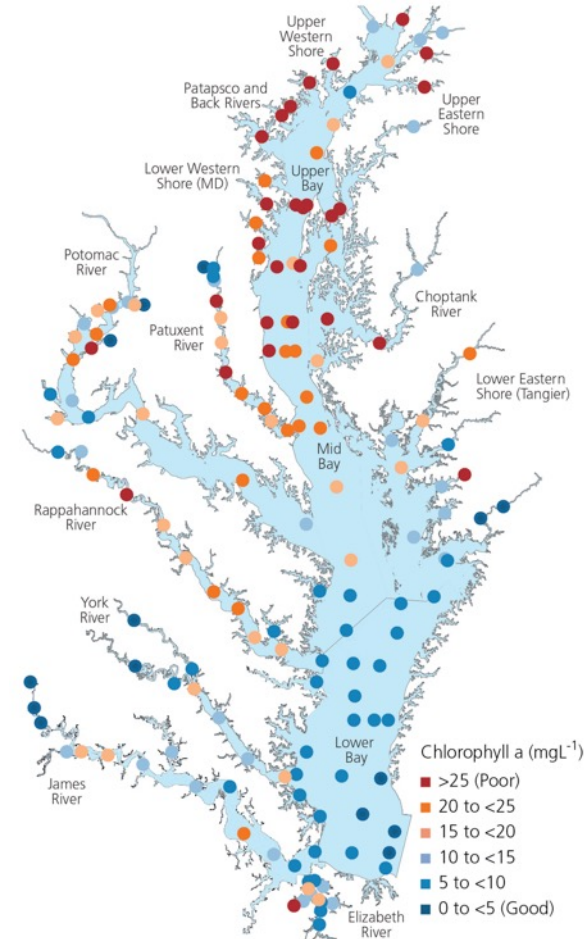
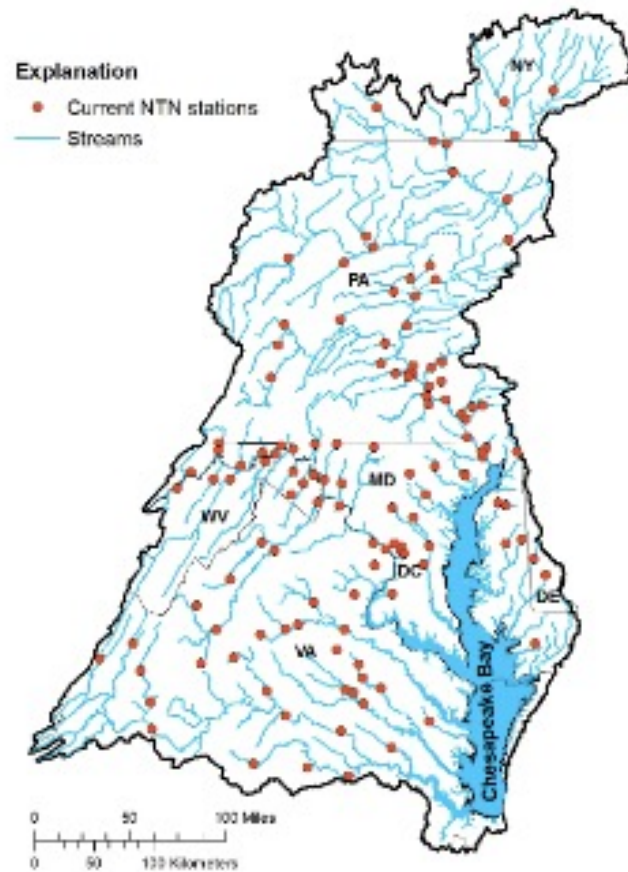




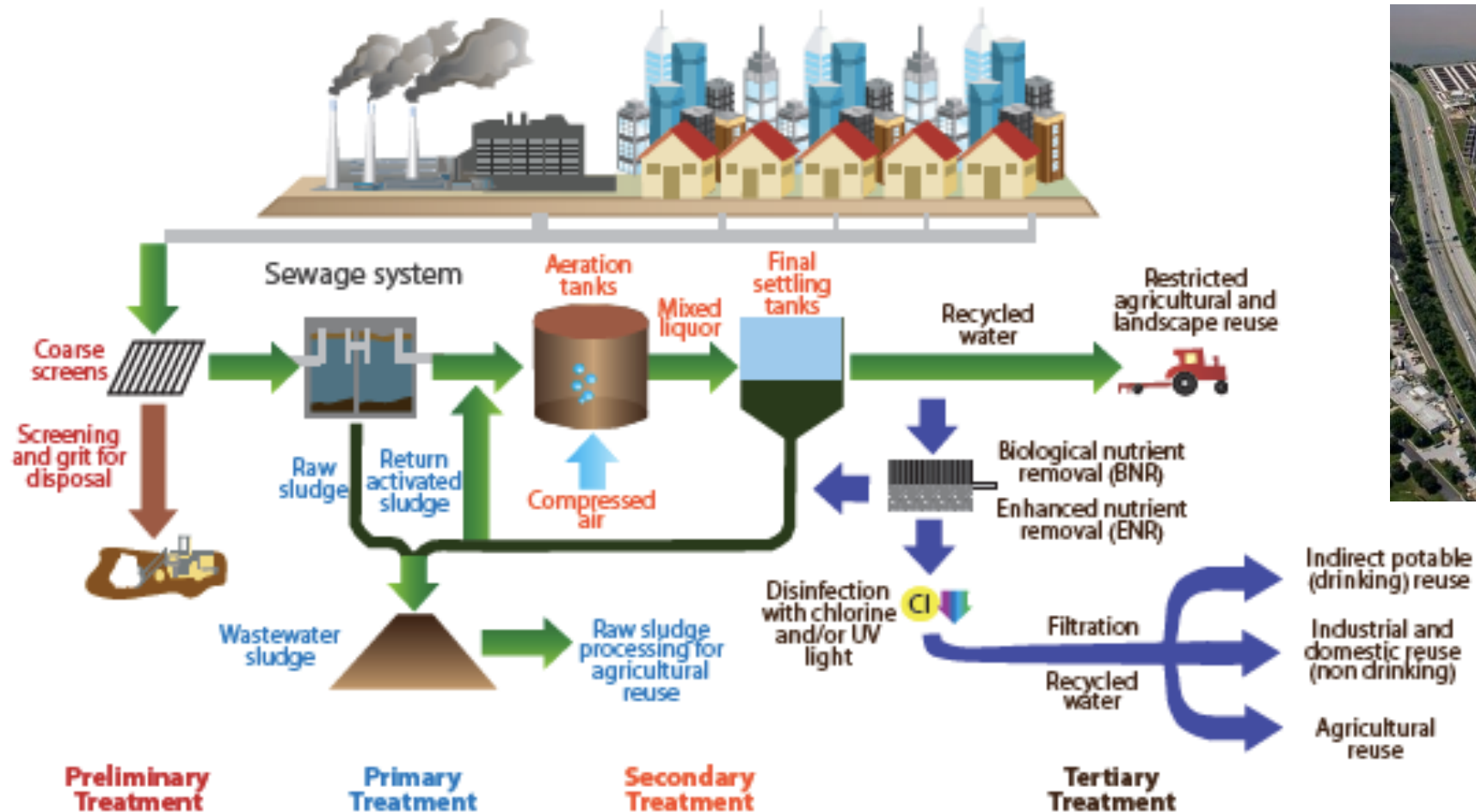
# Computer models now used



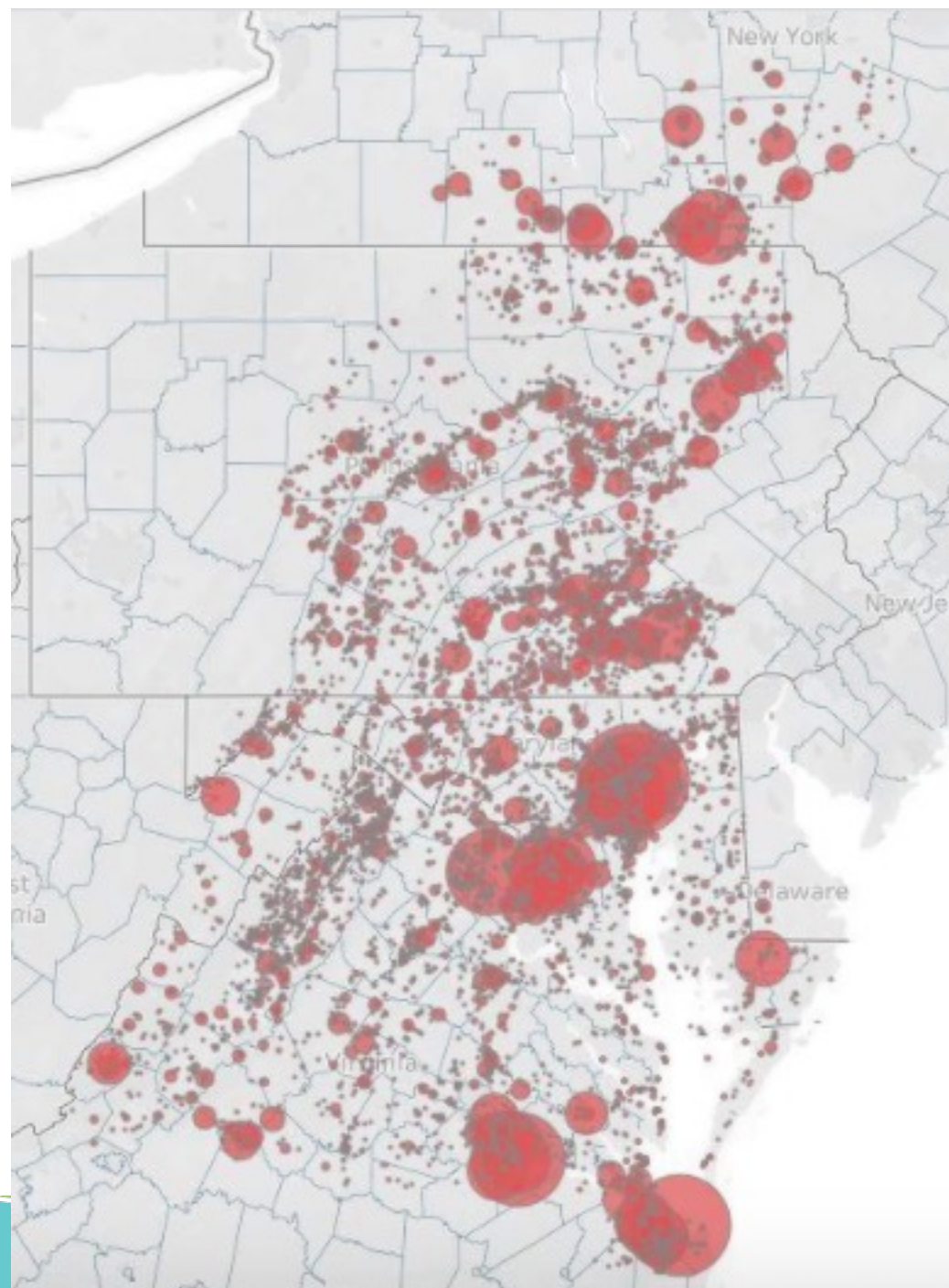
# Integrated monitoring set up in mid 1980s



# Major pollution reductions through sewage upgrades





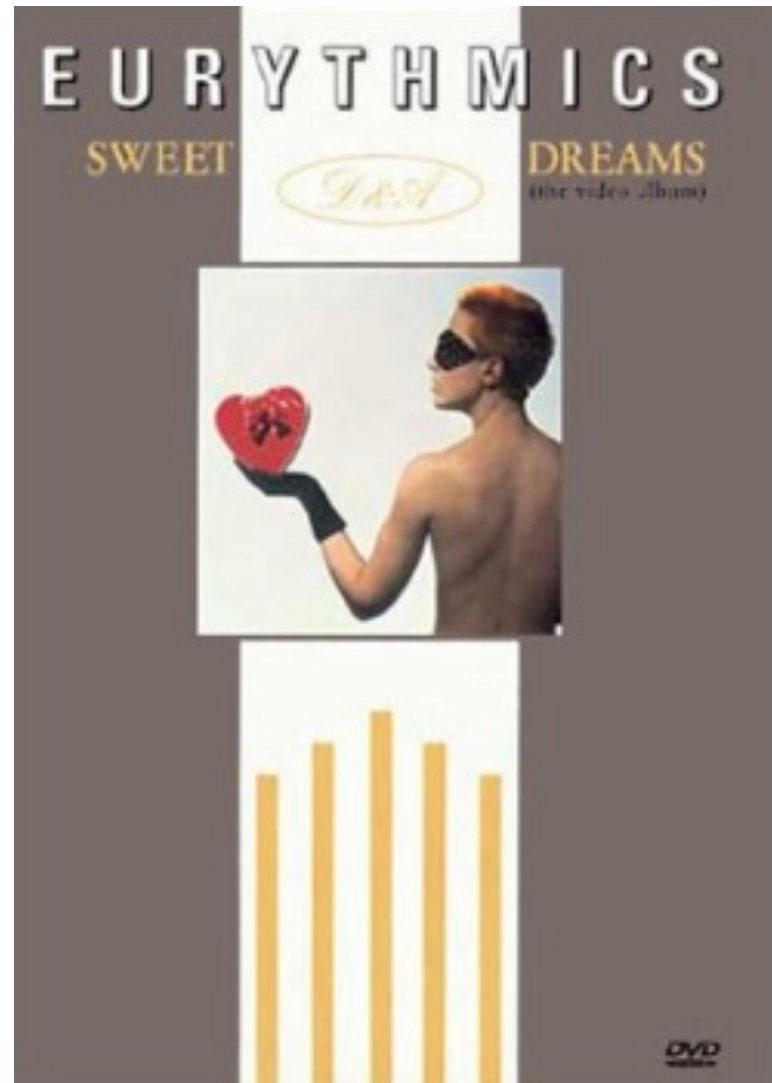


# Chesapeake Bay Program was created in 1983 as a sweet dream



“When I signed the Chesapeake Bay Program agreement, I thought that it would take a few years to clean it up.” Governor Harry Hughes

# Sweet dreams . . .



1983



Sweet dreams are made of this  
Who am I to disagree?





I travel the world  
And the Chesapeake,

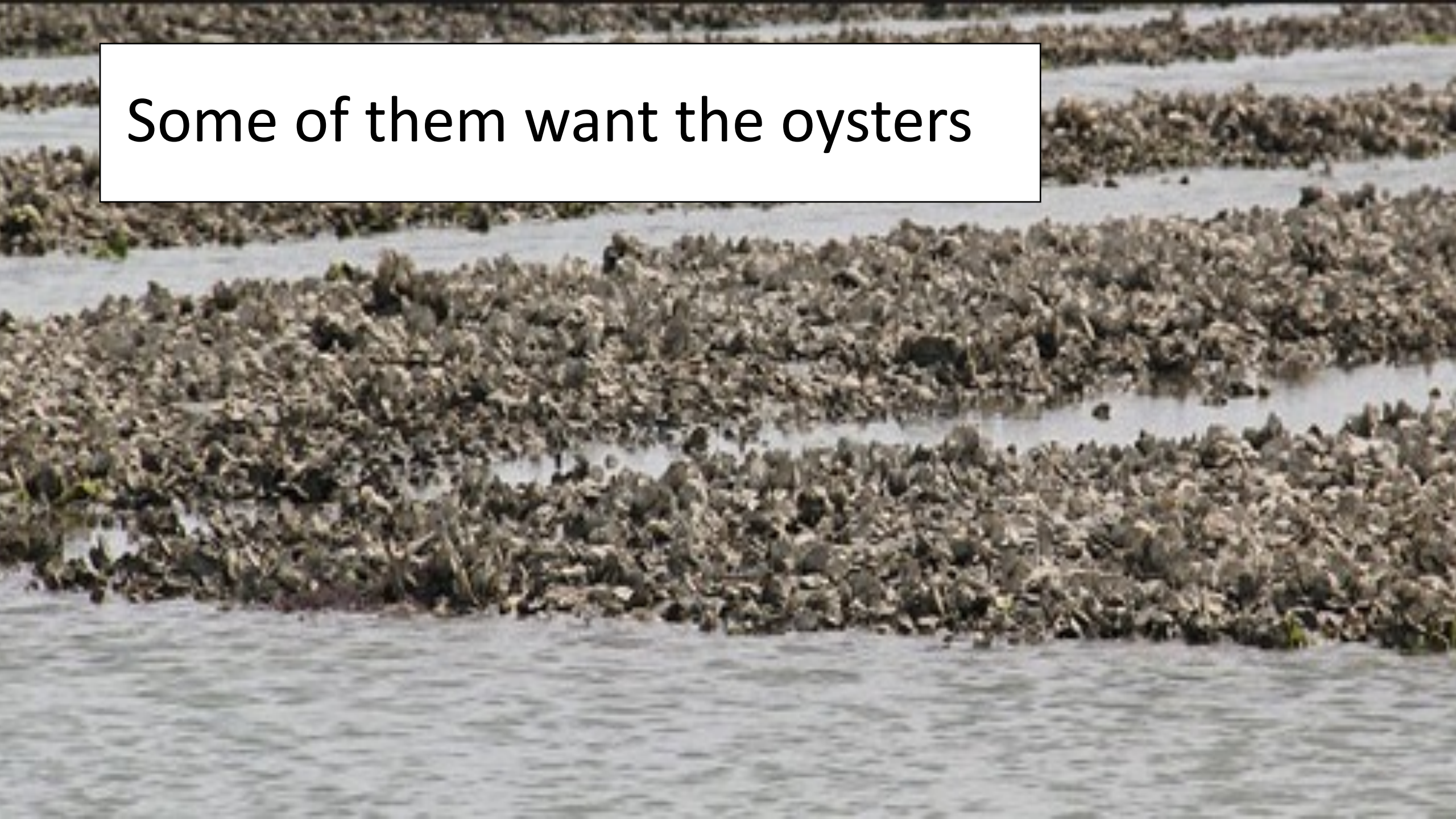


Everybody's looking to save the Bay.





Some of them want the oysters





Some of them want the blue crabs



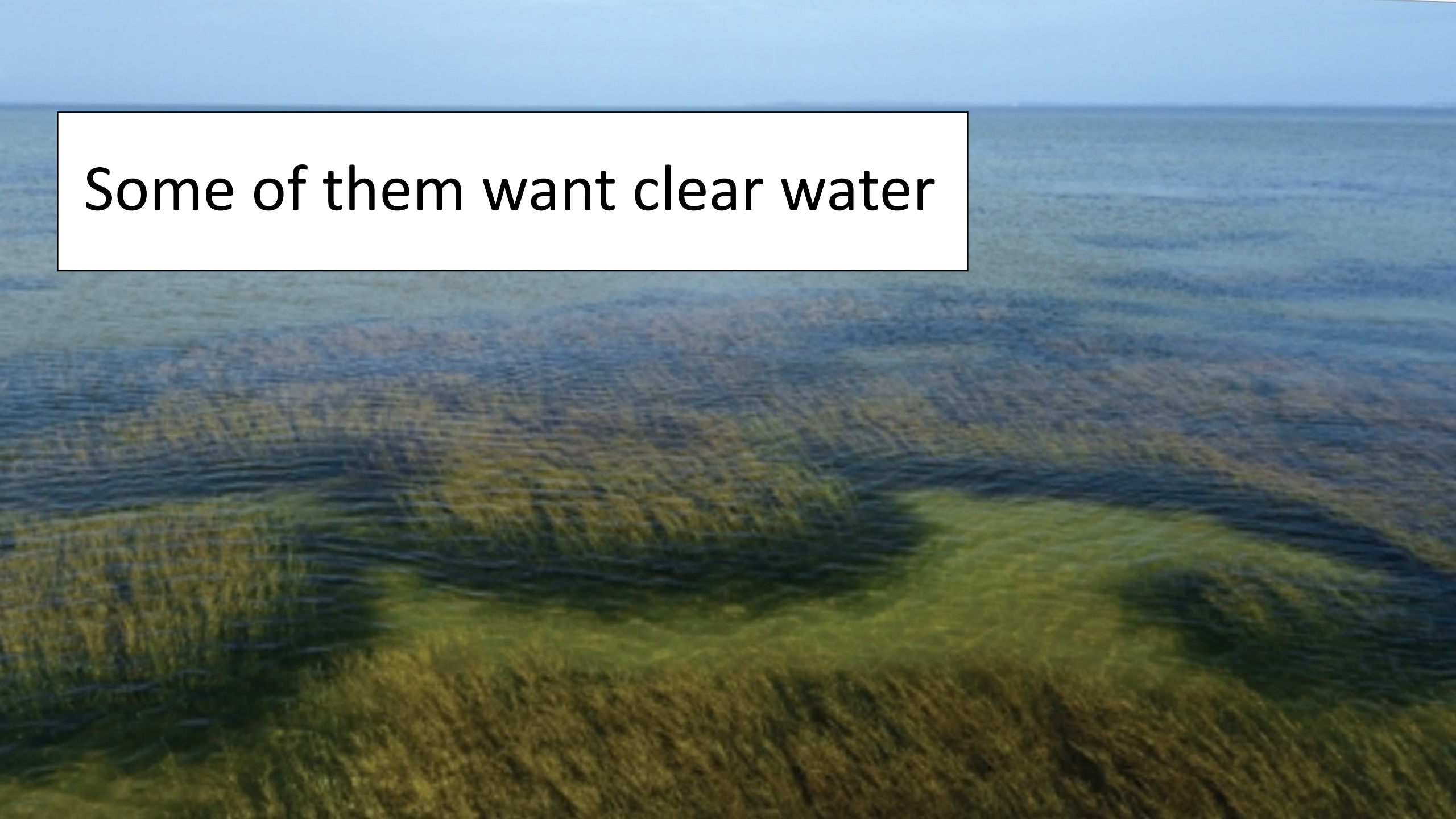




Some of them want the rockfish

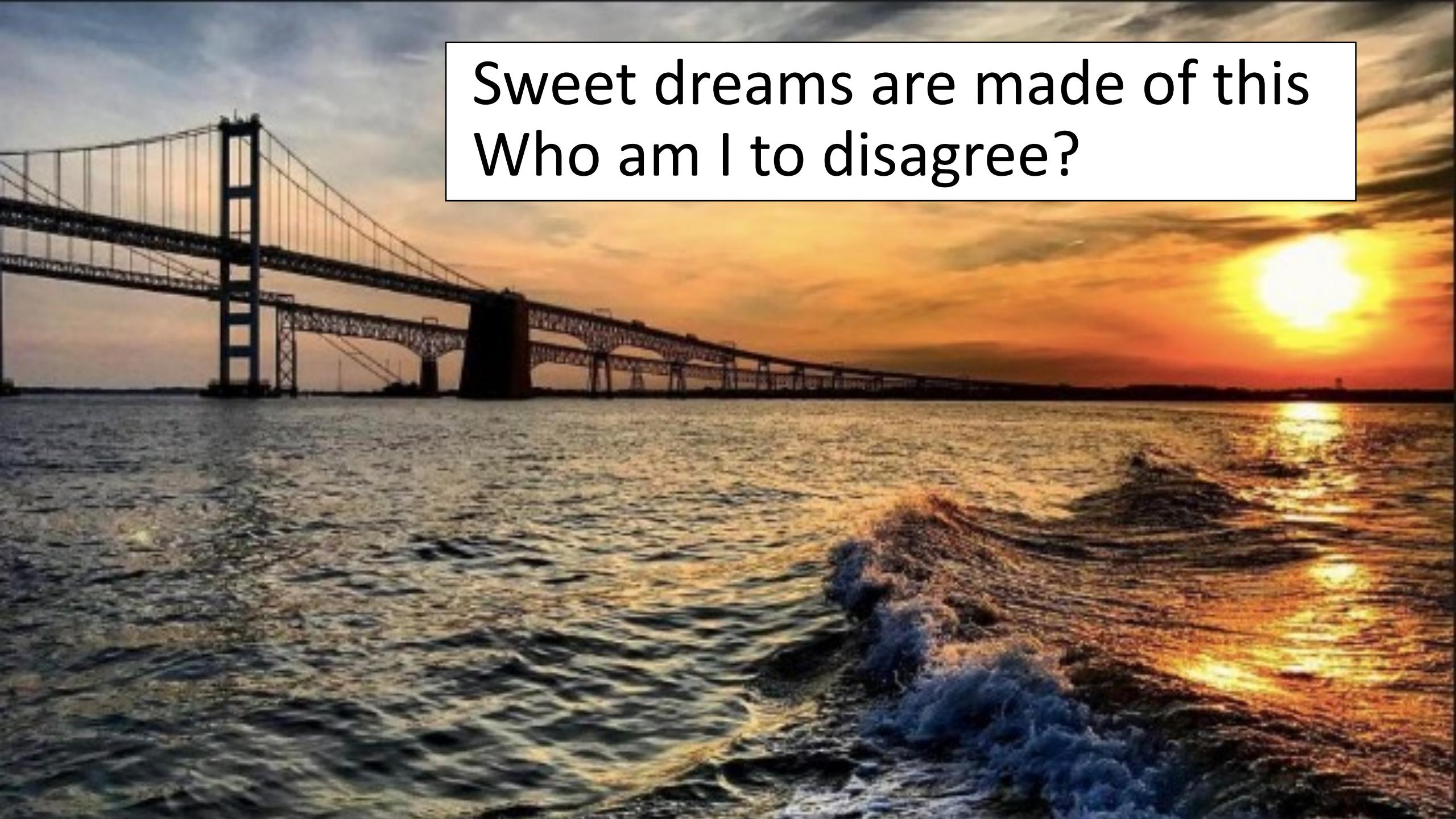


Some of them want clear water





Sweet dreams are made of this  
Who am I to disagree?







I travel the world  
And the seven seas  
Everybody's looking for something





A photograph of four people standing in a row. From left to right: a man with glasses and a dark suit, a man with blonde hair in a dark suit and yellow tie, a woman with blonde hair in a patterned top, and an older man with glasses and a mustache in a dark suit and red tie. They are all smiling. The background is a light-colored wall with a faint floral pattern. A white text box is overlaid on the image.

Hold your head up  
Keep your head up, movin' on  
Hold your head up, movin' on



Keep your head up, movin' on  
Hold your head up, movin' on  
Keep your head up, movin' on  
Hold your head up



Some of them want to use the Bay





Some of them what to get used by the Bay



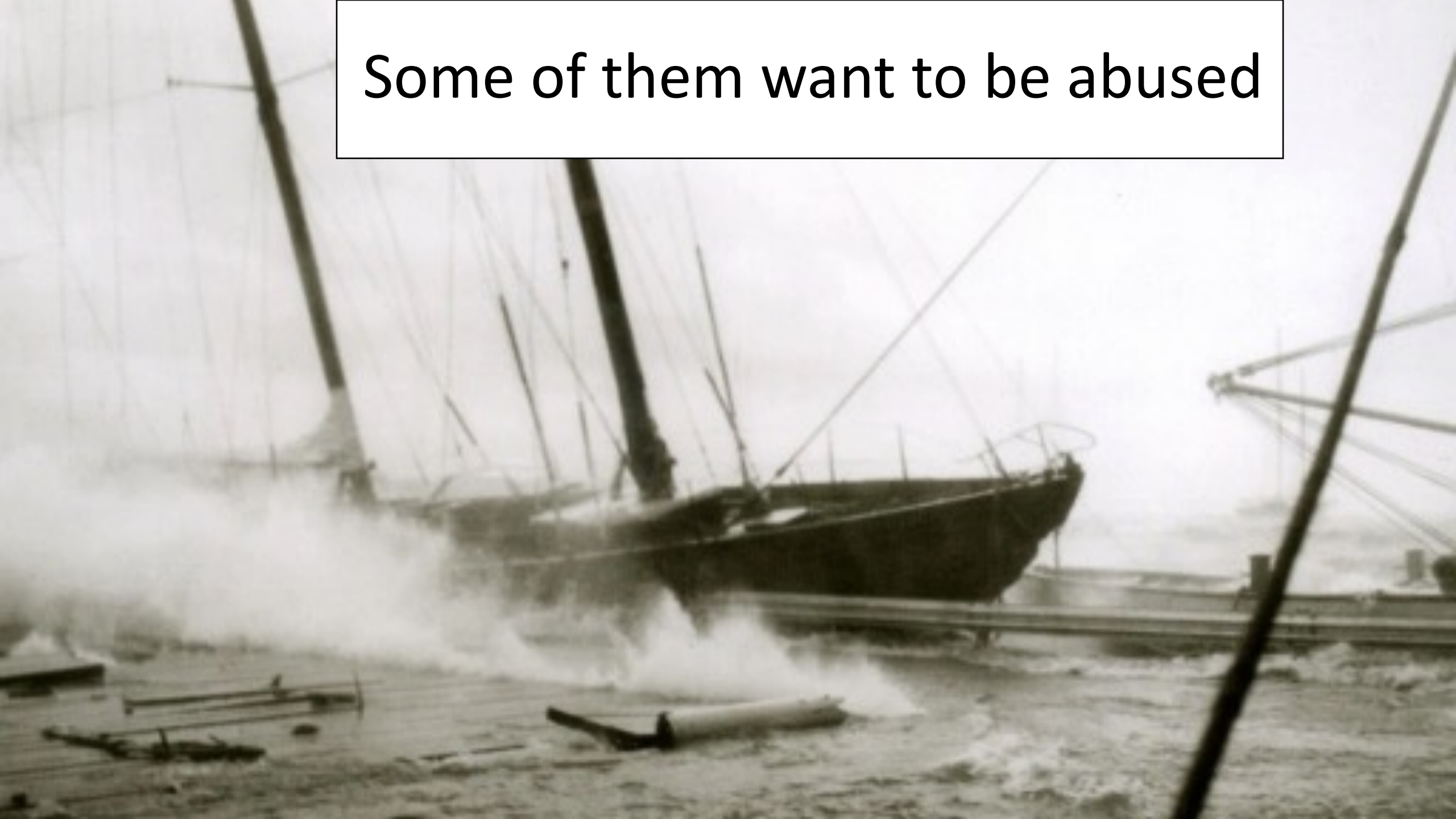


Some of them want to abuse the Bay



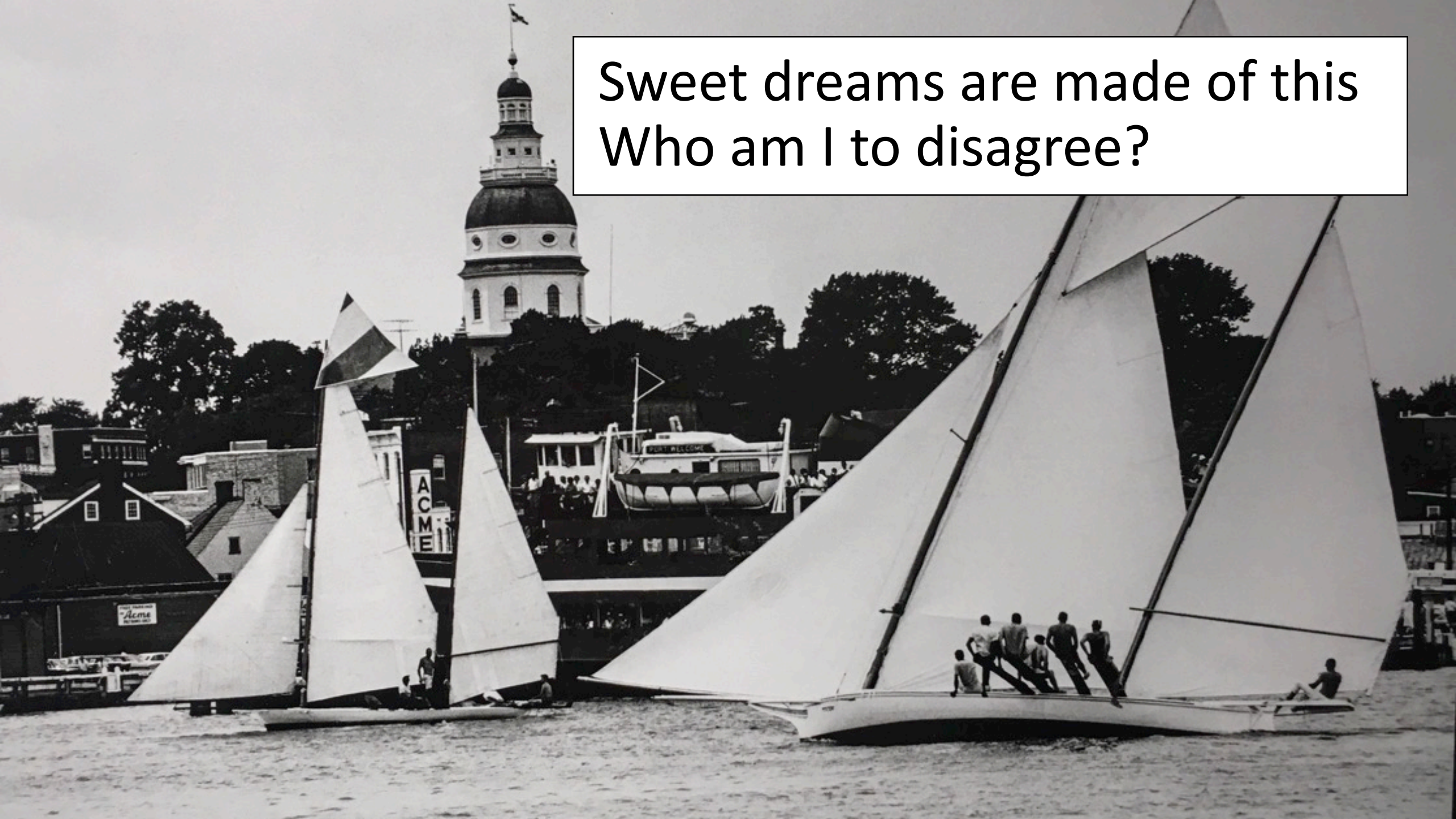


Some of them want to be abused

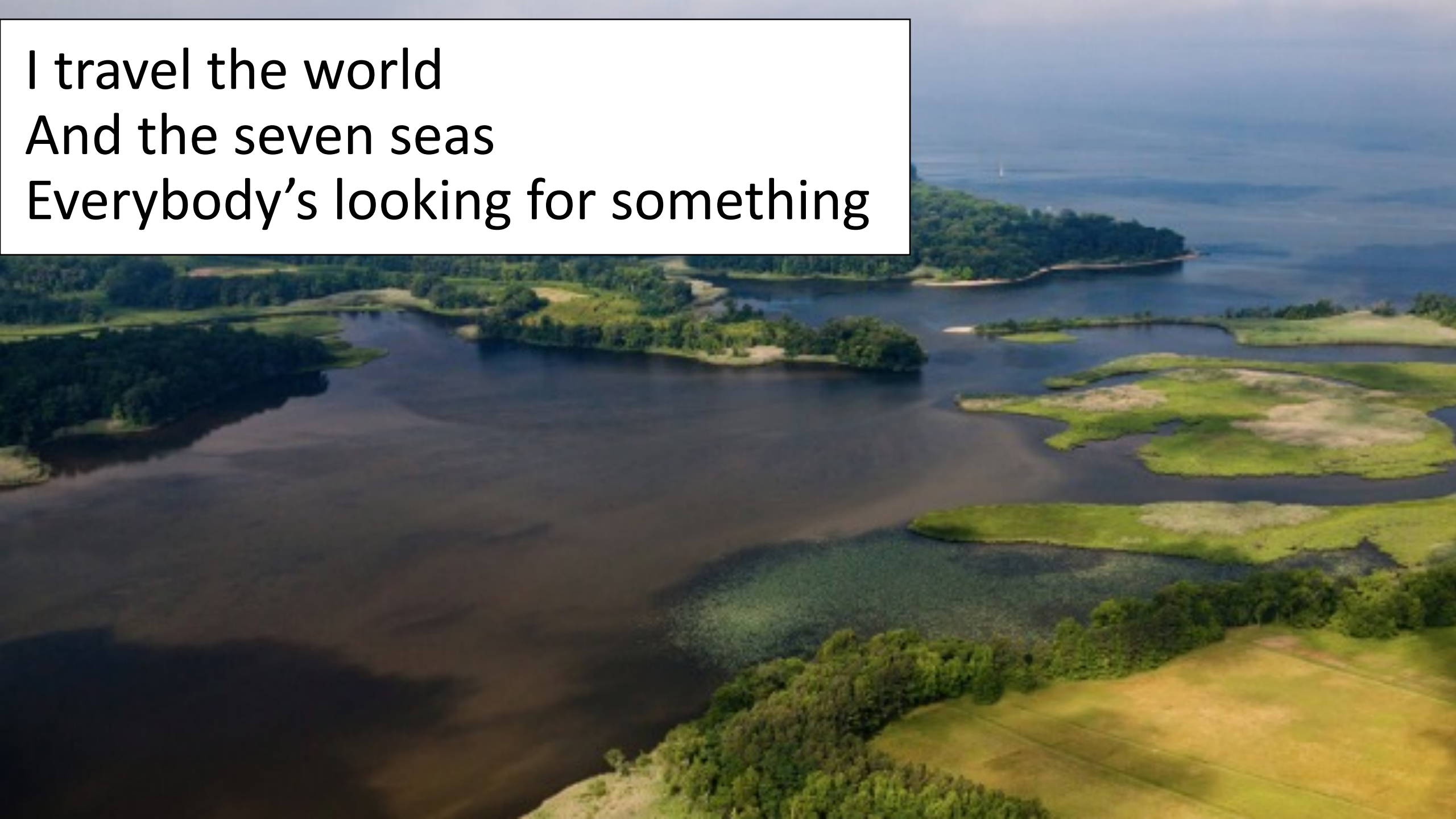




Sweet dreams are made of this  
Who am I to disagree?







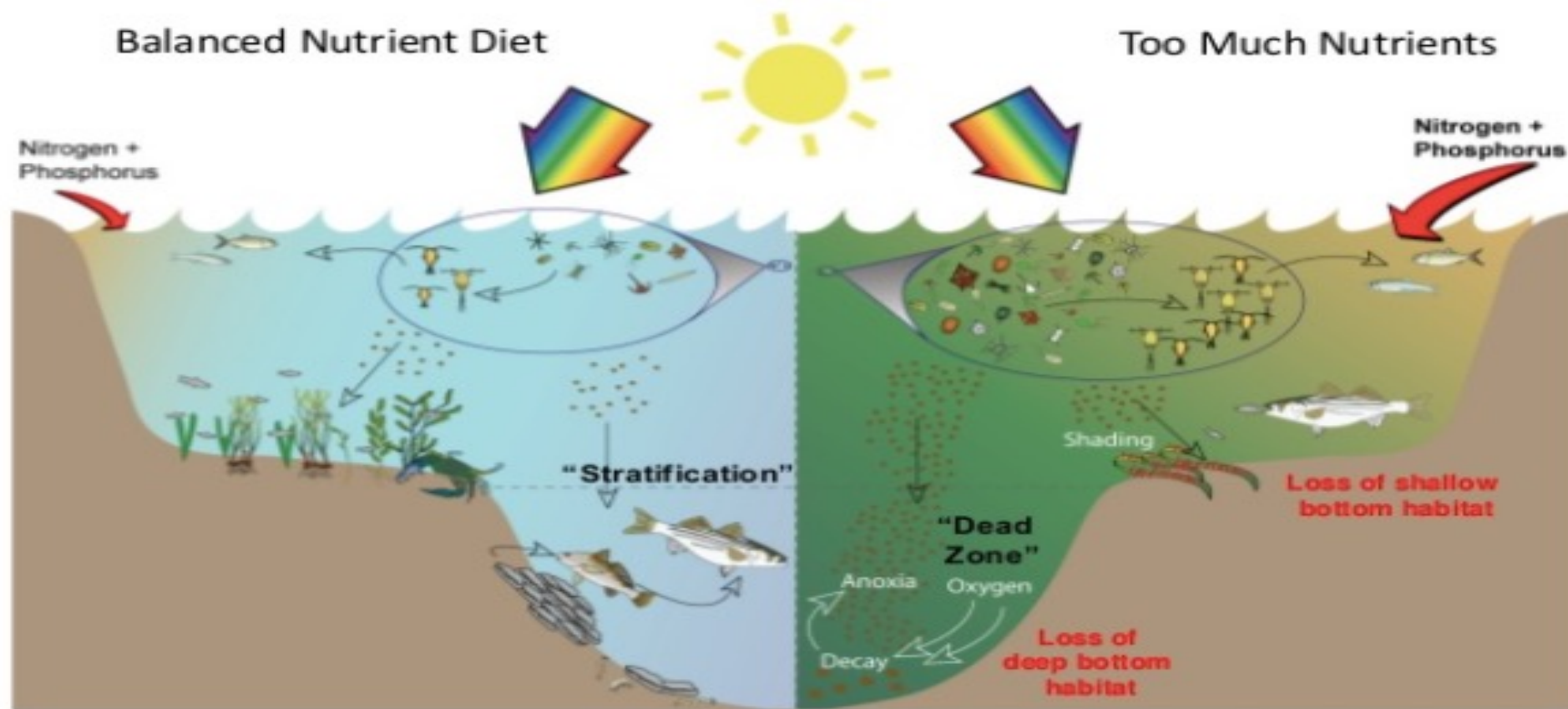
I travel the world  
And the seven seas  
Everybody's looking for something

# Chesapeake Bay agreements; 1984 & 1987 called for 40% nutrient reductions





# Even after two Chesapeake Bay agreements, Bay problems were not resolved

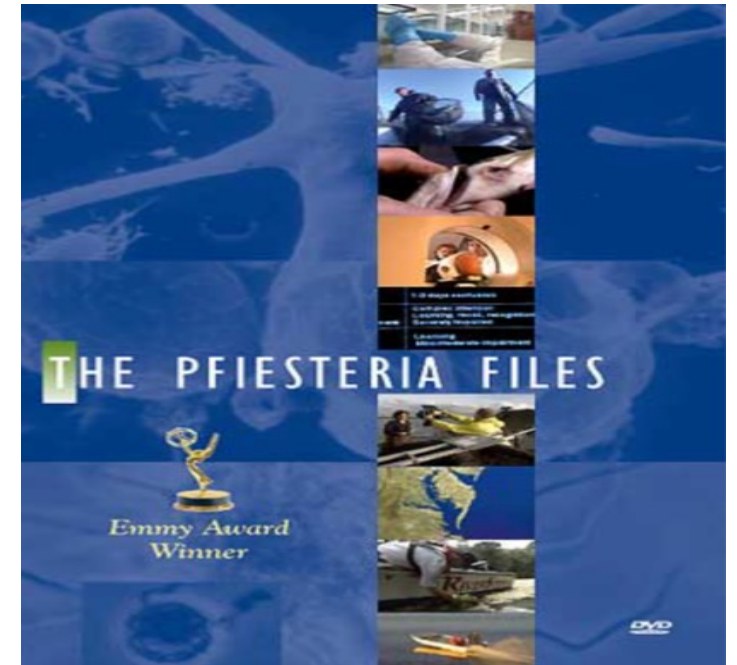
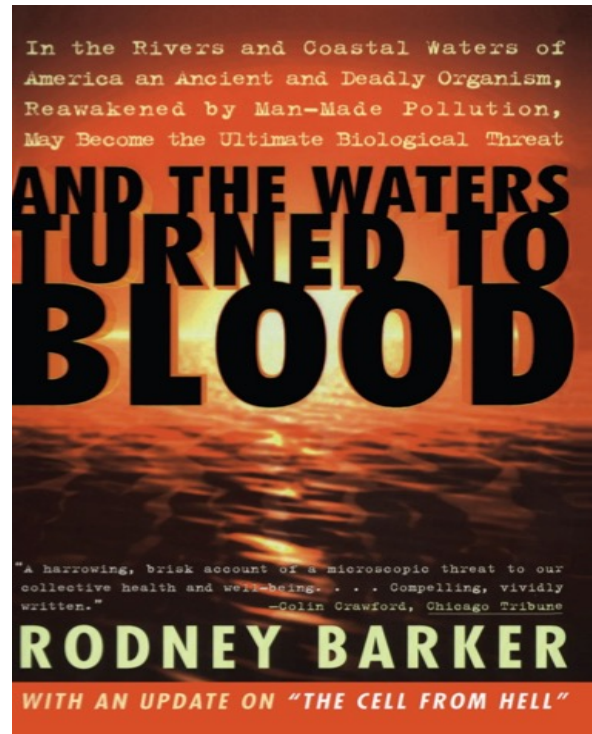


# 1997; Fish kills in Pocomoke River





# 1997; Extensive media coverage



# No escape from reality . . .



Freddie Mercury  
(1946-1991)





# "A Decade of Progress" 1983-1993

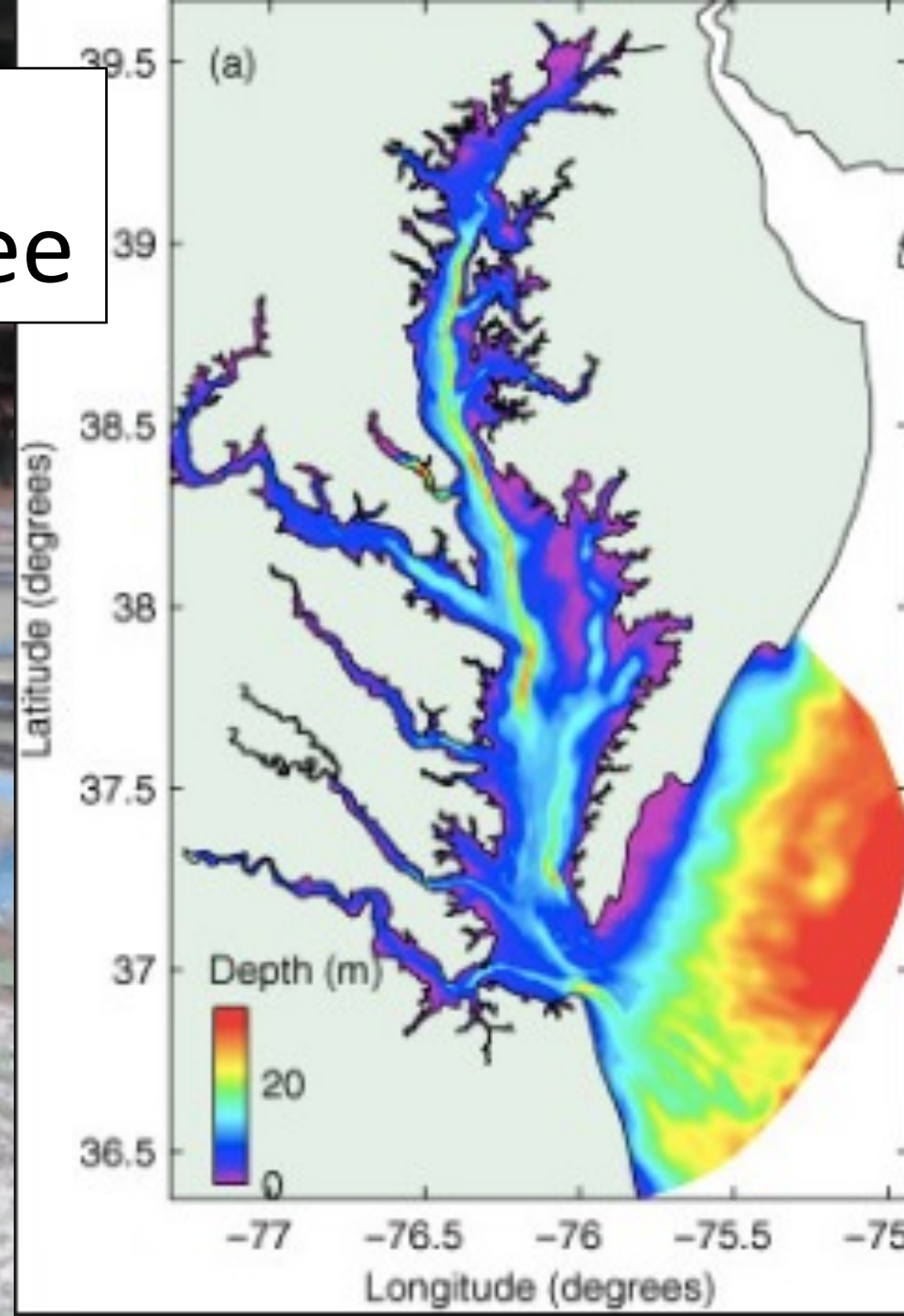
Is this the real life?  
Is this just fantasy?

Caught in an algal bloom  
No escape from reality





Open your eyes  
Look up to the models and see

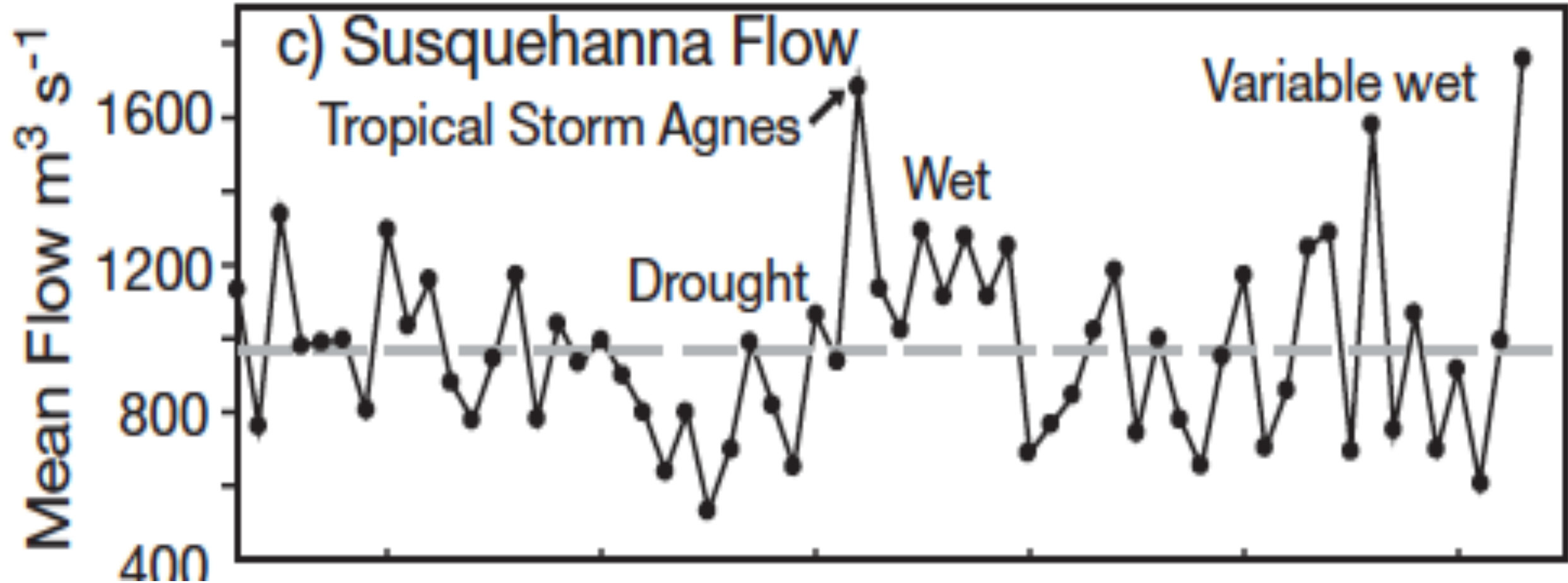


I'm just a poor Bay, I need no sympathy

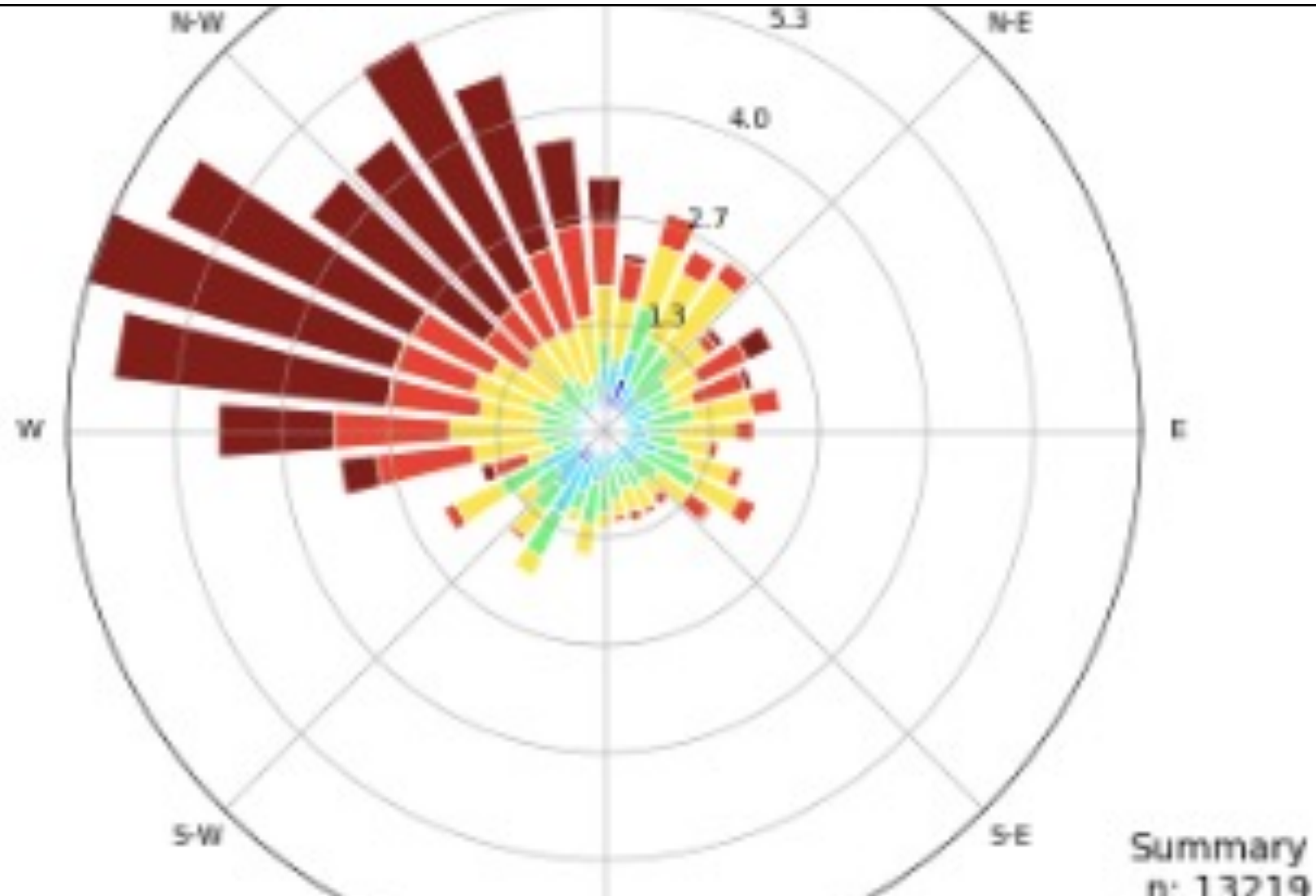




Because I'm easy come, easy go  
A little high, a little low



Anyway the wind blows, doesn't  
really matter to me, to me





Mama, just killed the crab  
Picked him up off the seabed





Boiled him up, and now he's dead





Mama, recovery has just begun  
But we have to avoid throwing it all away







Mama, oh oh  
We love our Chesapeake Bay



If I'm not back again this time tomorrow  
Carry on, carry on, as if nothing really matters





# 2000; Chesapeake 2000 Agreement

In June 2000, the Chesapeake Bay Program partners signed a new agreement to guide the restoration and protection of the Bay through the next decade and beyond.

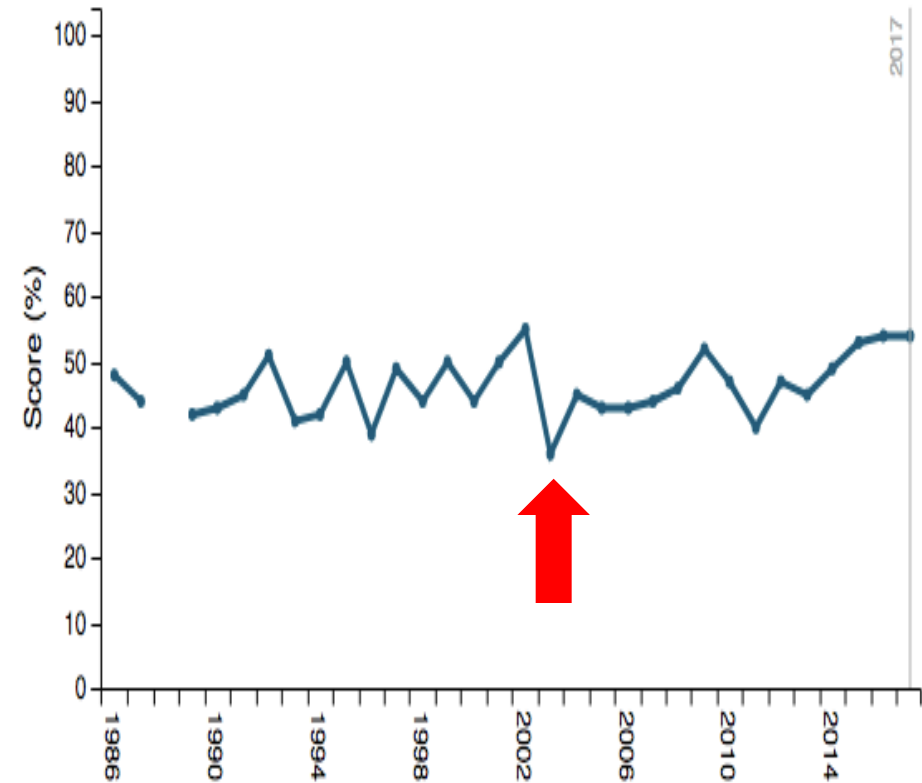
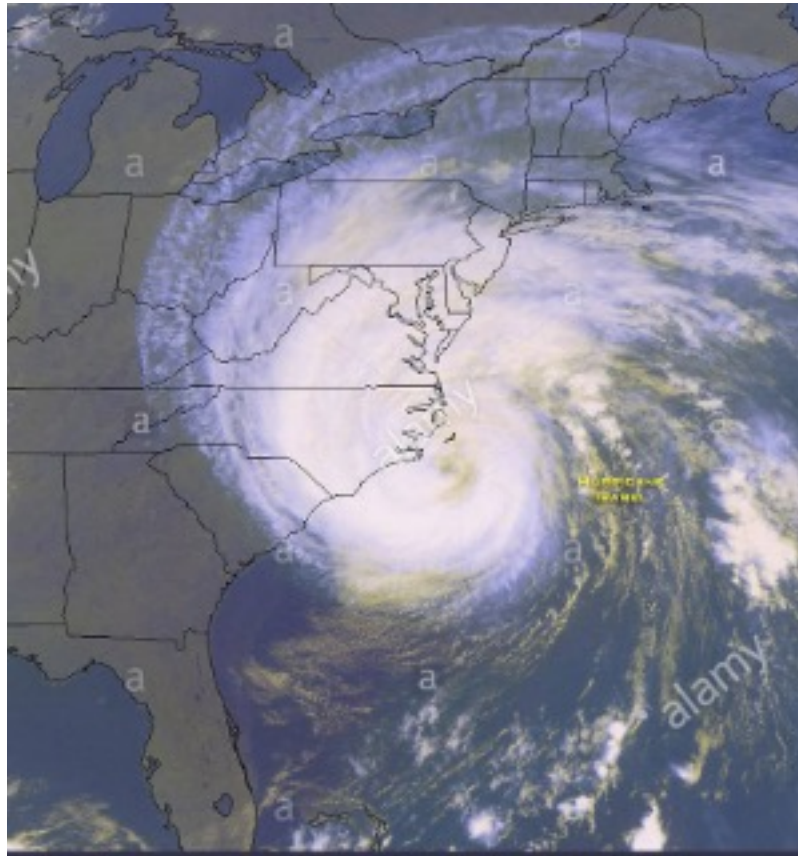
In *Chesapeake 2000*, the partners agreed to:



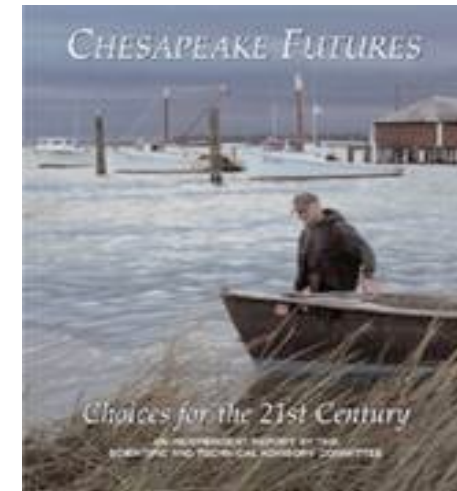
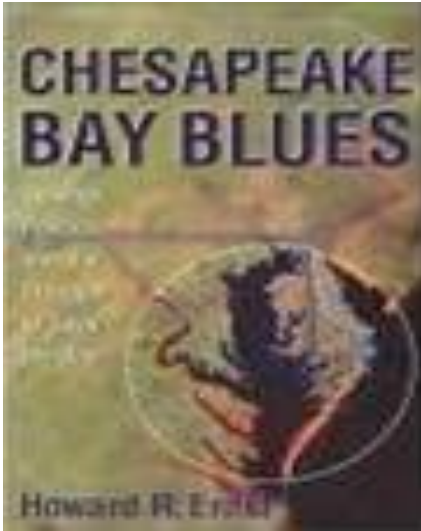
*“by 2010, correct the nutrient- and sediment-related problems in the Chesapeake Bay and its tidal tributaries sufficiently to remove the Bay and the tidal portions of its tributaries from the list of impaired waters under the Clean Water Act”.*



# 2003: Wet year & Hurricane Isabel

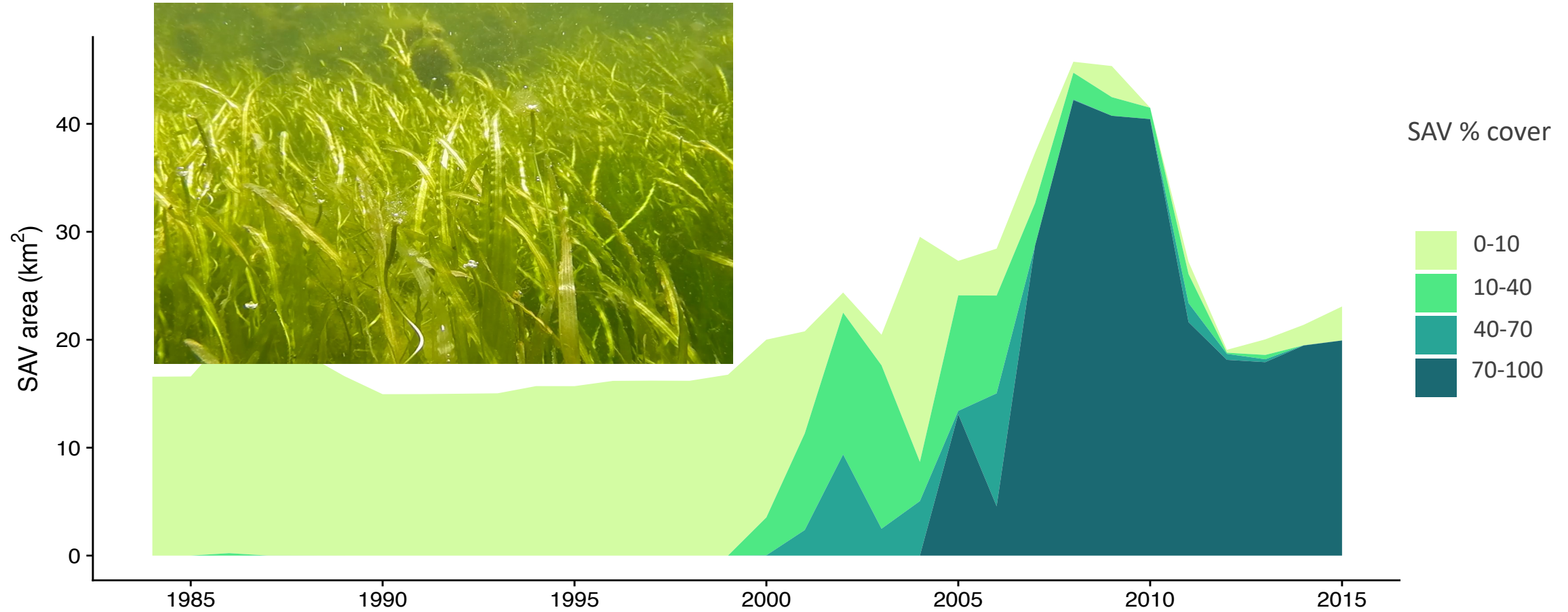


# 2003; Turning point for Chesapeake Bay management



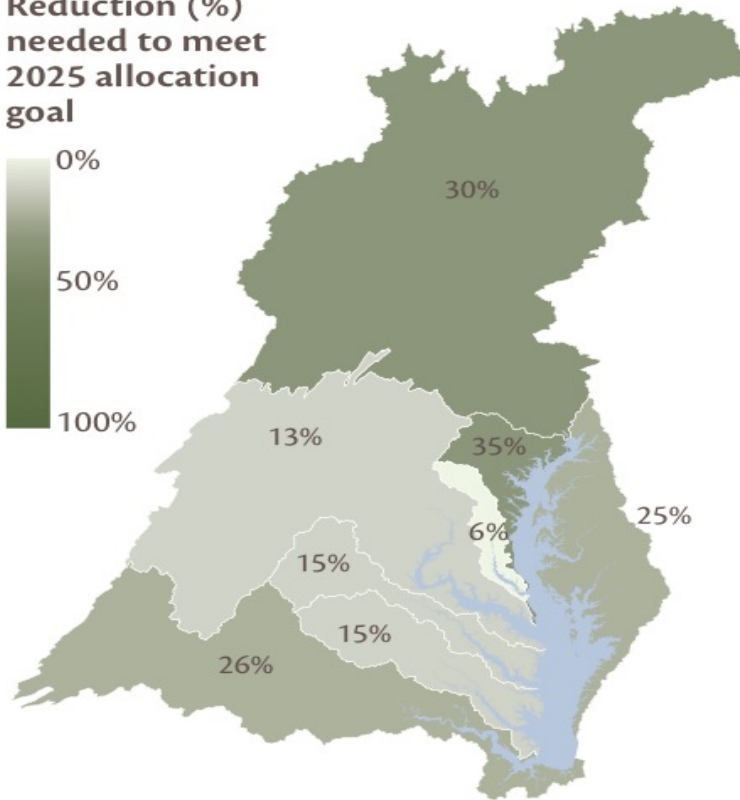
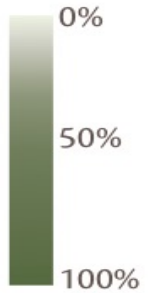


# 2005; Susquehanna resurgence

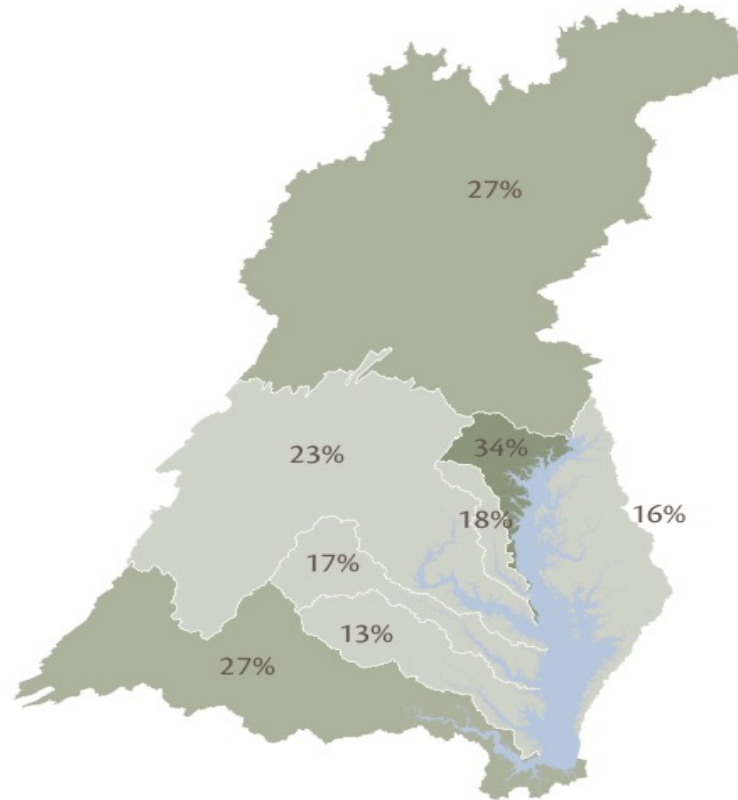


# 2010; Chesapeake Bay Total Maximum Daily Load: TMDL or "Nutrient diet"

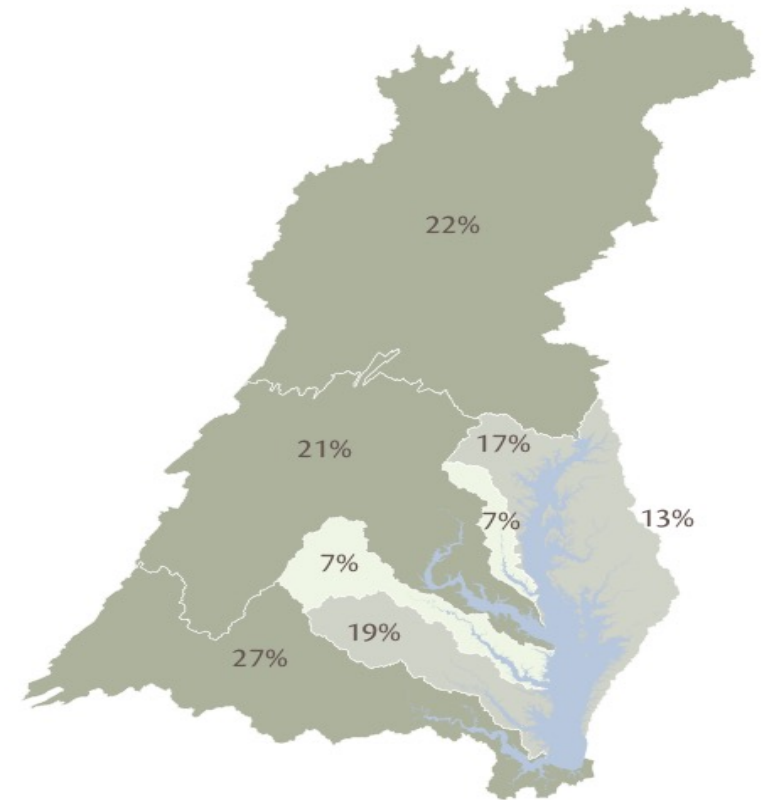
Reduction (%)  
needed to meet  
2025 allocation  
goal



*Total nitrogen*



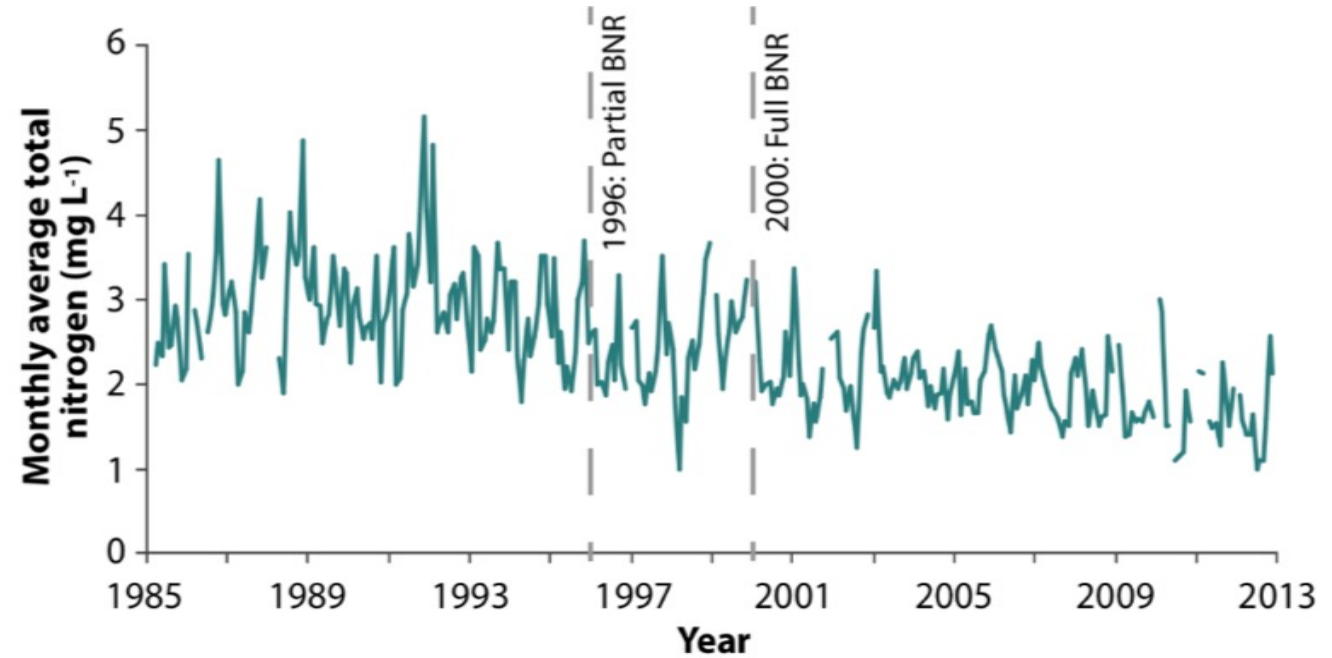
*Total phosphorus*



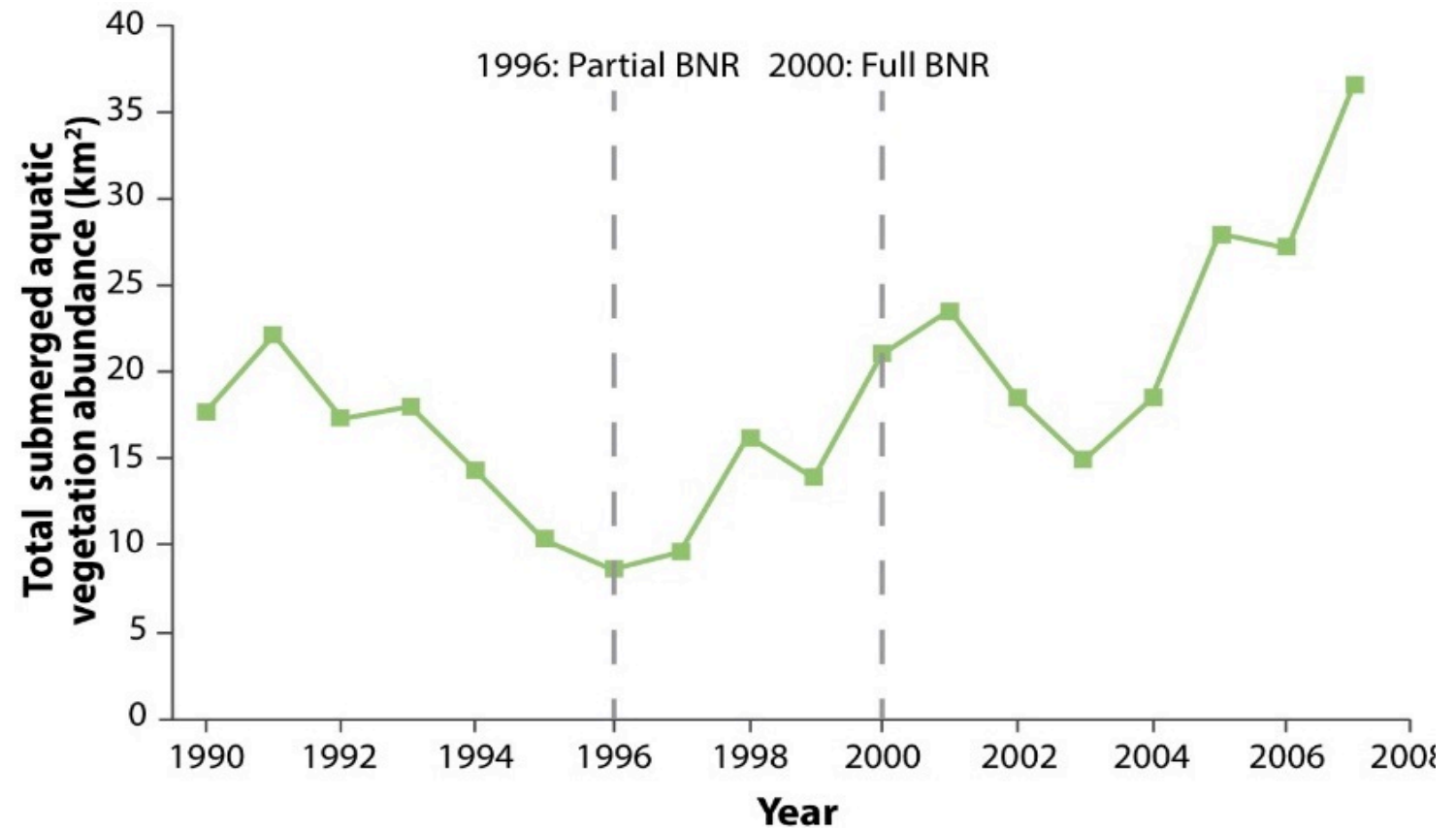
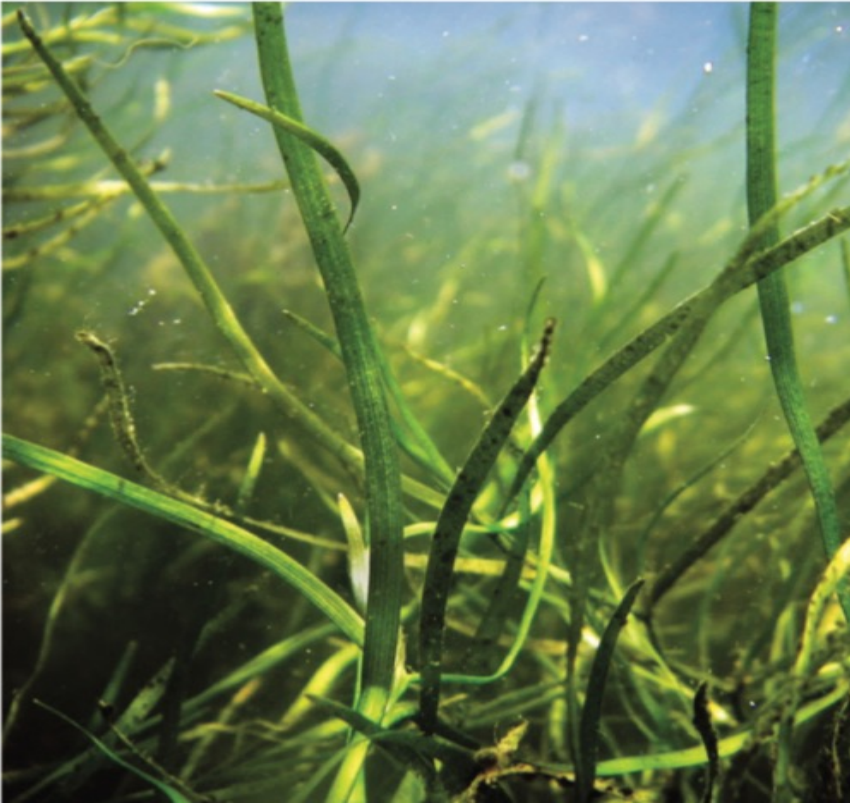
*Total suspended solids*



# Clean Water Act led to sewage treatment upgrades . . .

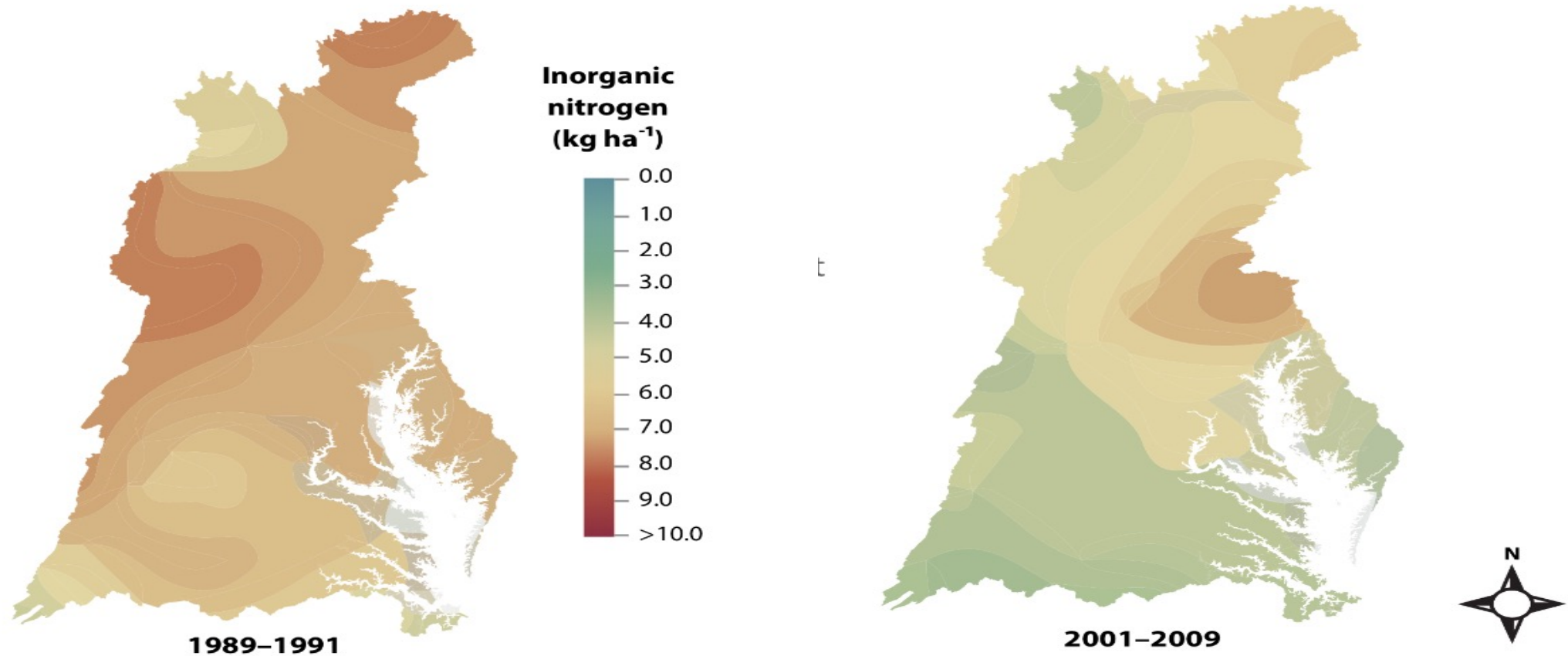


. . . resulting in SAV resurgence.

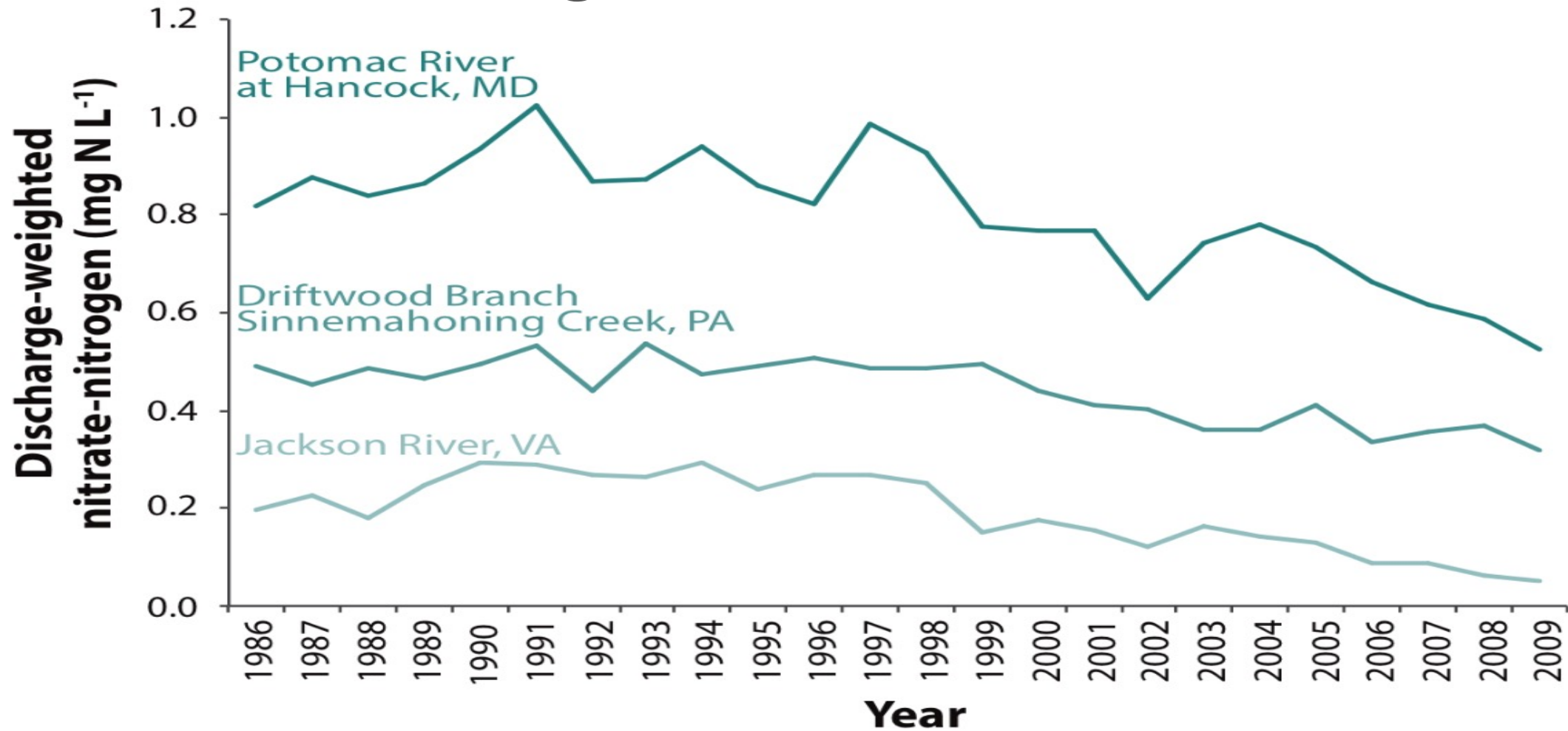




# Clean Air Act led to reduced nitrogen deposition . . .

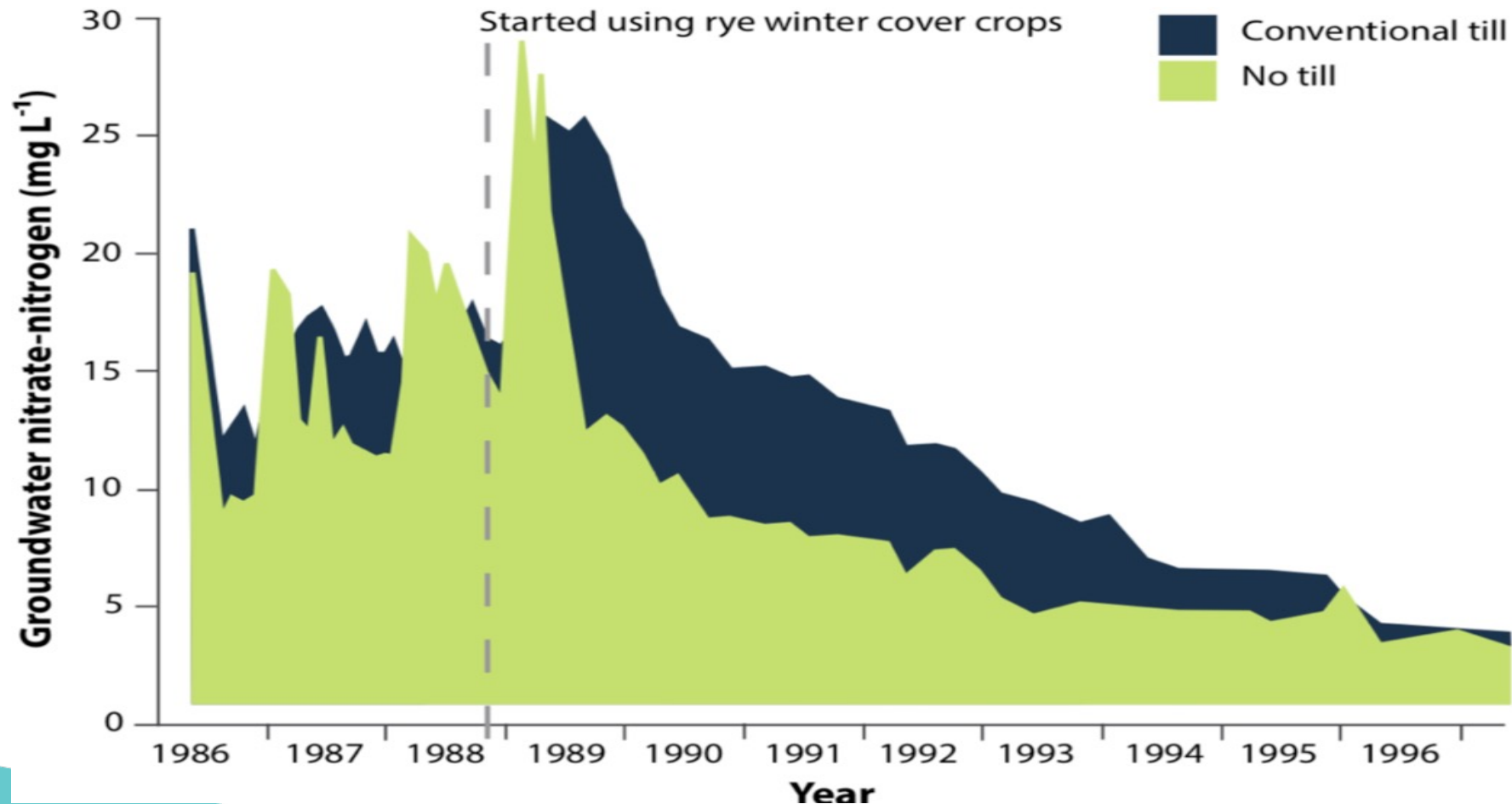


... resulting in lower stream nitrate.

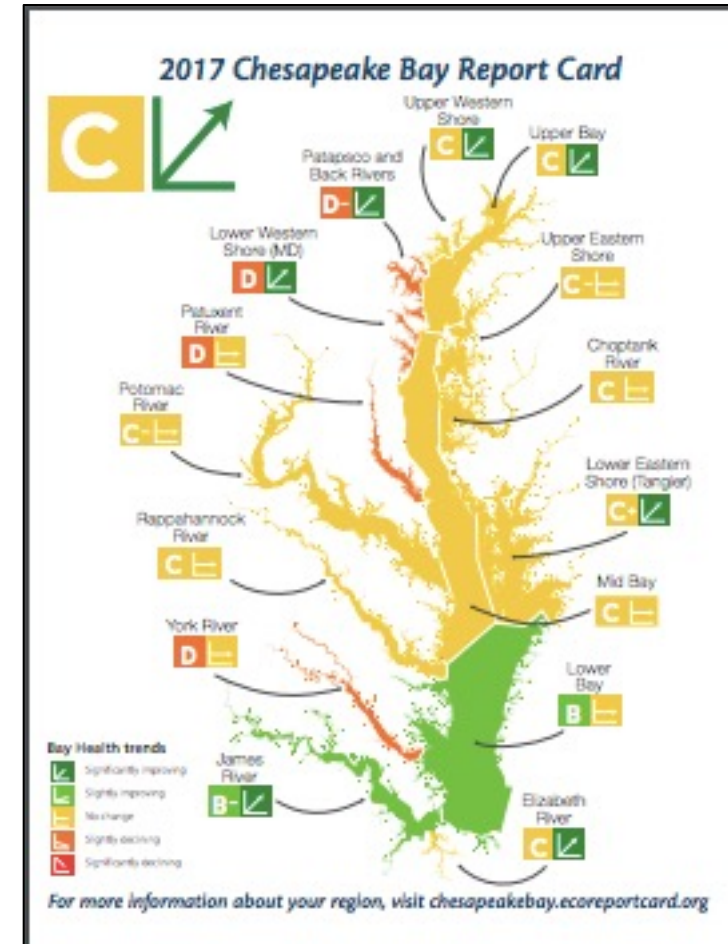
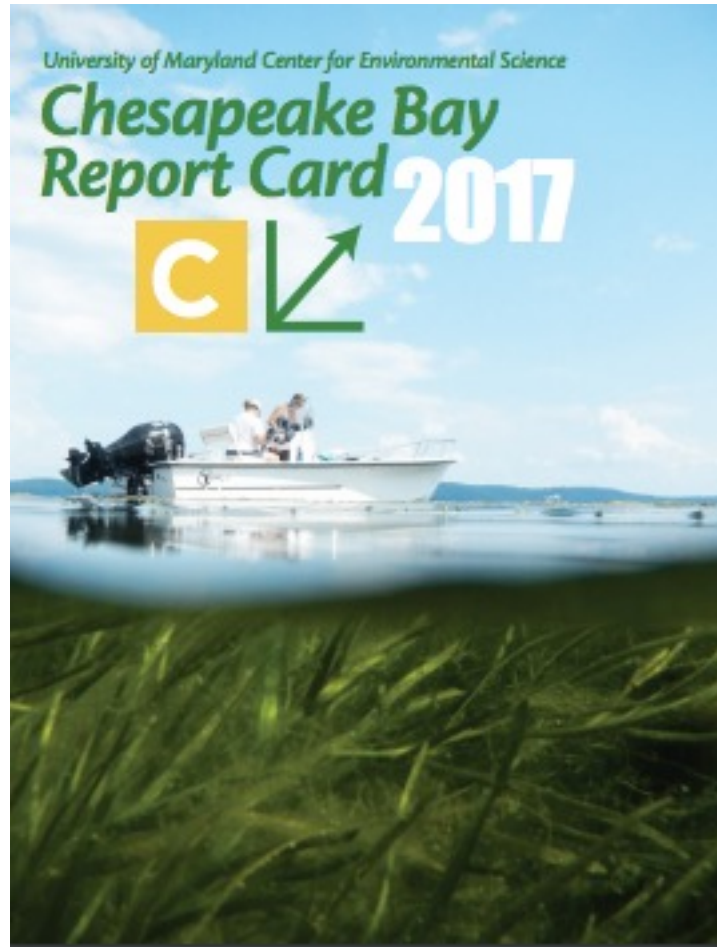




# Winter cover crops reduce groundwater nitrate

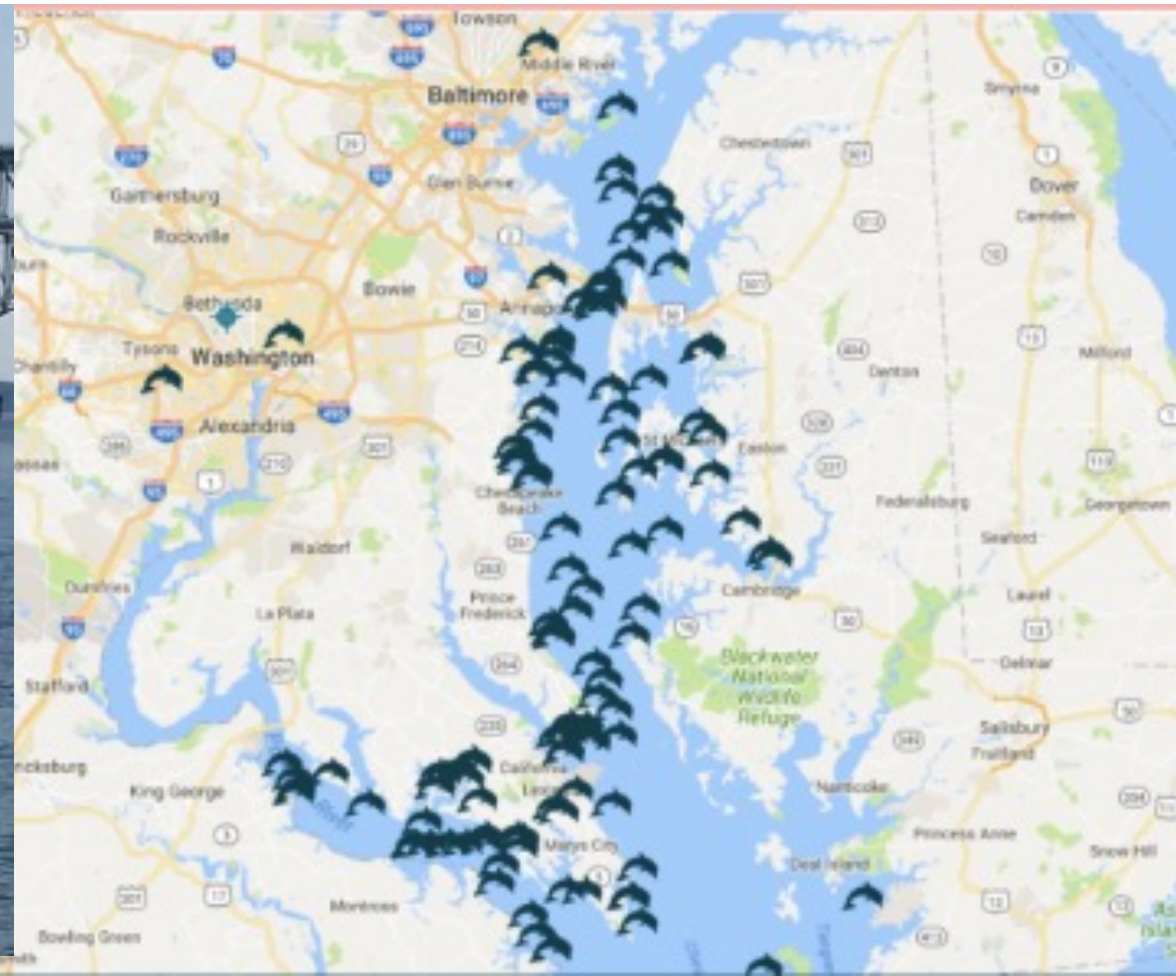


# 2017; Chesapeake report card shows improving scores for the first time





# 2018: Dolphins returning to the Bay

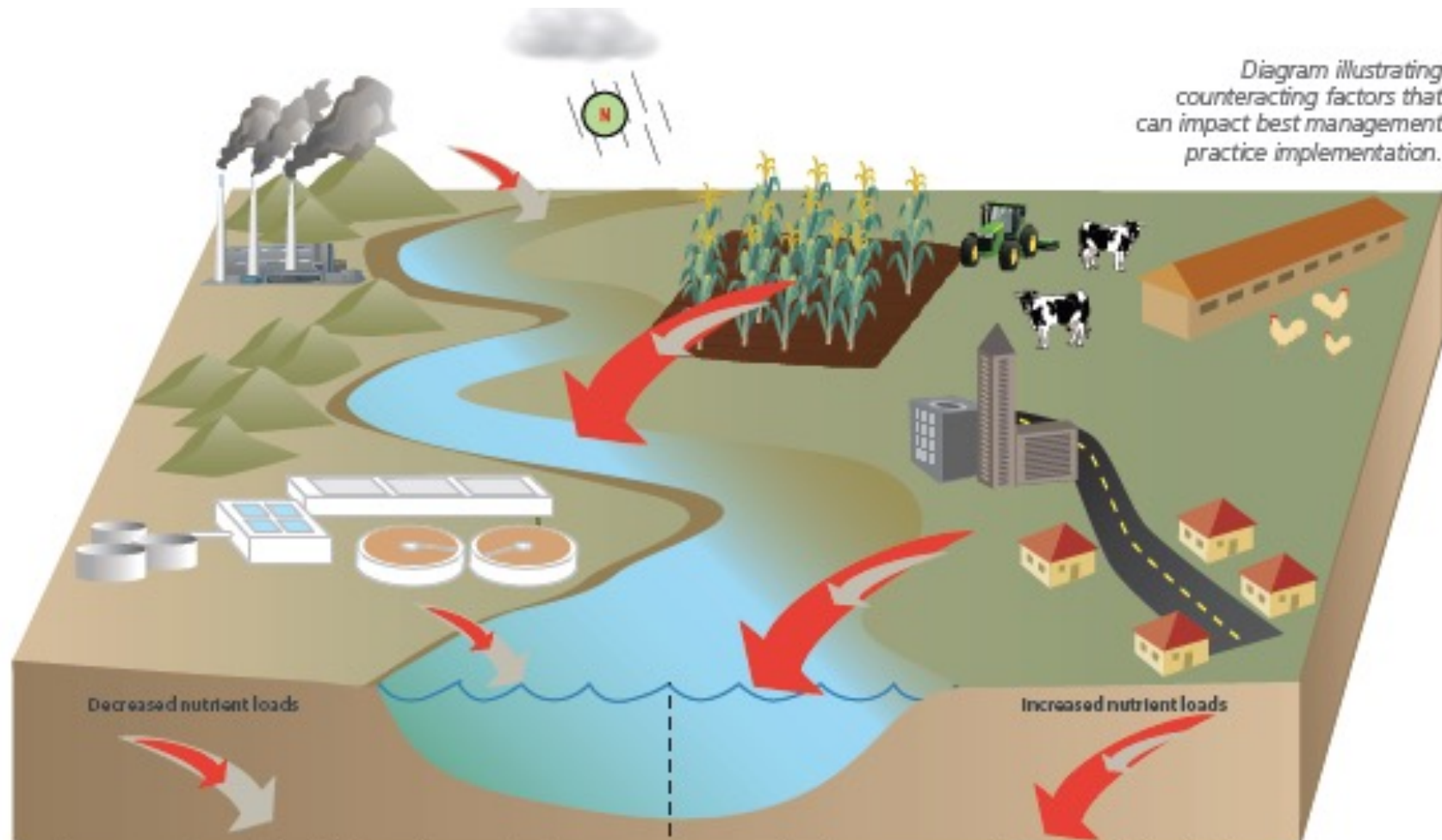


# MidAtlantic

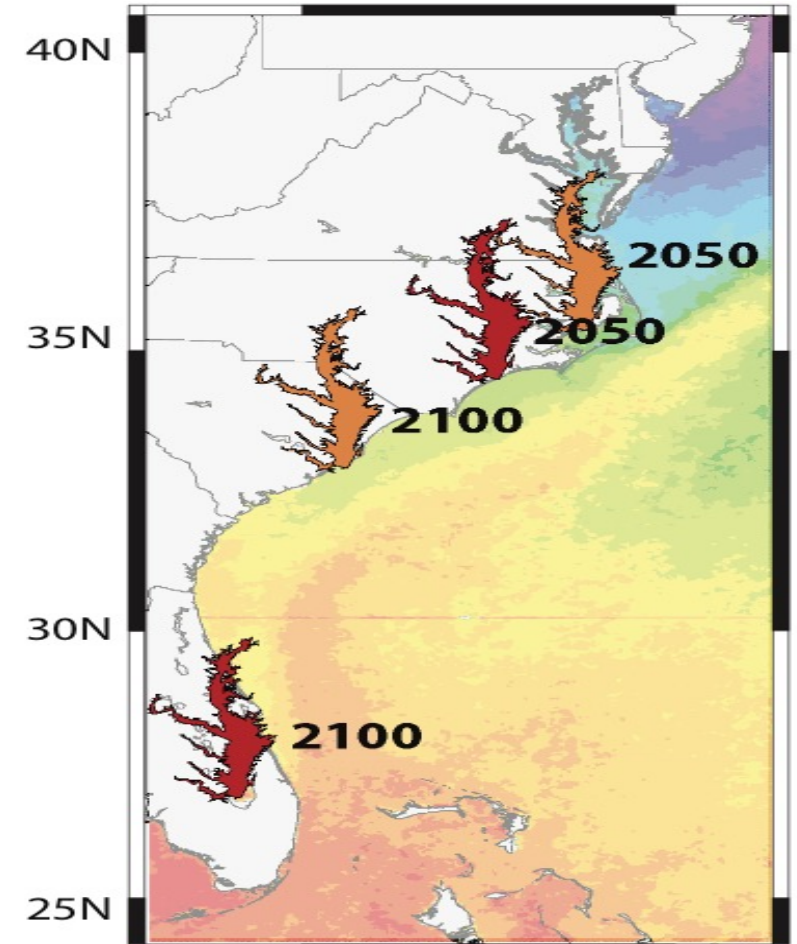
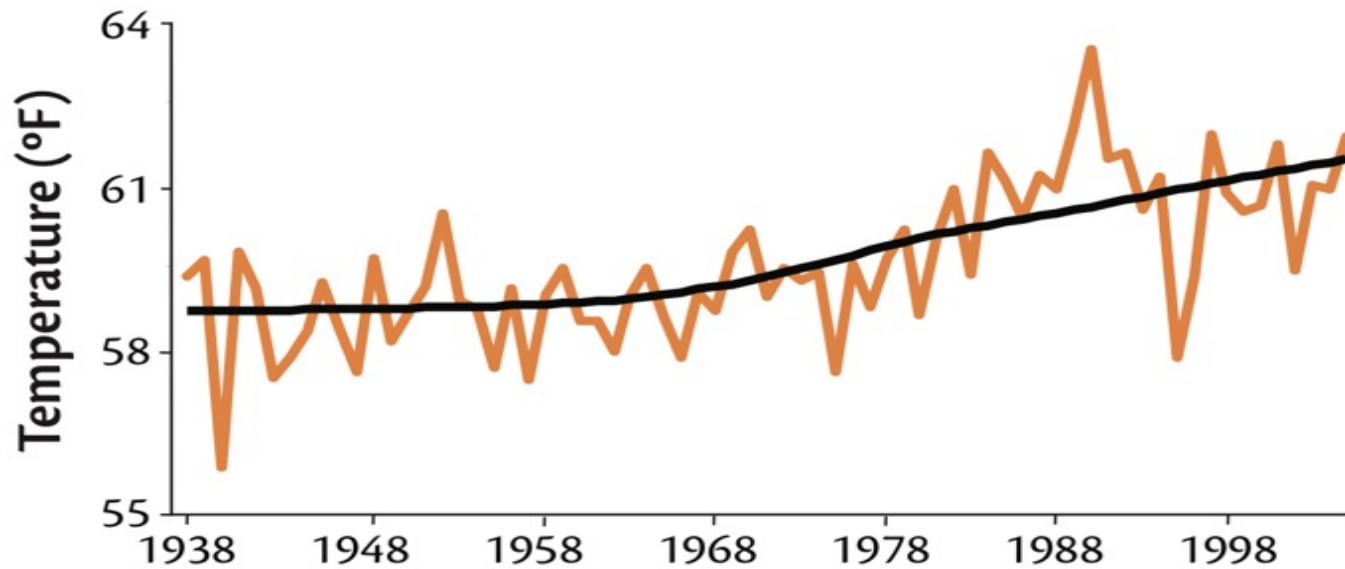




# Stormwater runoff needs to be controlled

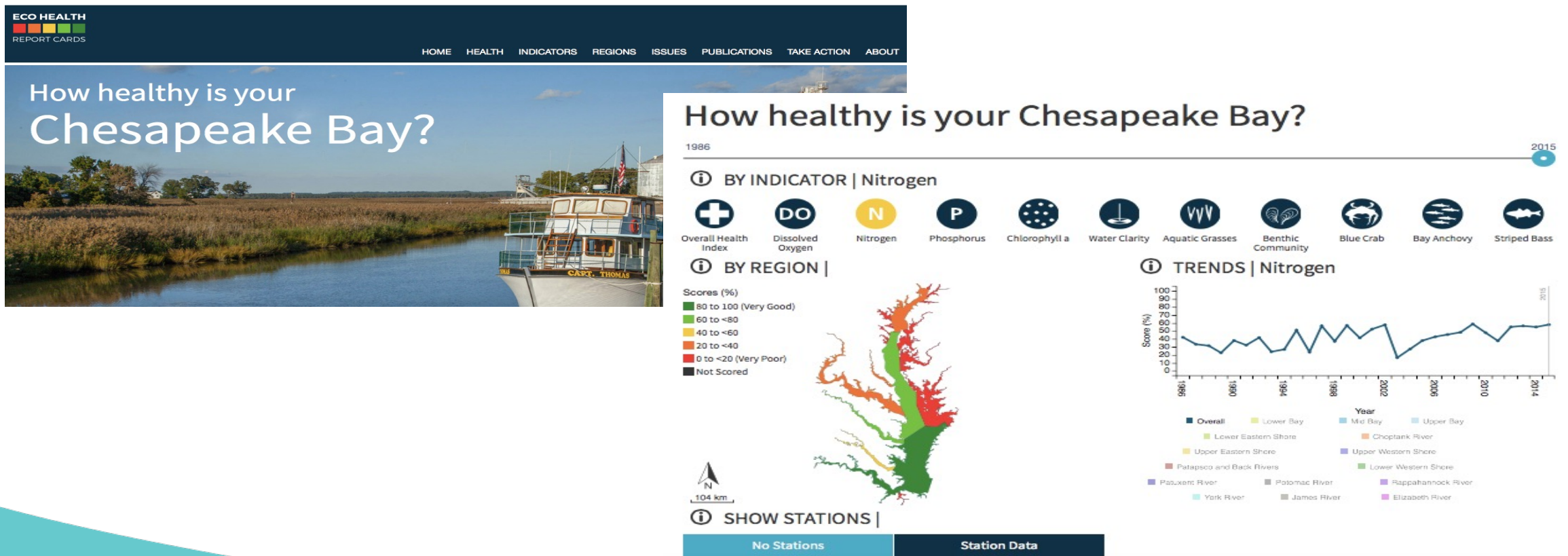


# Responding to climate change

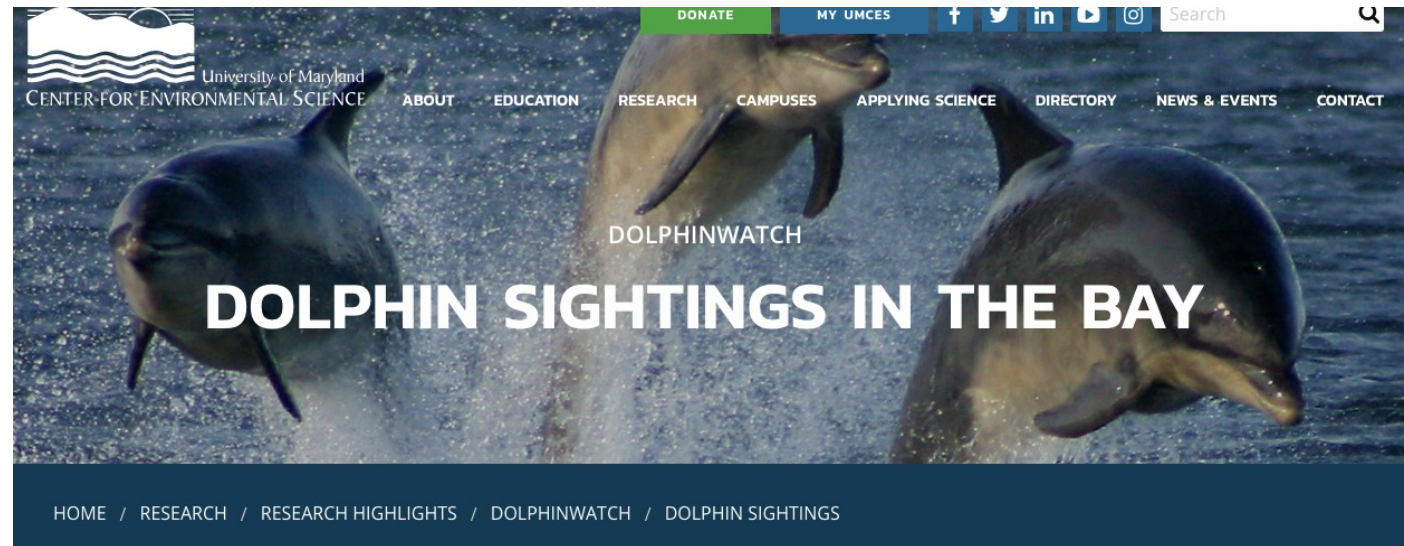




# Expanded report cards (watershed & socio-economic indicators)

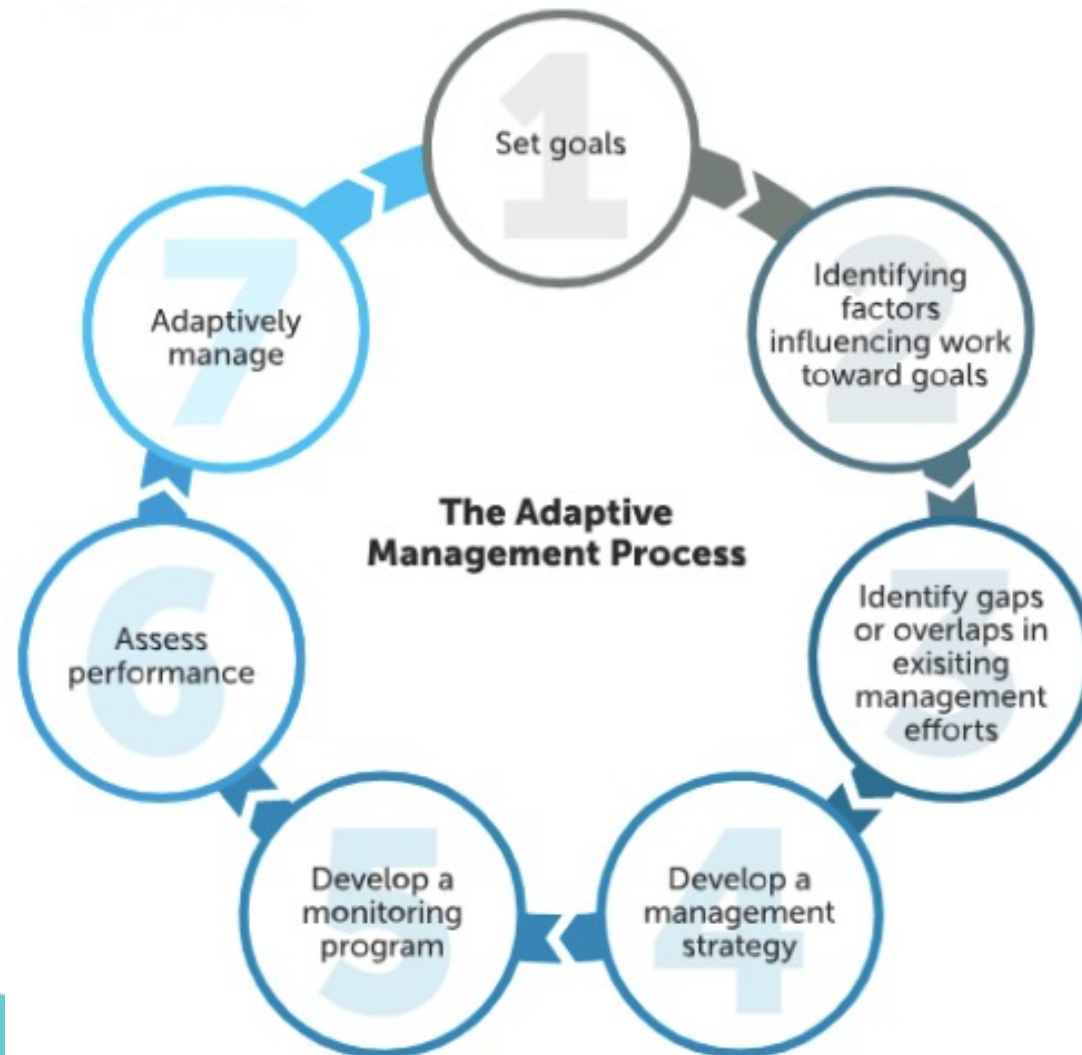


# Engagement of citizen scientists

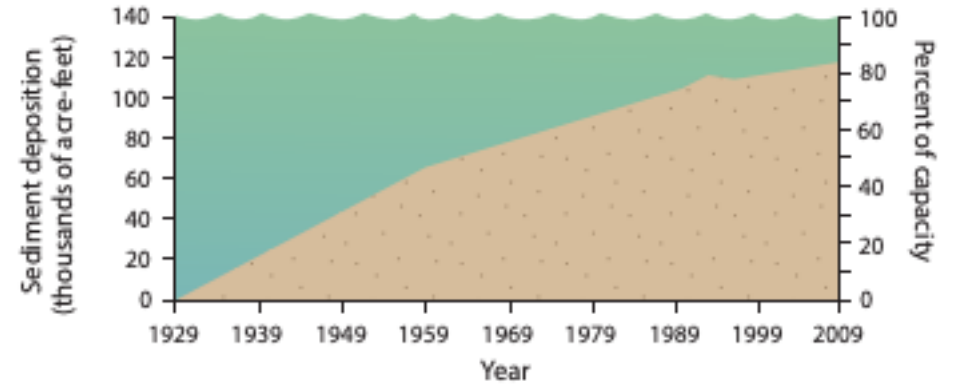




# Implementing adaptive management

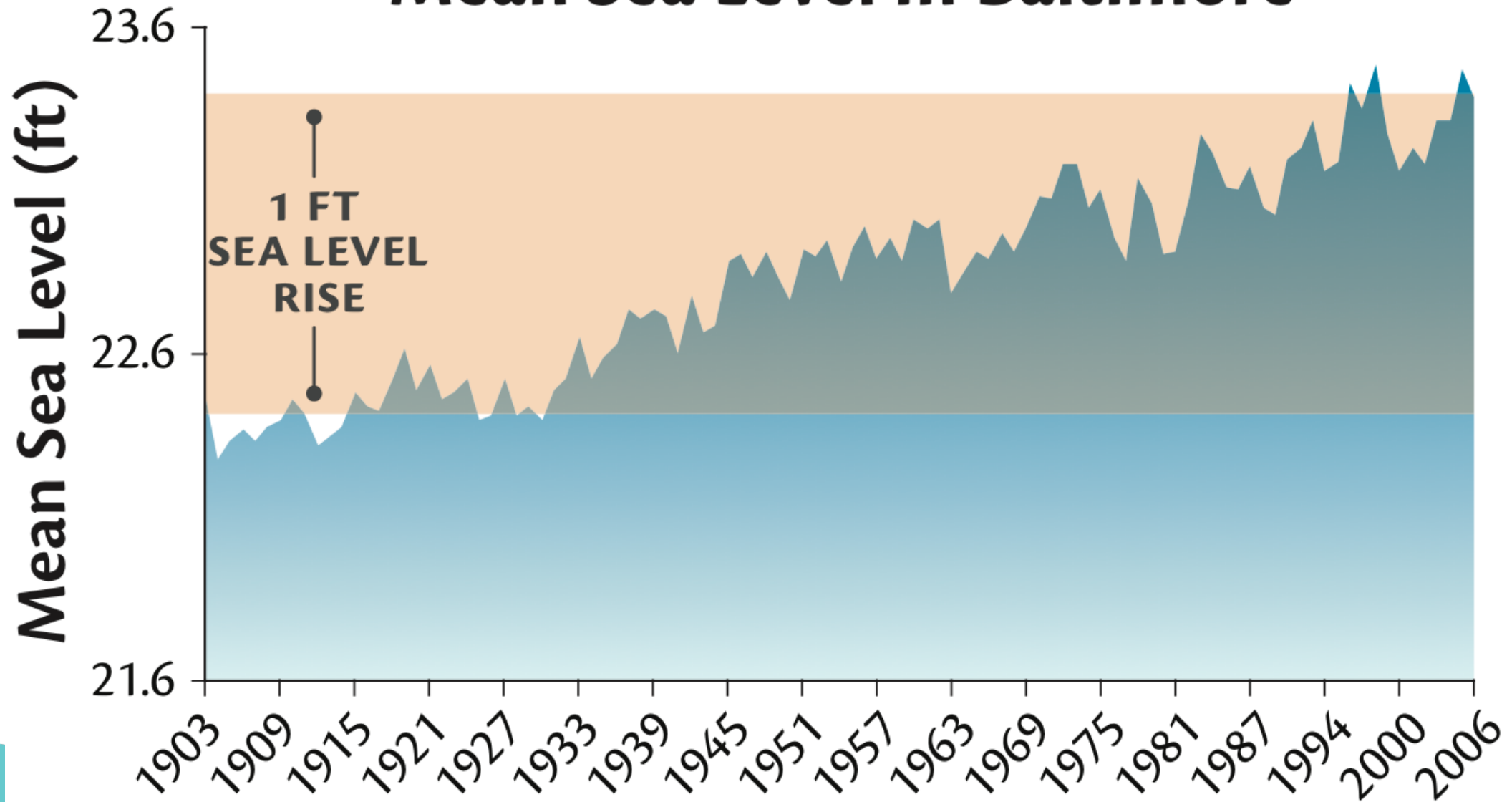


# Conowingo Dam reservoir filled up





# Mean Sea Level in Baltimore



Fair and meaningful participation in environmental decision-making

Sustainable practices implemented in agriculture and urban development

Diverse local knowledge input into decision-making

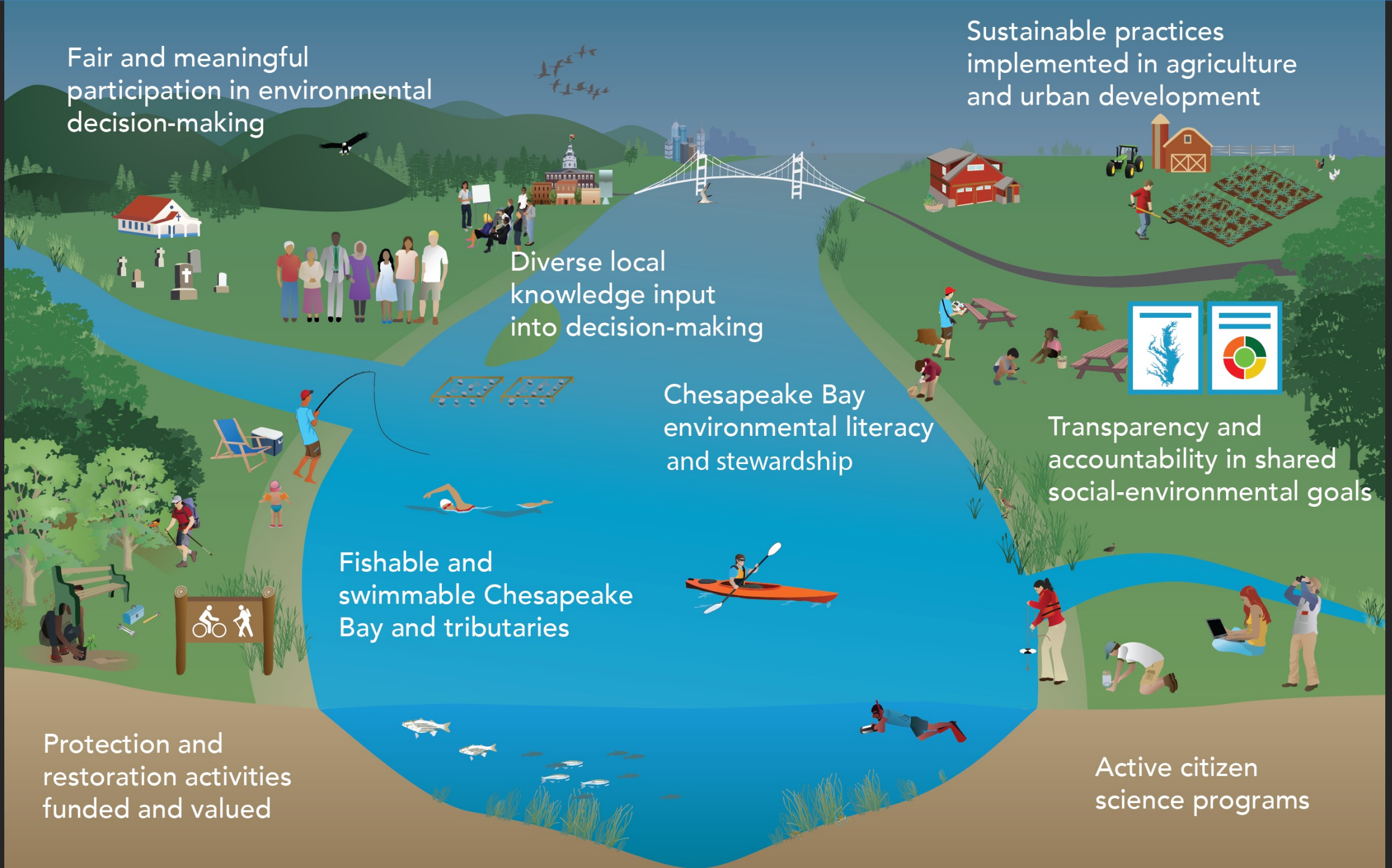
Chesapeake Bay environmental literacy and stewardship

Transparency and accountability in shared social-environmental goals

Fishable and swimmable Chesapeake Bay and tributaries

Protection and restoration activities funded and valued

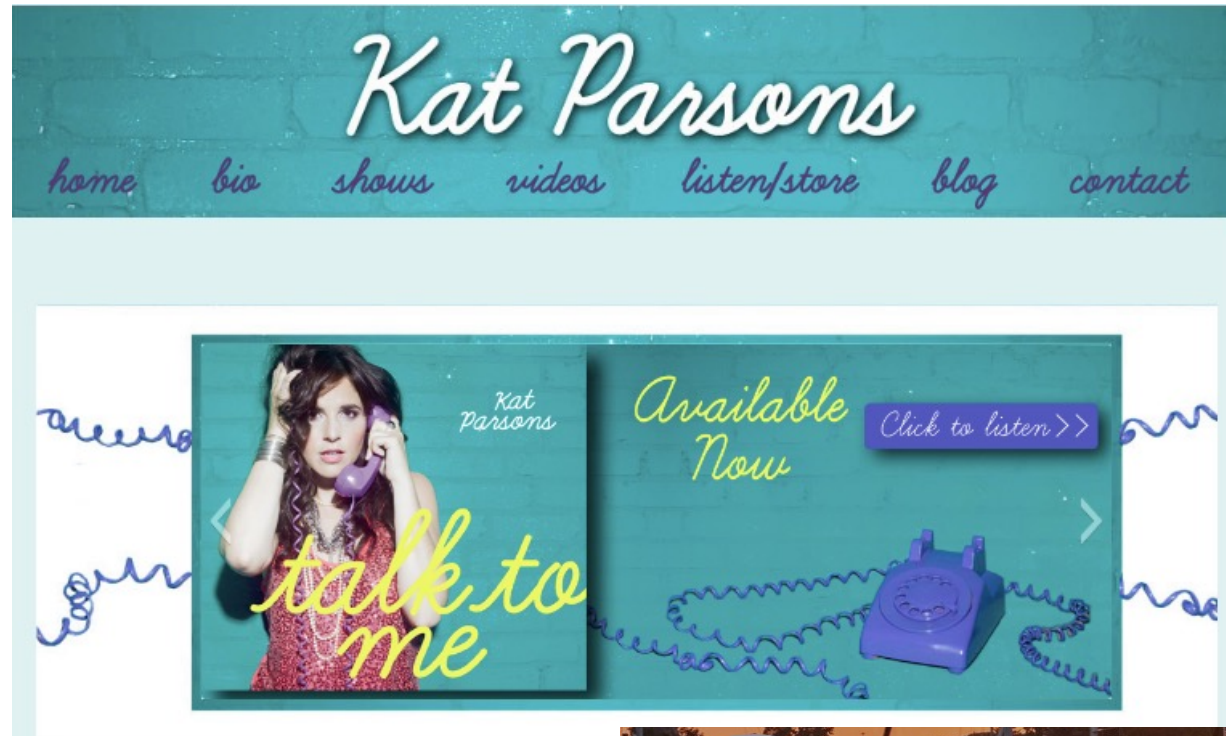
Active citizen science programs





# Acknowledgements:

## Singing by Kat Parsons (katparsons.com)



With assistance from:

