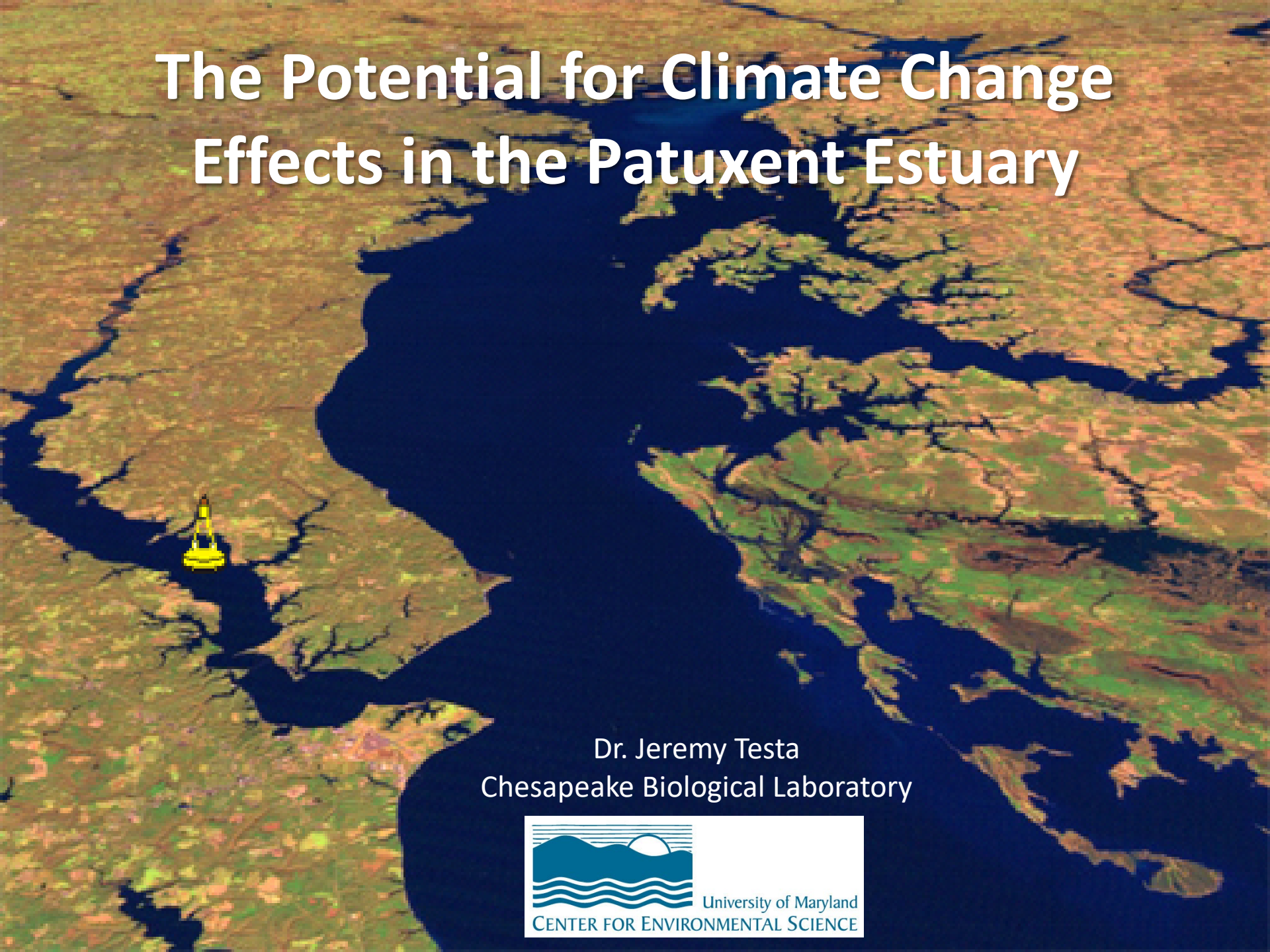
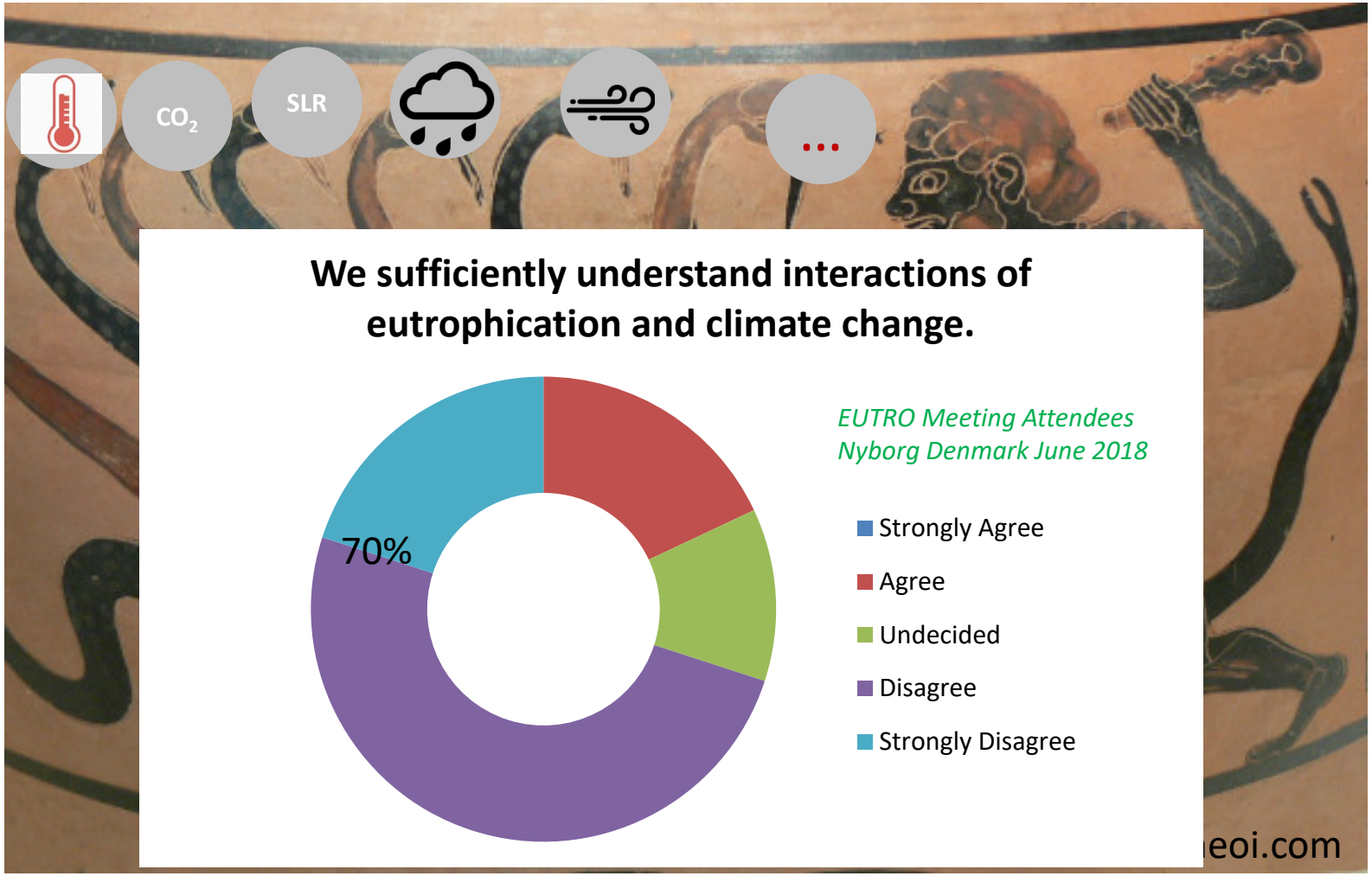
The Potential for Climate Change Effects in the Patuxent Estuary



Dr. Jeremy Testa
Chesapeake Biological Laboratory

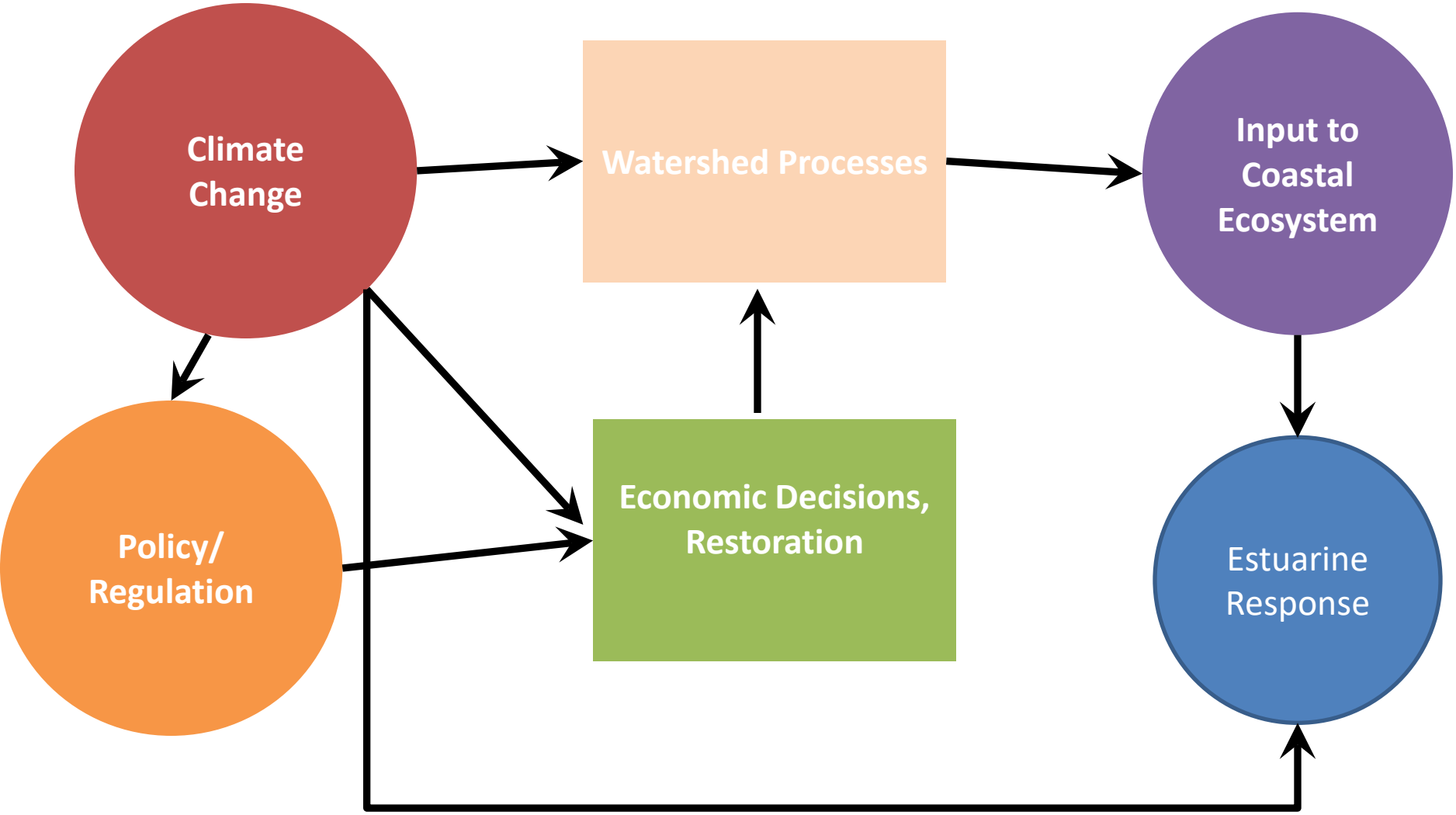
University of Maryland
Center for Environmental Science

The Complex Climate Future

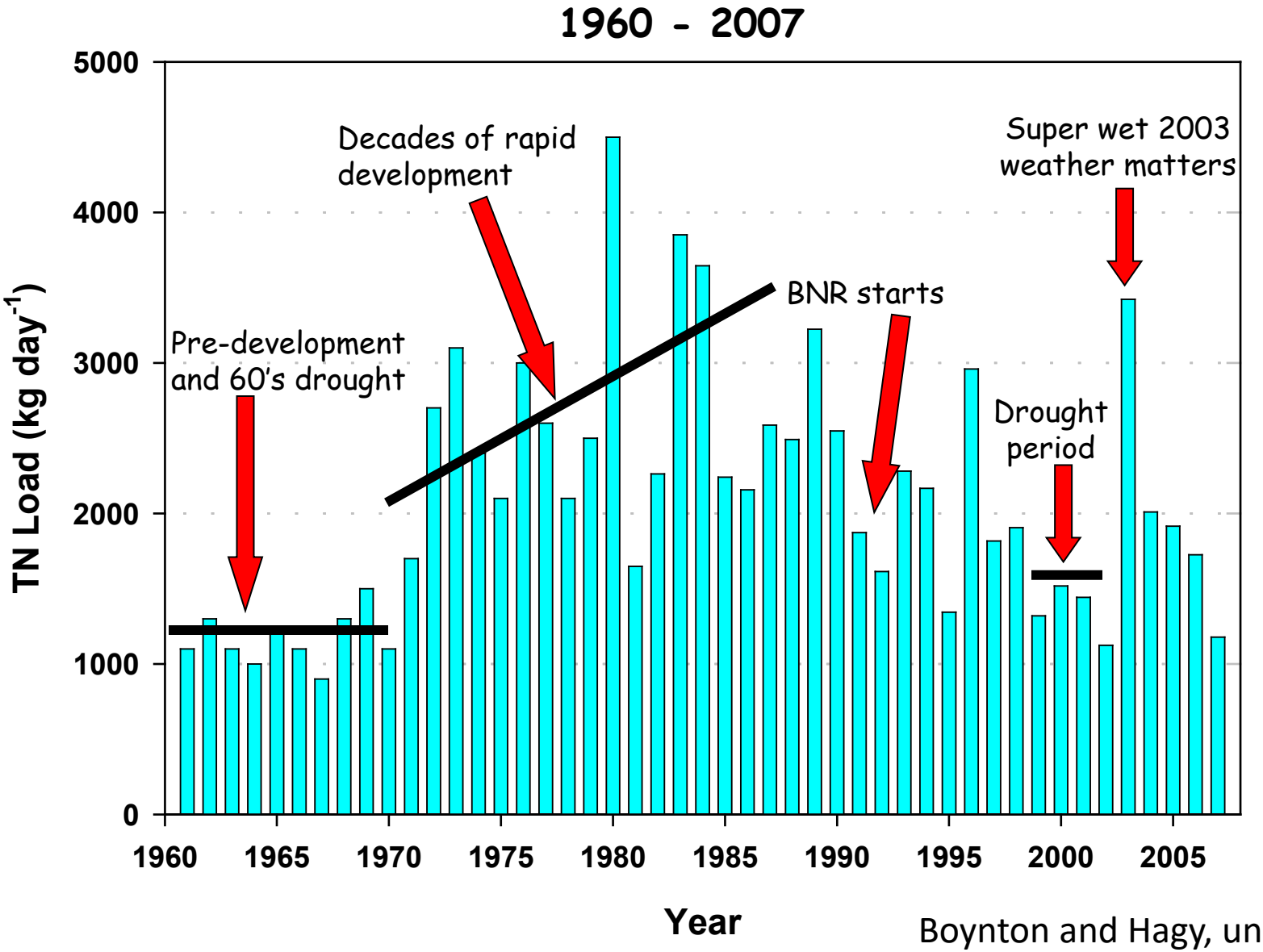


Future change will involve a complex stew of potential physical, chemical, and biological alterations

Estuarine Ecosystem Change in Response to Climate is ***both*** Direct, and Coupled



Aspects of Climate Drive Patuxent River Nitrogen Inputs



Boynton and Hagy, unpublished

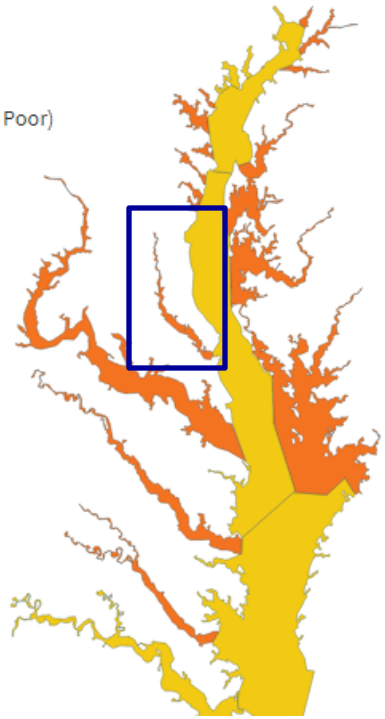
ECO HEALTH
REPORT CARDS

HOME BAY HEALTH WATERSHED HEALTH INDICATORS BAY REGIONS WATERSHED REGIONS ISSUES PUBLICATIONS TAKE ACTION ABOUT

Overall Health Index | Dissolved Oxygen | Nitrogen | Phosphorus | Chlorophyll a | Water Clarity | Aquatic Grasses | Benthic Community | Blue Crab | Bay Anchovy | Striped Bass

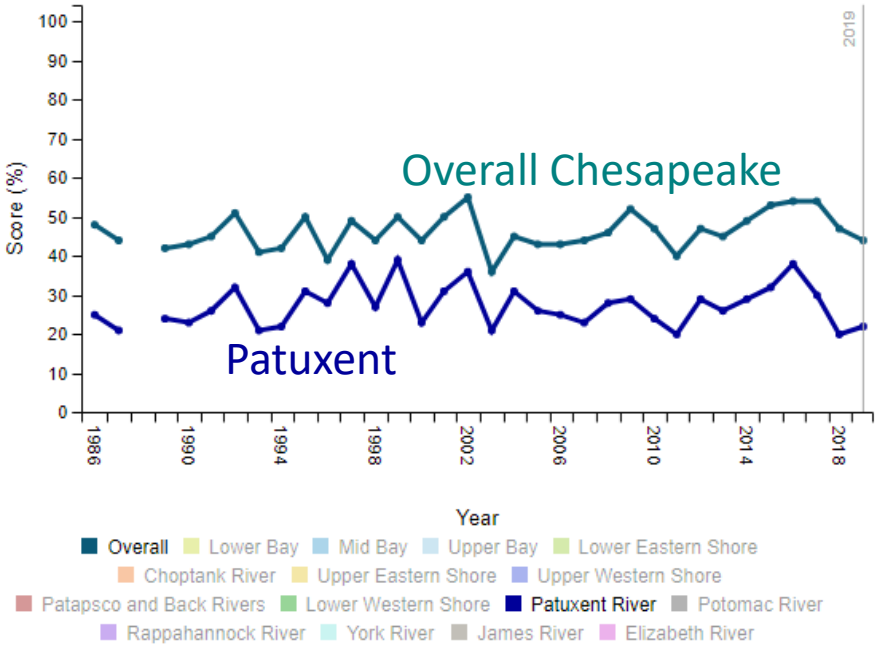
BY REGION | Overall

Scores (%)
- 80 to 100 (Very Good)
- 60 to <80
- 40 to <60
- 20 to <40
- 0 to <20 (Very Poor)
- Not Scored



Patuxent "Health" Lags Behind Other Regions

TRENDS | Overall



https://ecoreportcard.org/report-cards/chesapeake-bay/bay-health/

Climate Change and Estuaries

- Altered precipitation and river discharge

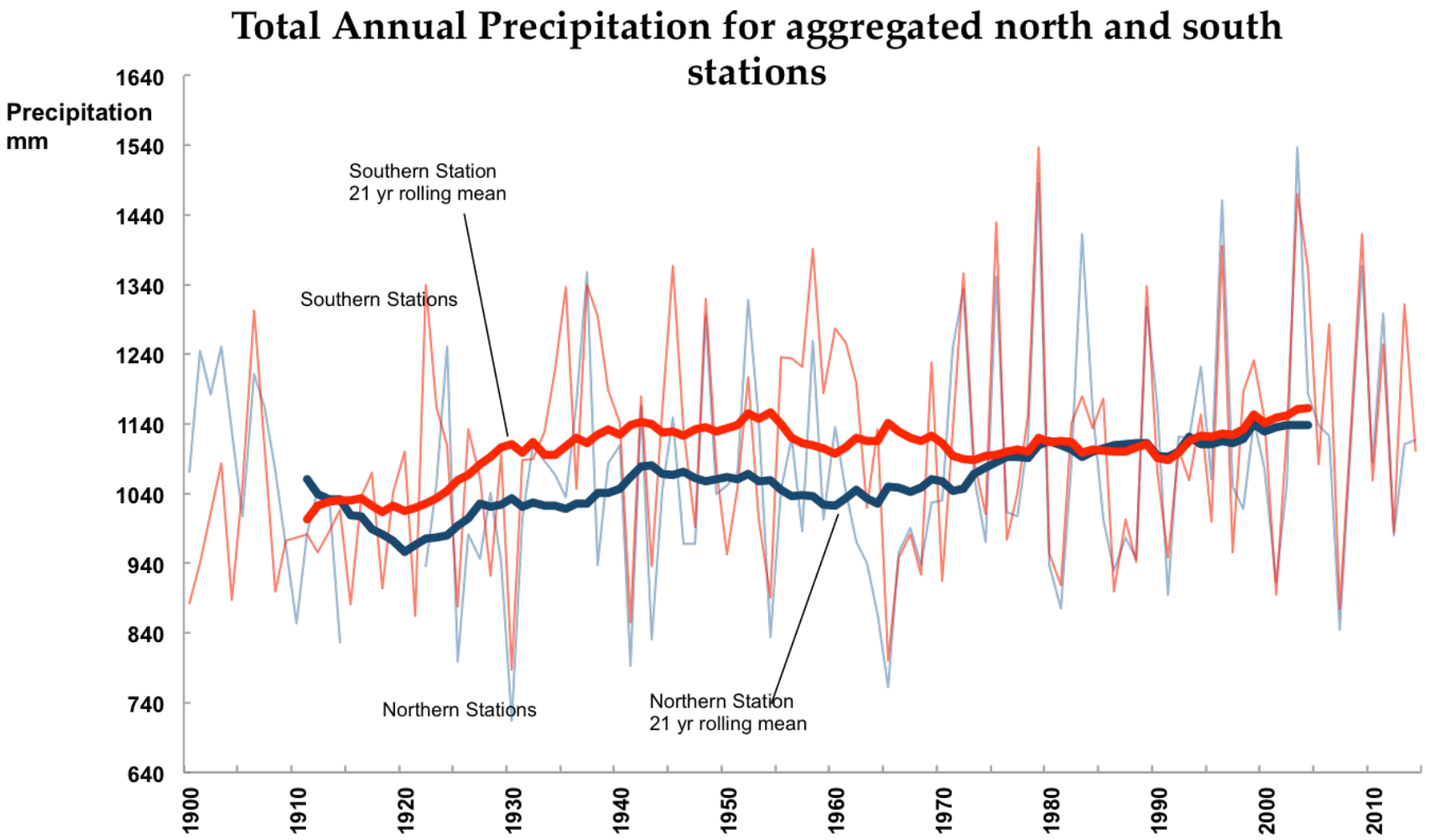
  - alters nutrient inputs, stratification, more flashy inputs?

- Warming

  - alters biogeochemical processes, reduces oxygen solubility, impacts habitat for organisms

- Sea level rise

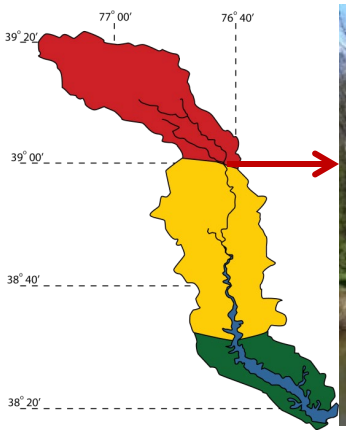
  - erosion (wetlands, former farms), more tidal mixing?, temperature effects

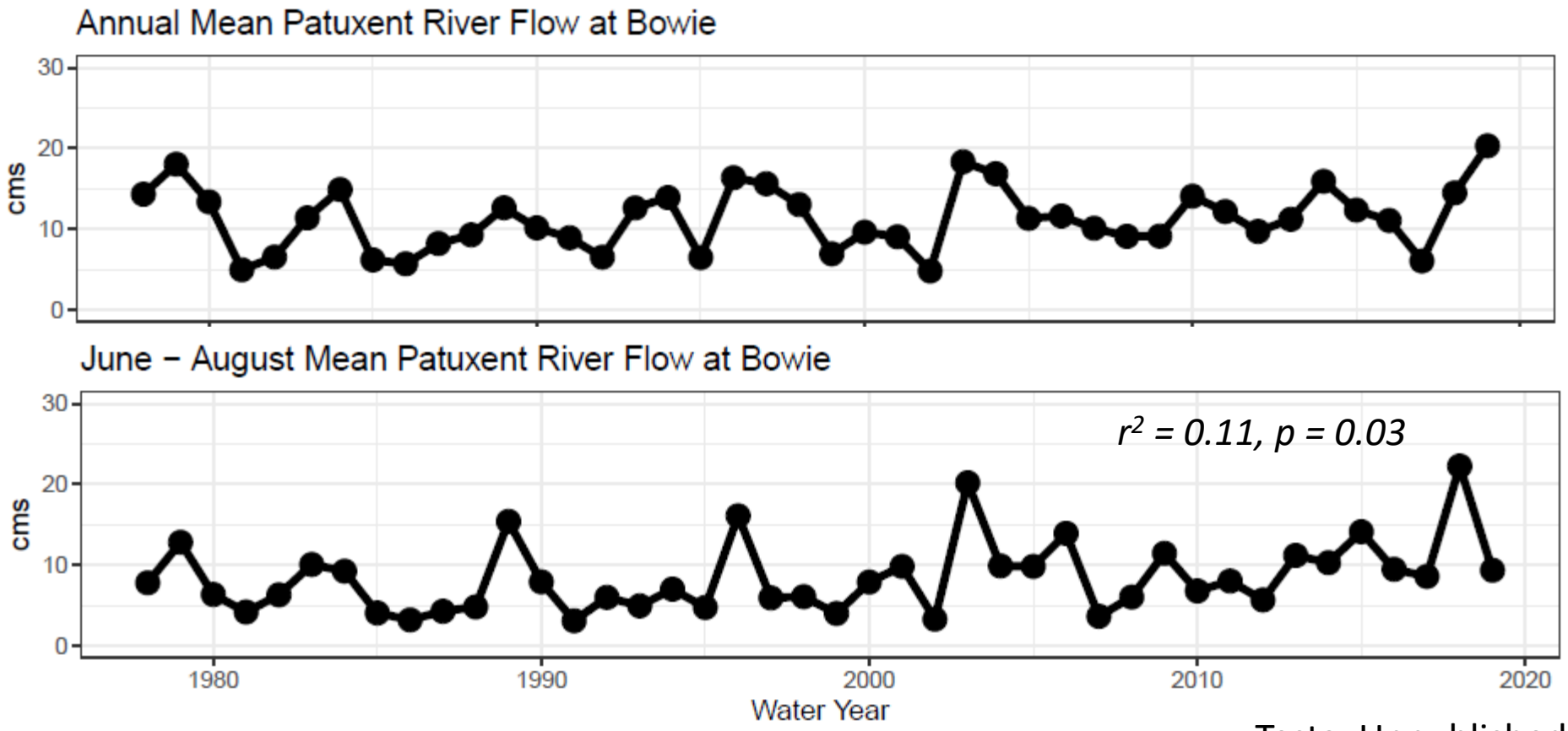


Historical annual precipitation has been increasing by 0.2 to 0.7 inches per decade.

Source: http://www.chesapeakedata.com/changingchesapeake/ ***Kari St. Laurent, DNERR***

Recent Changes in Patuxent River Discharge

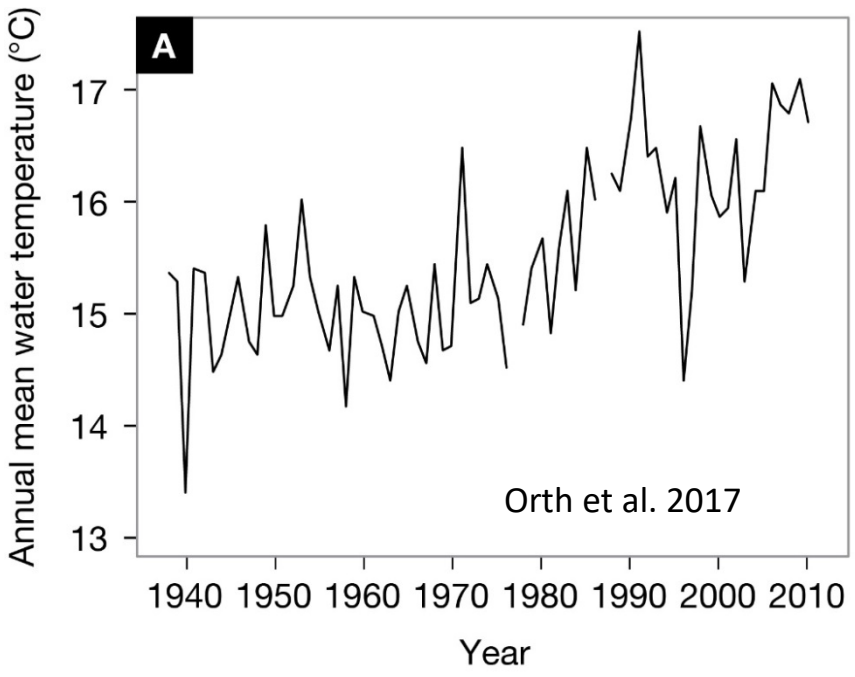




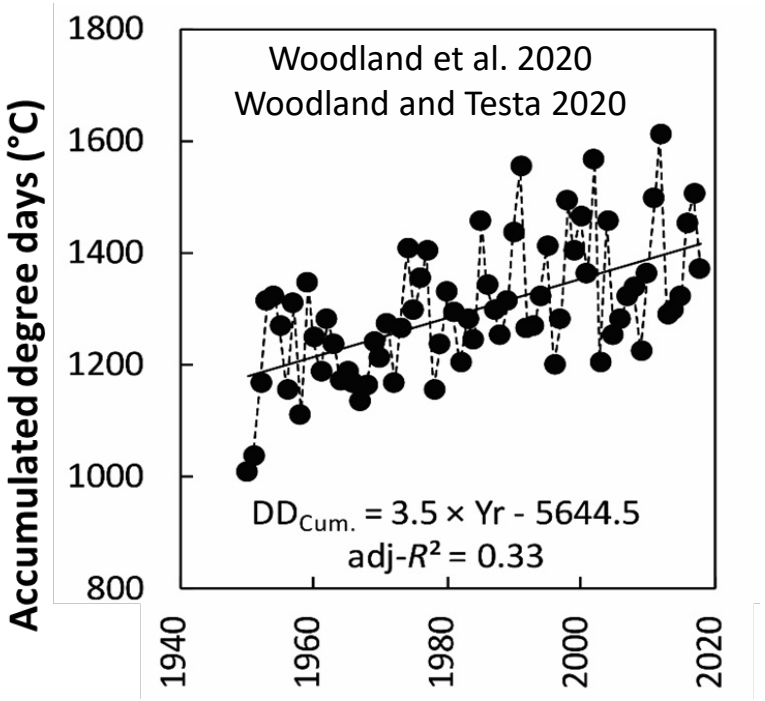
Testa, Unpublished

Climate change is warming the Patuxent River

Both the yearly average temperature…

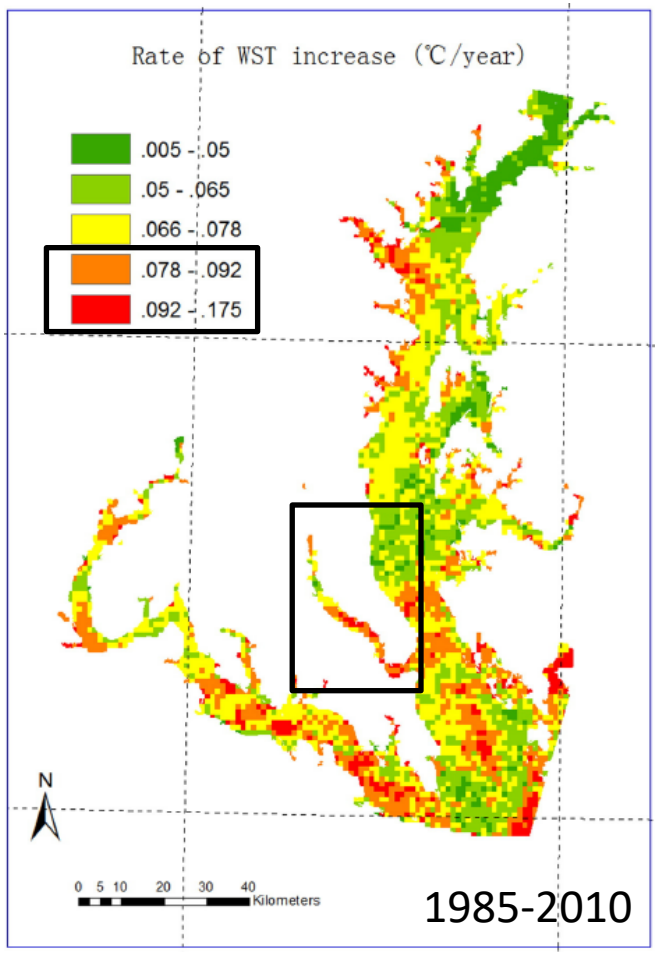


…and cumulative temperature

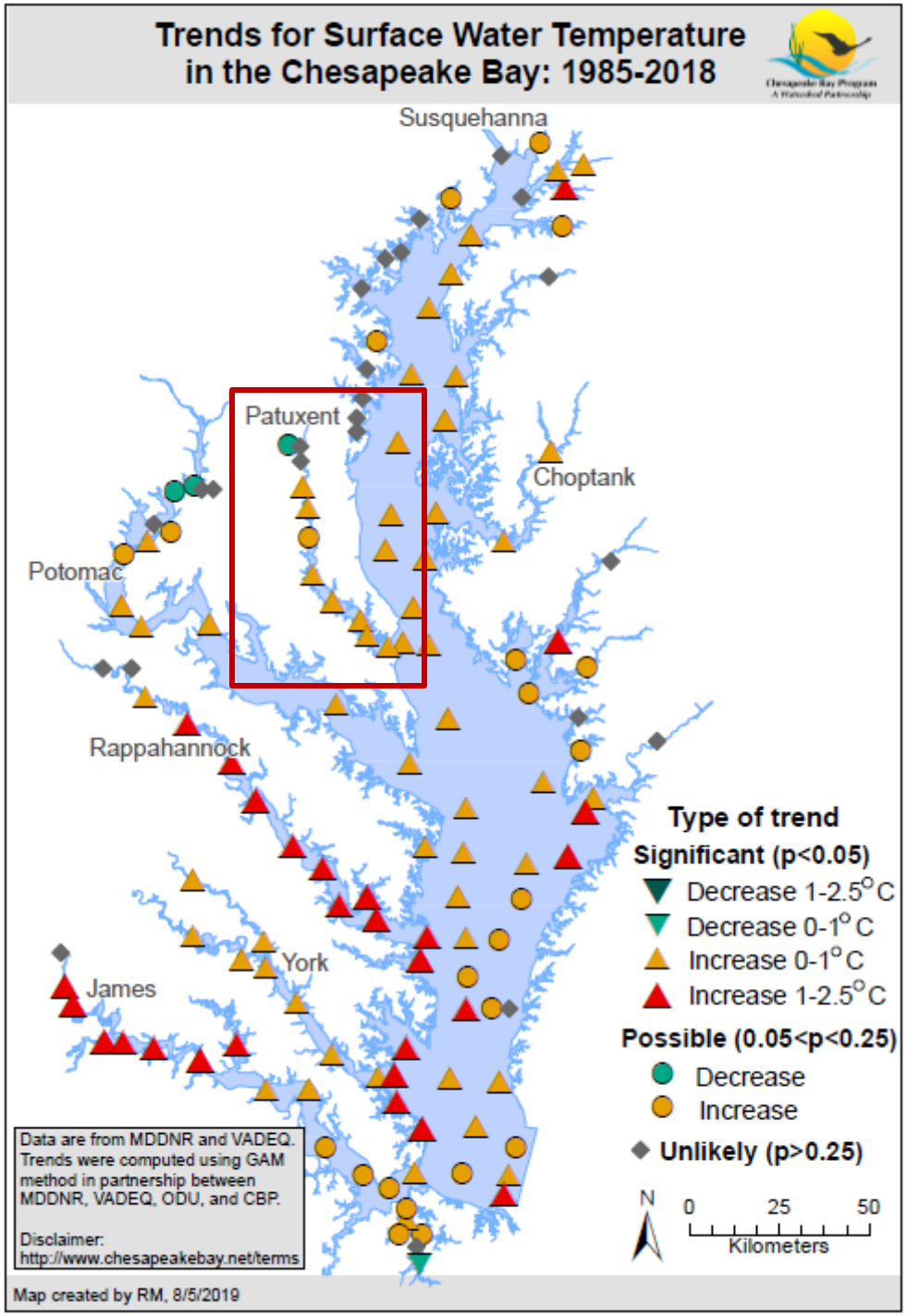


Climate change is warming the Patuxent River

- Increases over recent 30-35 yrs

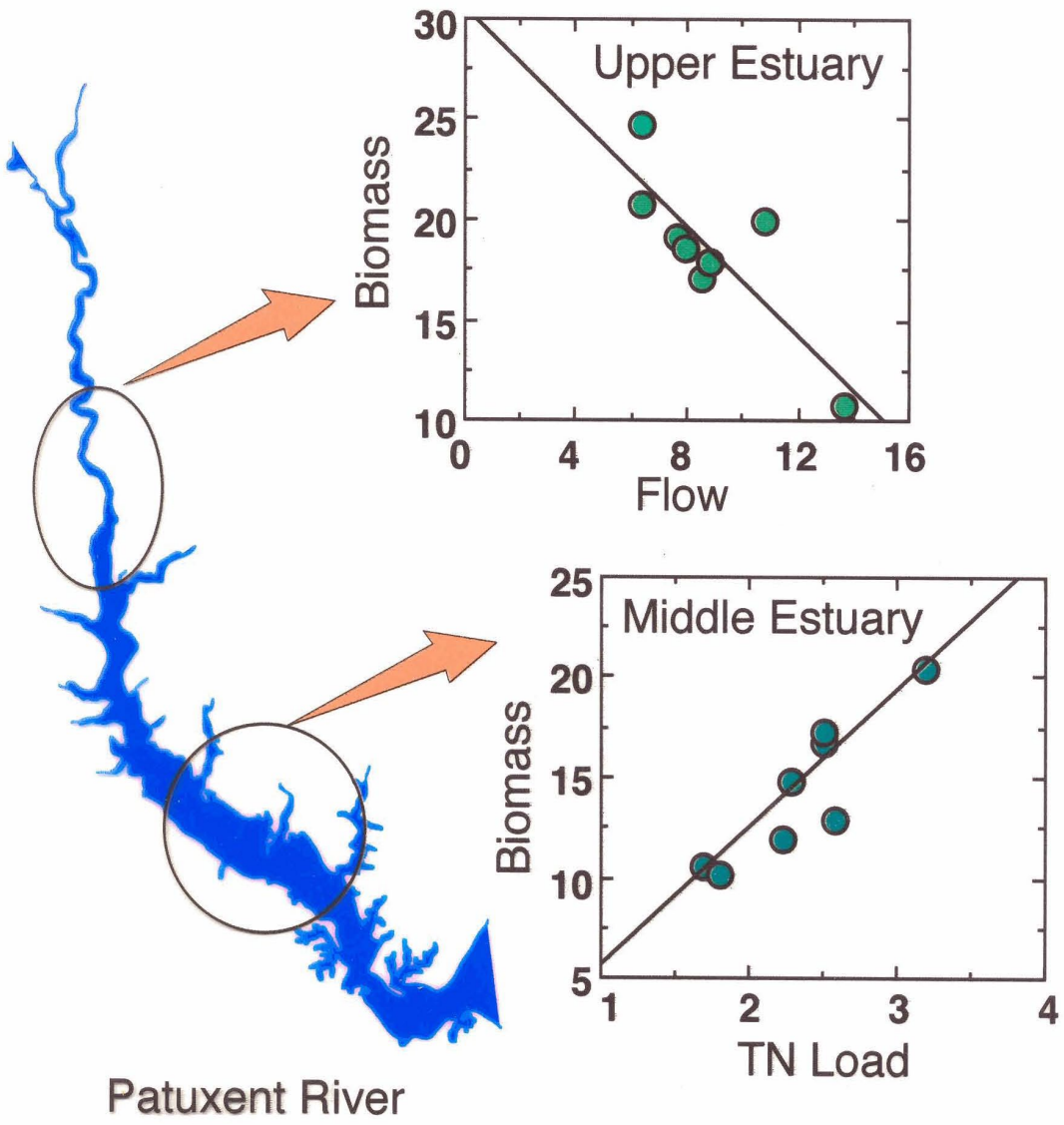


Ding and Elmore 2015



How Does the Patuxent Respond to Flow and Warming?

Algal Biomass vs. Flow or Load (1985-1992)

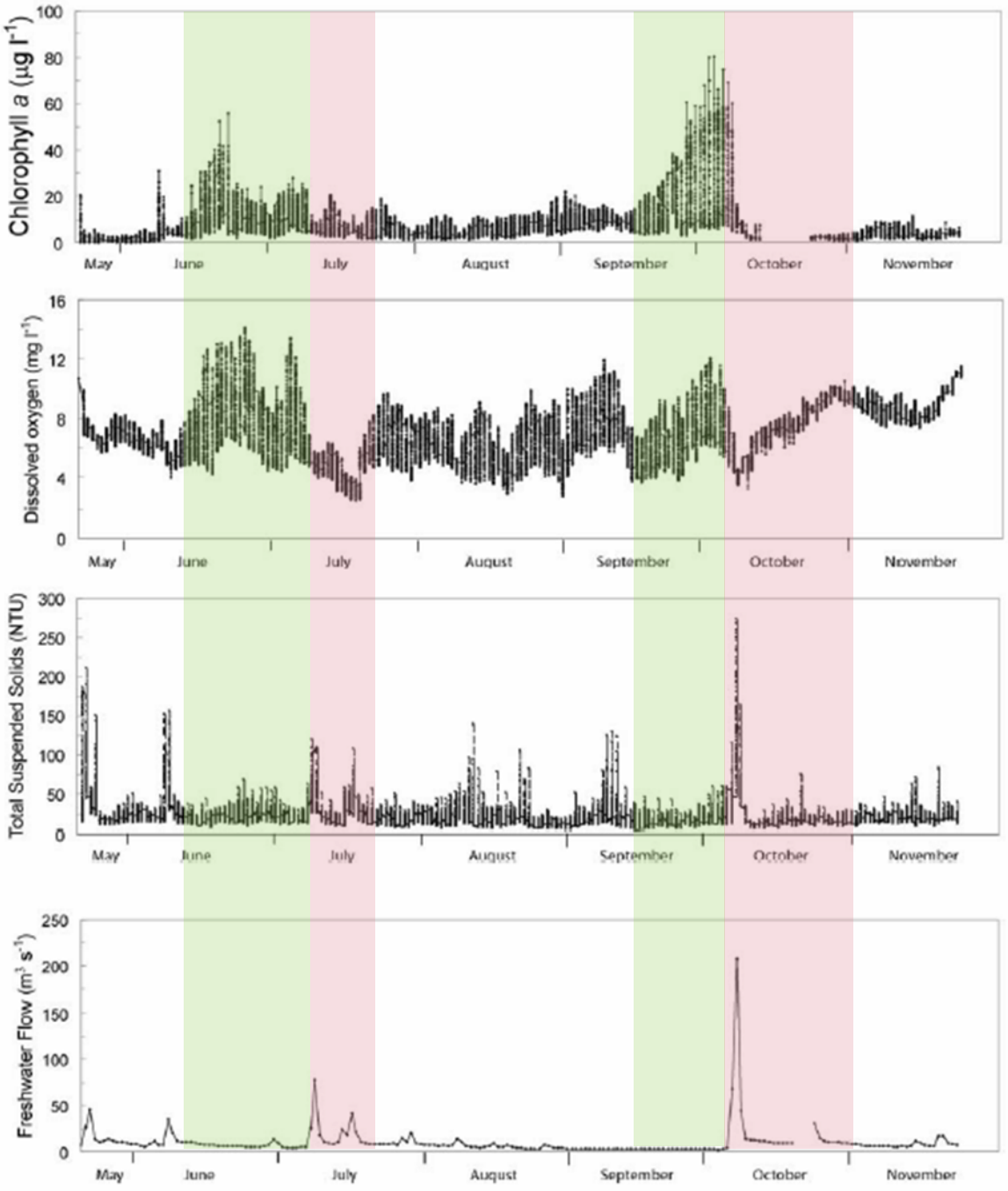


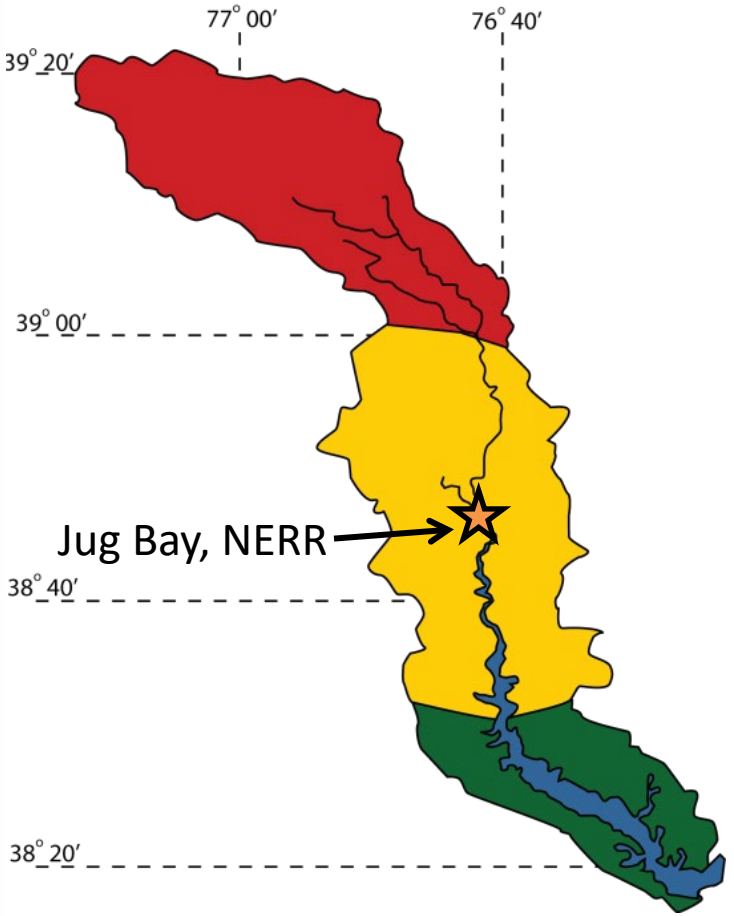
- In the upper Patuxent, more flow = less algae
  turbidity, flushing increase with flow

- Opposite us true in mid-estuary
  nutrient load increases with flow

Boynton et al. 2008

Flow effects are transient

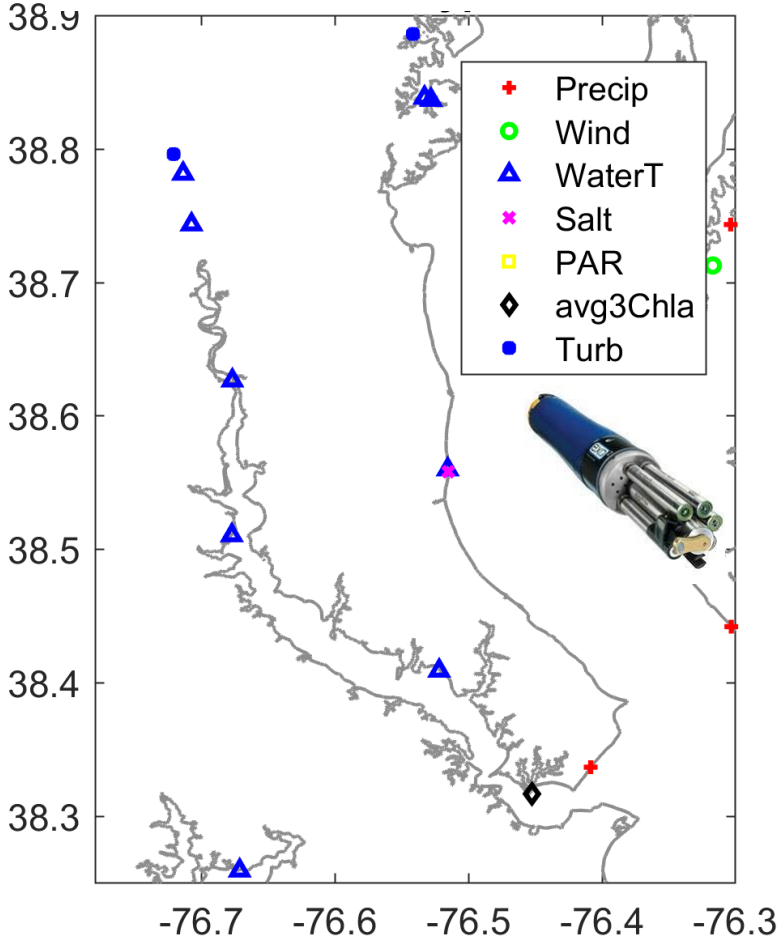




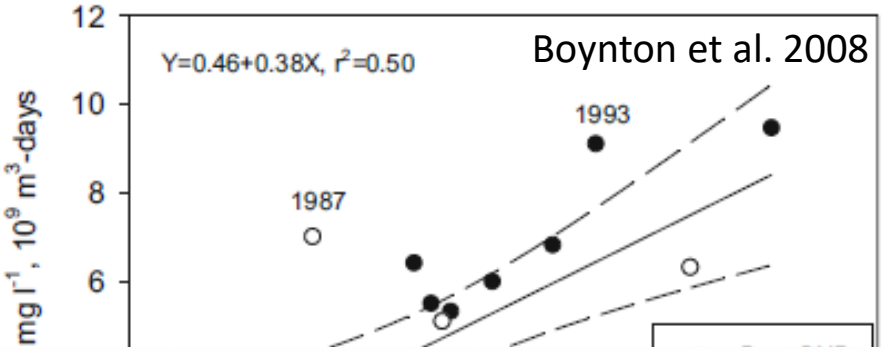
Testa, Unpublished

If the future is wetter and warmer, oxygen will be lower

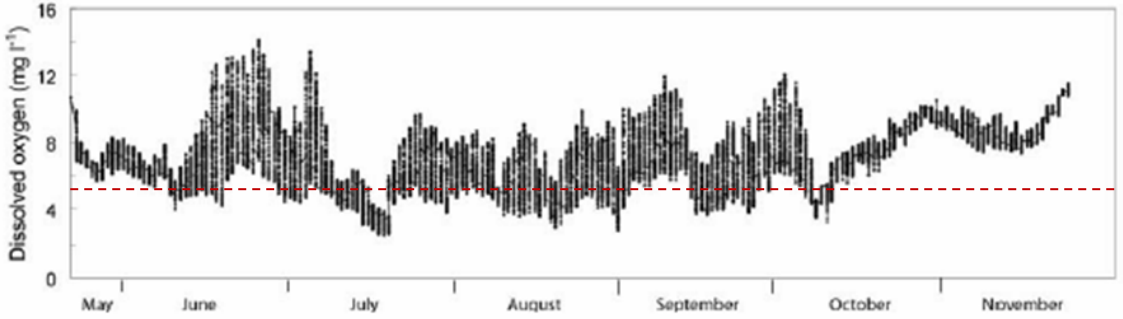
Primary Driver of Shallow Hypoxia

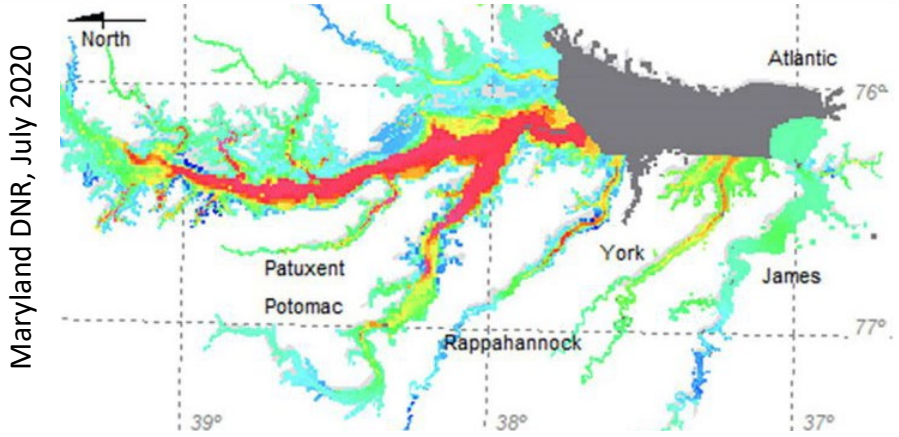


Liu, Testa, Brady Unpublished



Boynton et al. 2008





Maryland DNR, July 2020

What I Hope You Will Take Away From This Presentation

(1) Climate change is a factor across the coupled human-natural water system

(2) Expected climate changes are already evident in recent records

(3) Because the Patuxent is a complex estuary with diverse habitats, no one simple conceptual model of climate effects may fit

(4) A warmer, wetter future will put additional pressure on the Patuxent restoration, like most Bay regions

(5) We can make reasonable predictions of how physical properties, will change, but biological change is much more complicated

Thank You