

Thomas Miller
Chesapeake Biological Laboratory

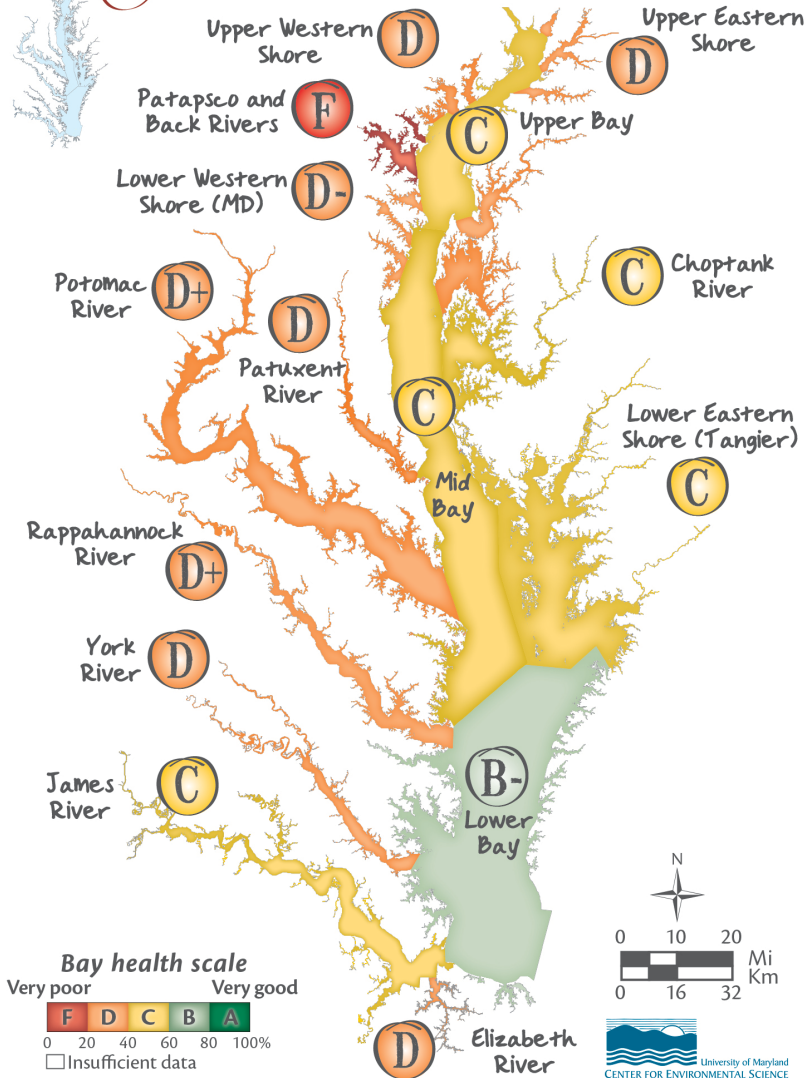
Chesapeake Bay Futures

Chesapeake Bay report card

Bay Health Index 2012

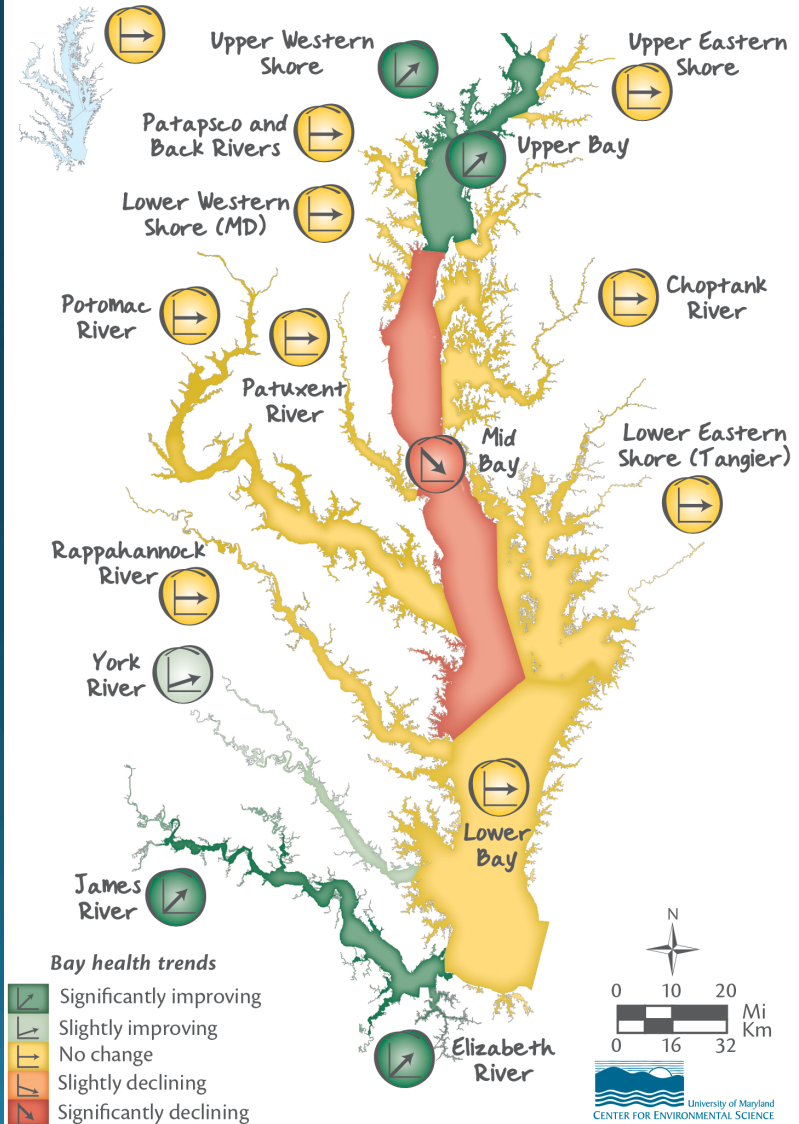
Overall score:

C

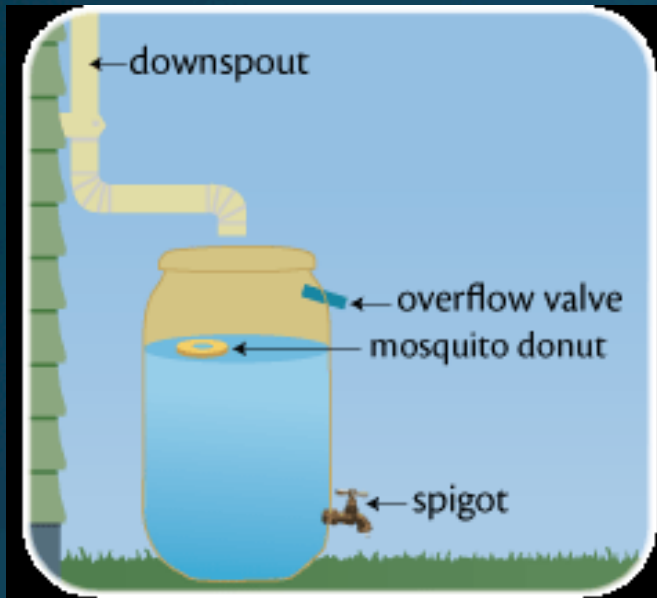


Bay Health Trends 2012

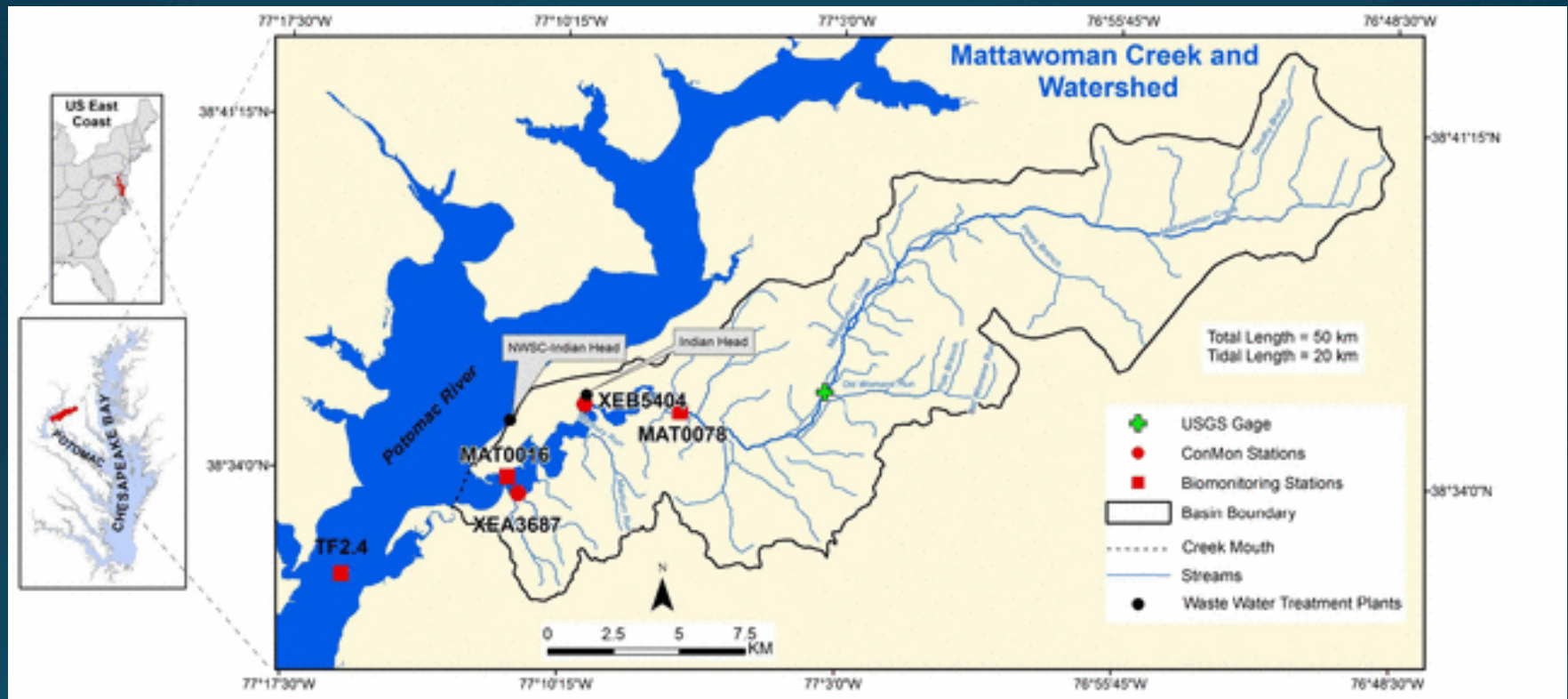
Overall trajectory:



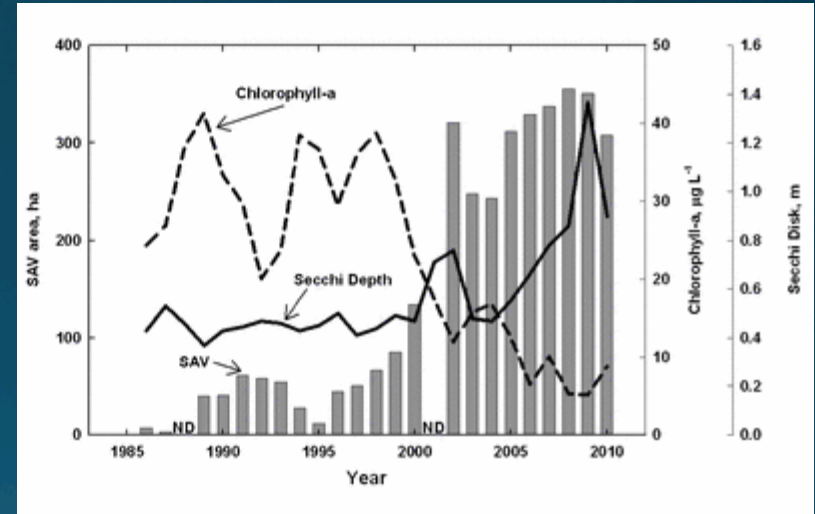
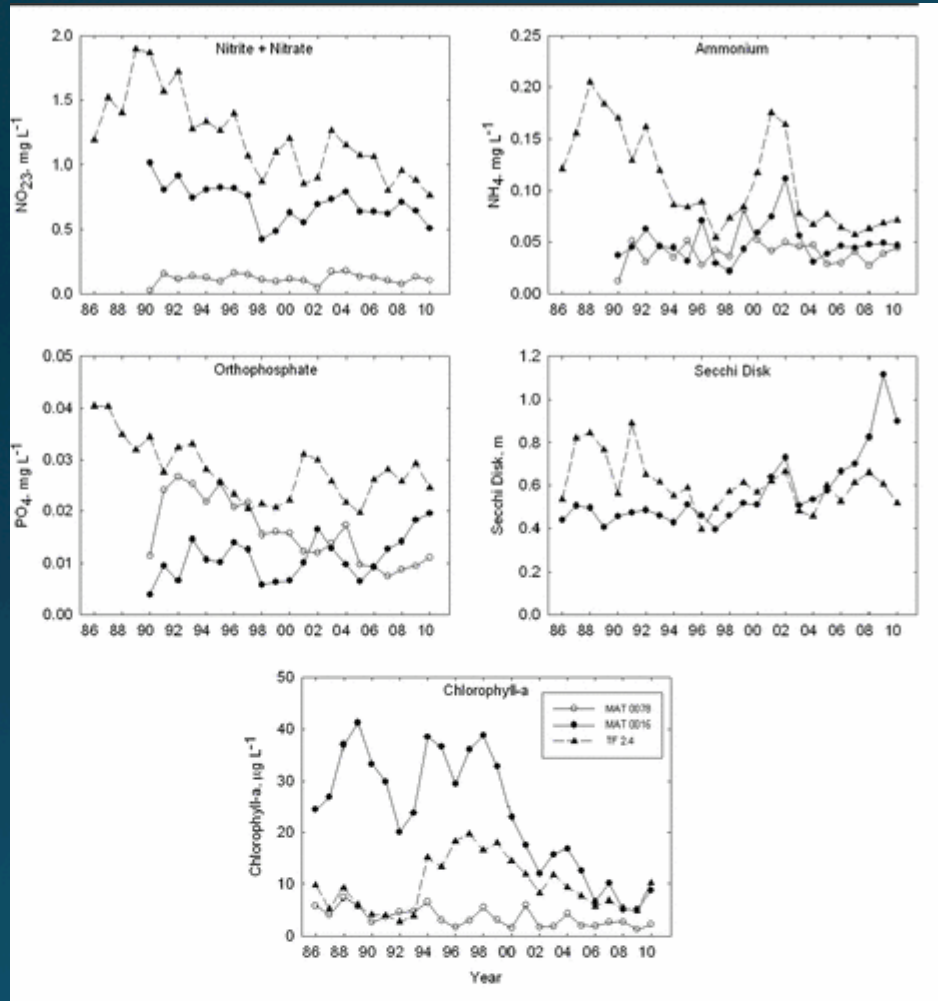
Act locally, think globally



Chesapeake Bay in Miniature

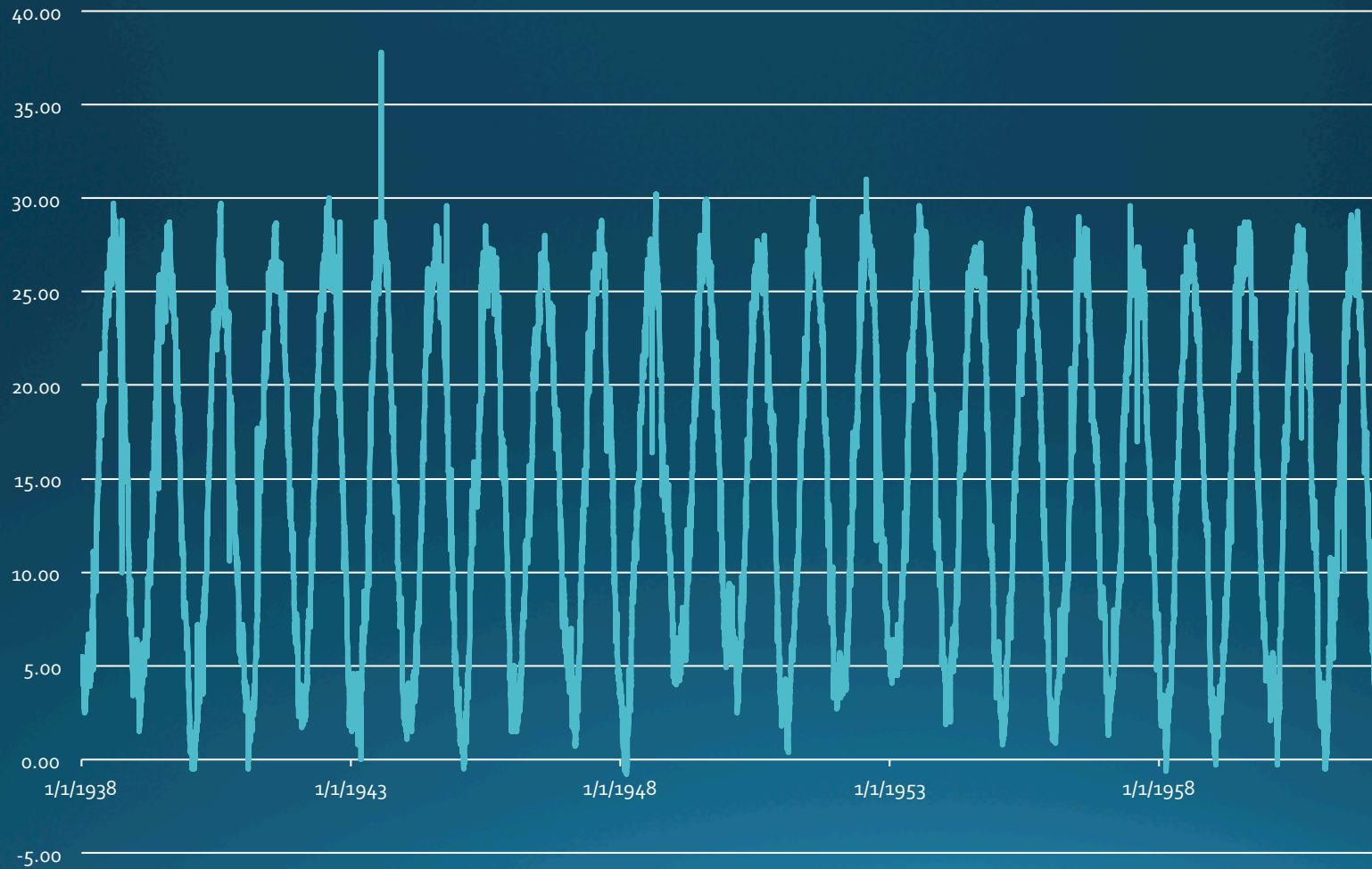


Decadal responses



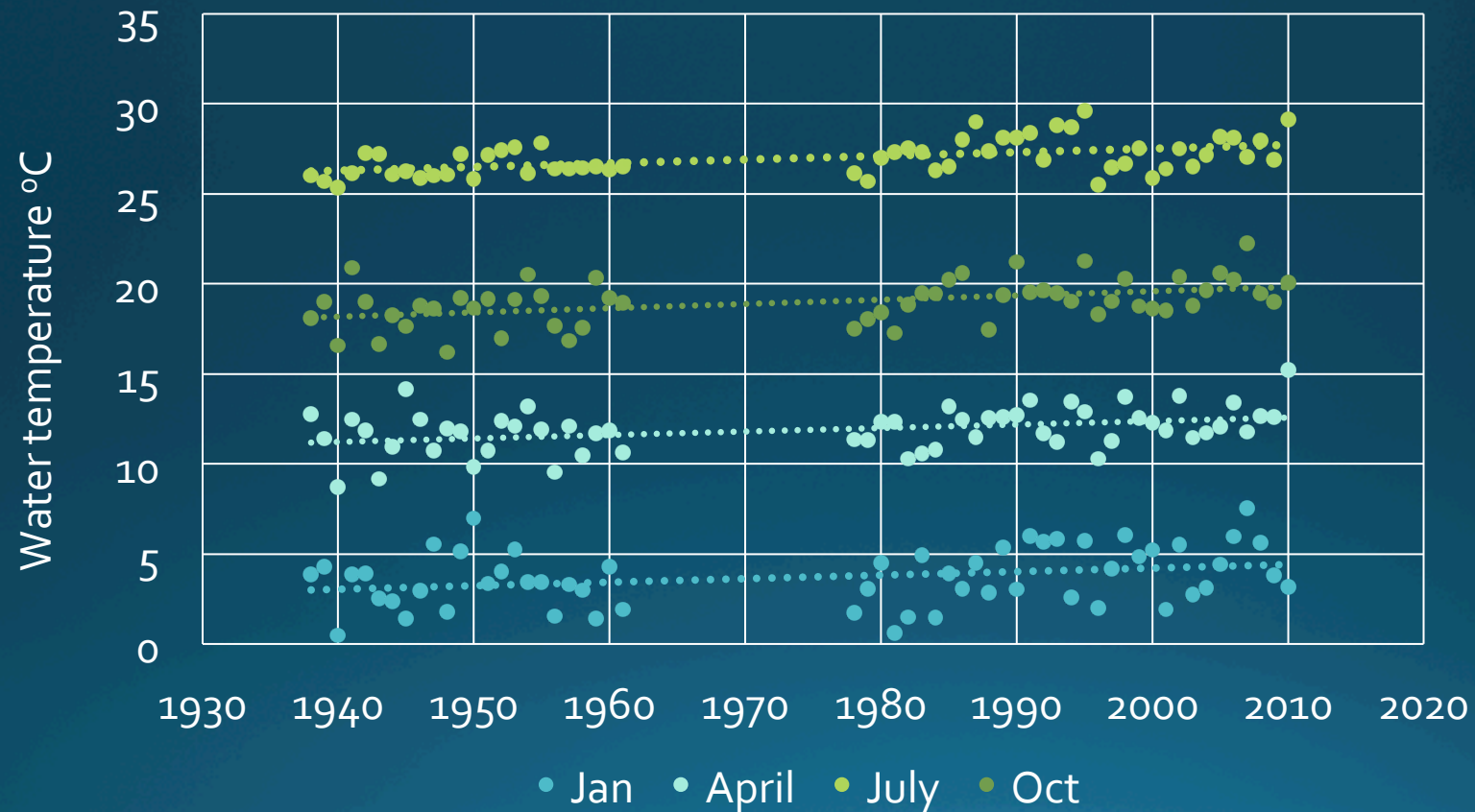
Chesapeake Bay Temperature

WaterTempC



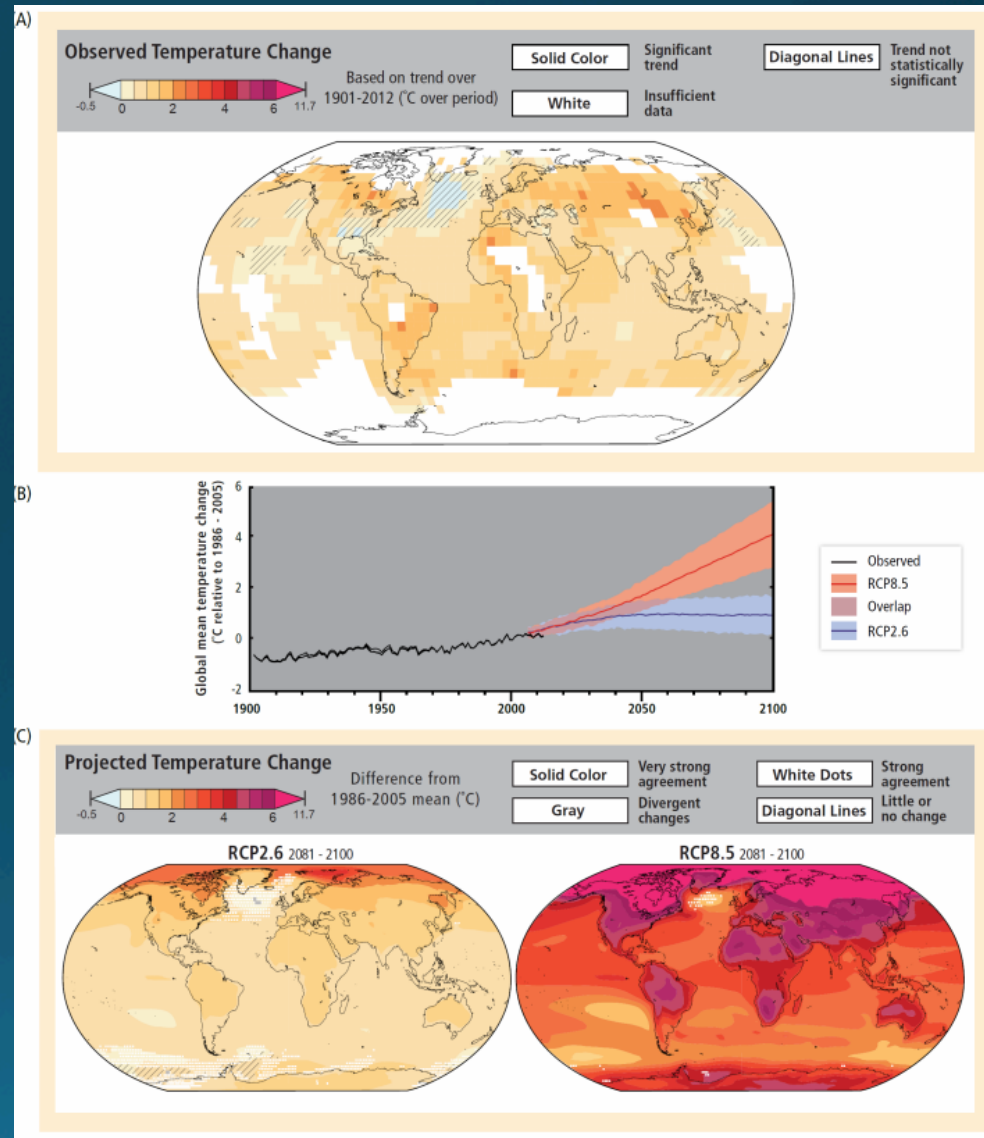
Global change in the Chesapeake

CBL Monthly Average Temperatures

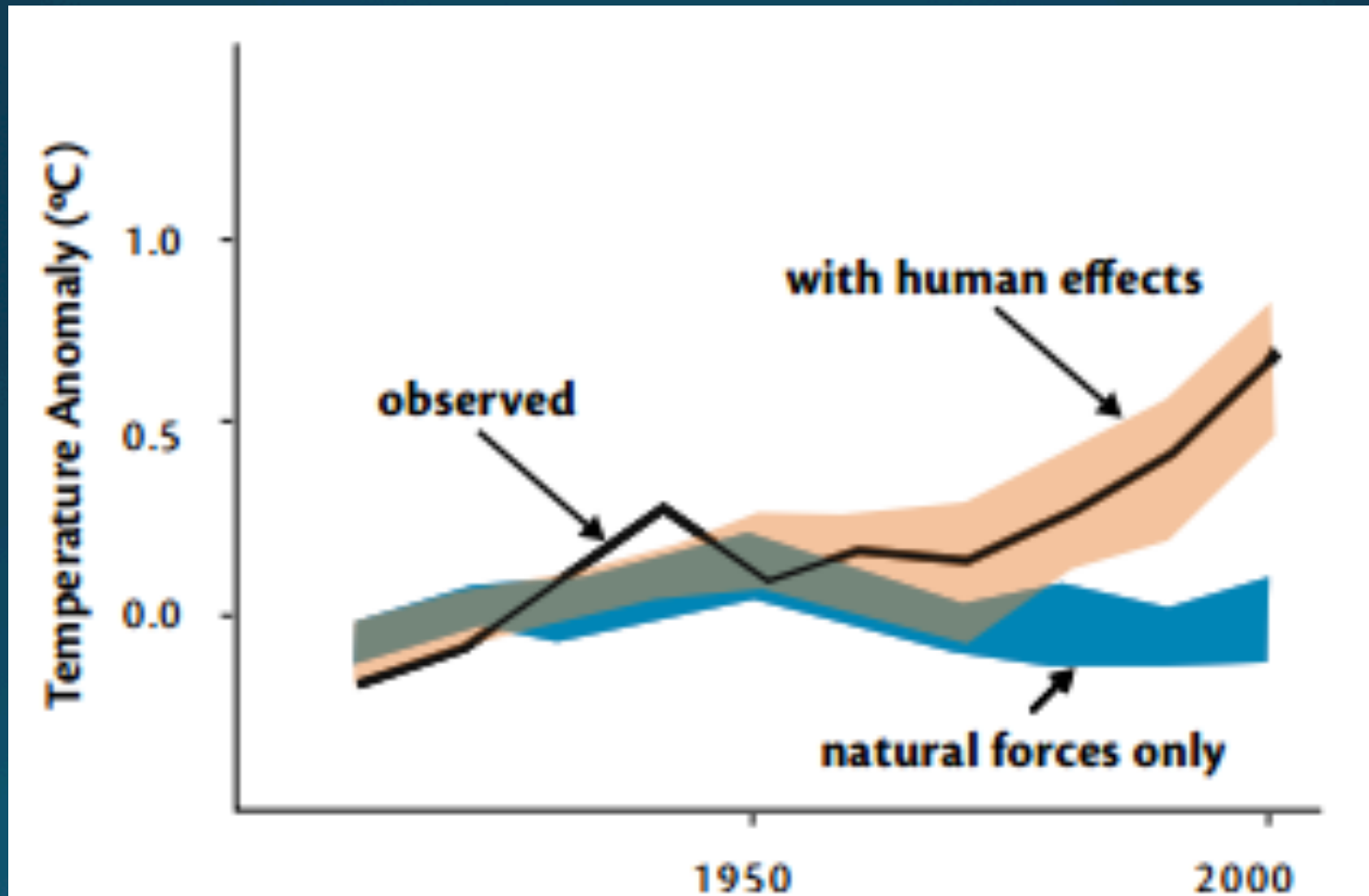


Global Climate Change

- Since 1900, in areas where we have data, temperatures have increased by about 1-3 °C.
- No regions have seen a decline in temperature
- By 2100
 - most conservative projections suggest a 2-4 °C increase
 - Most liberal projections suggest at 5-12 °C increase

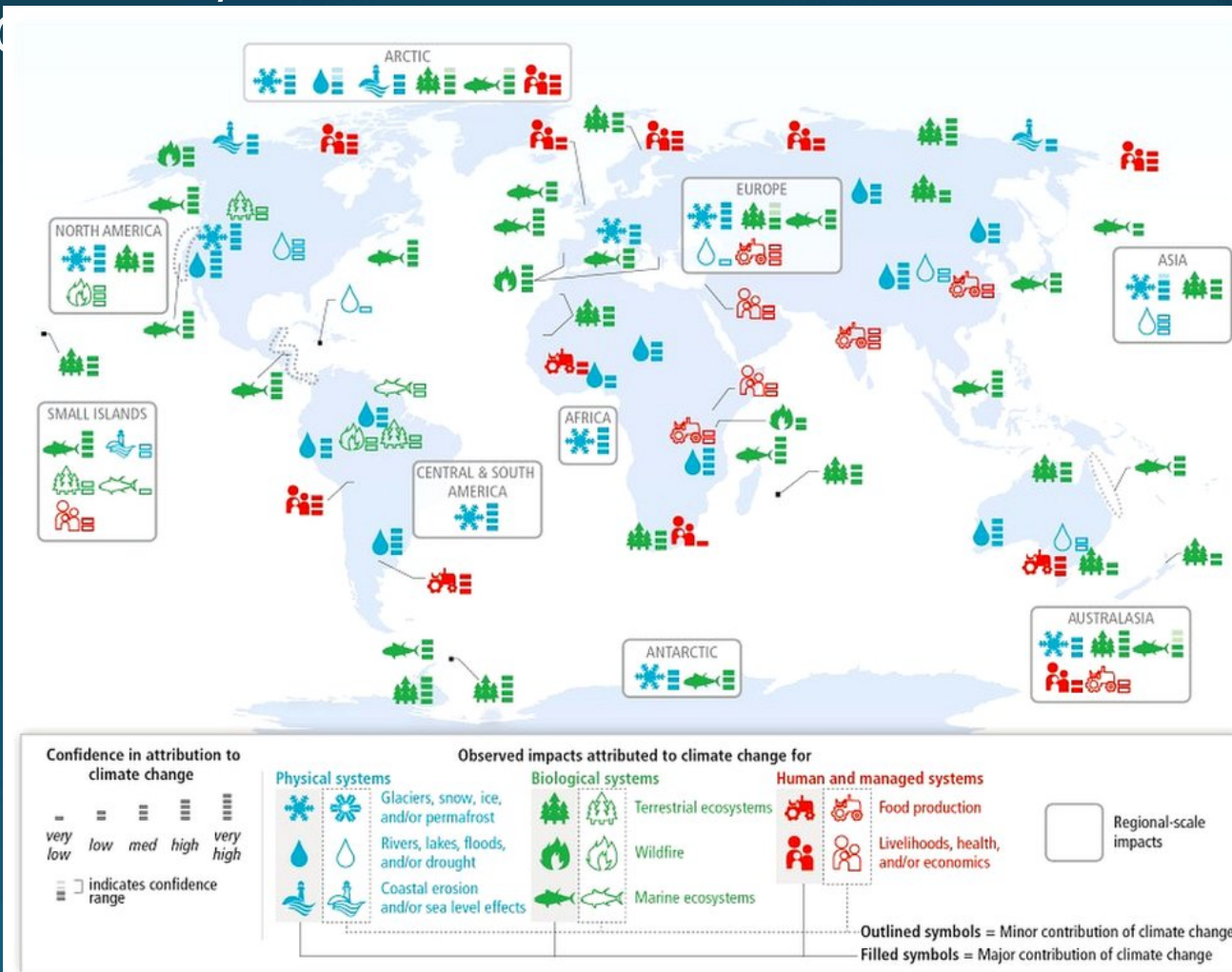


Human causation?



“Severe, pervasive and irreversible”

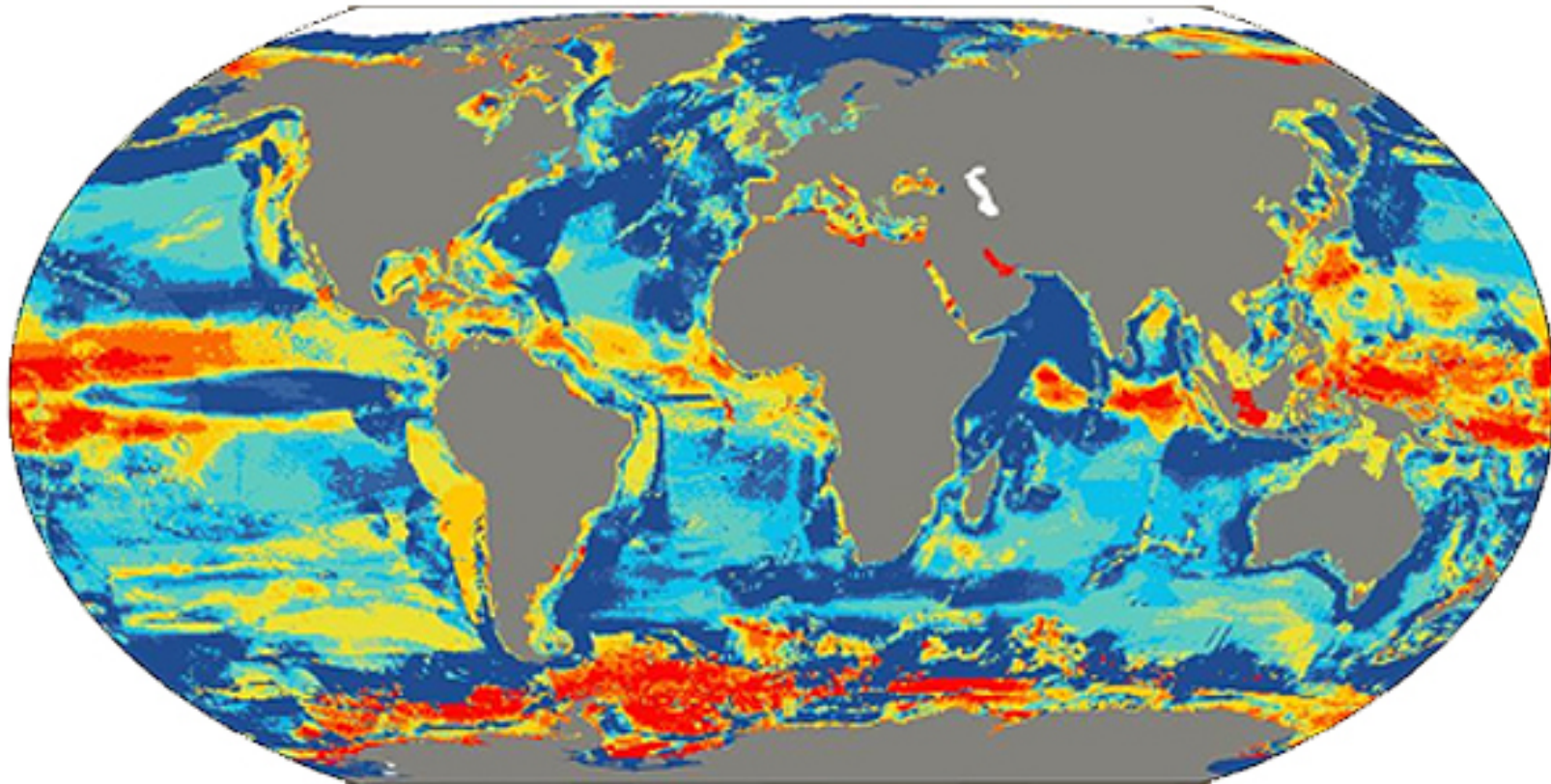
- “In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the ocean” (IPCC)



Fisheries catch by 2060

Estimated change in maximum fish catch by 2060

Compares 10 yr average 2001-2010 to projection of 2051-60



Source: IPCC

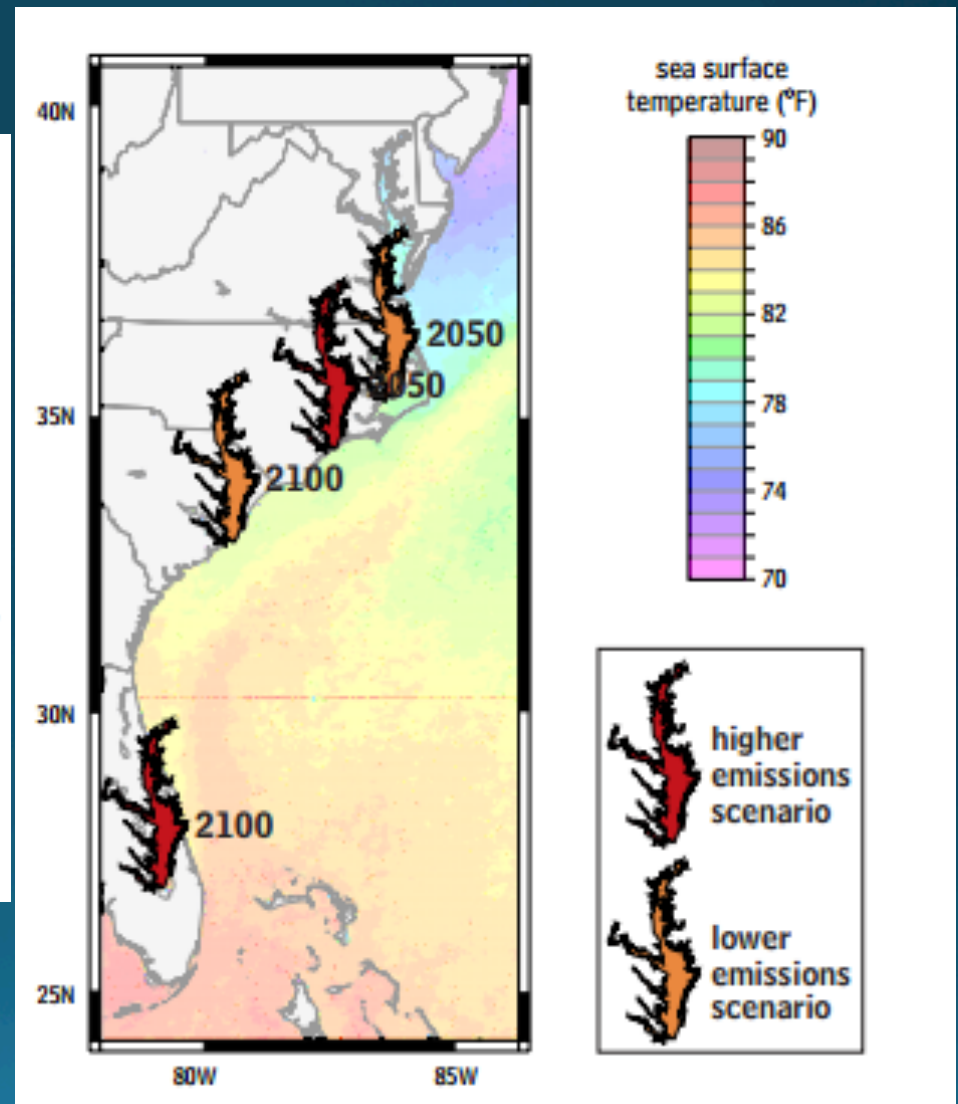
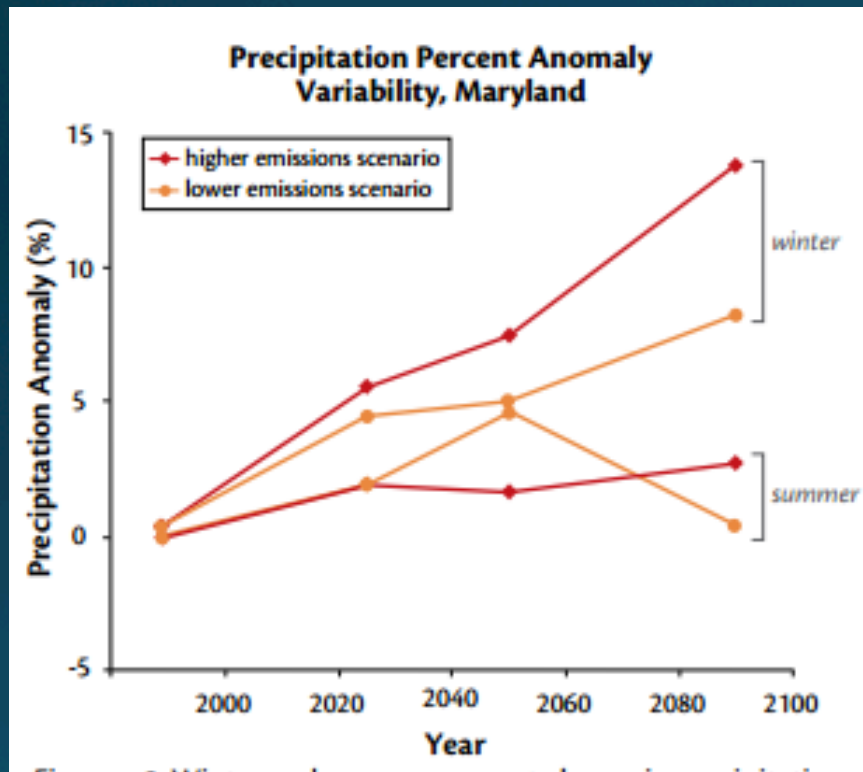
Policy responses

“Unless we act dramatically and quickly, science tells us our climate and our way of life are literally in jeopardy. Denial of the science is malpractice.”

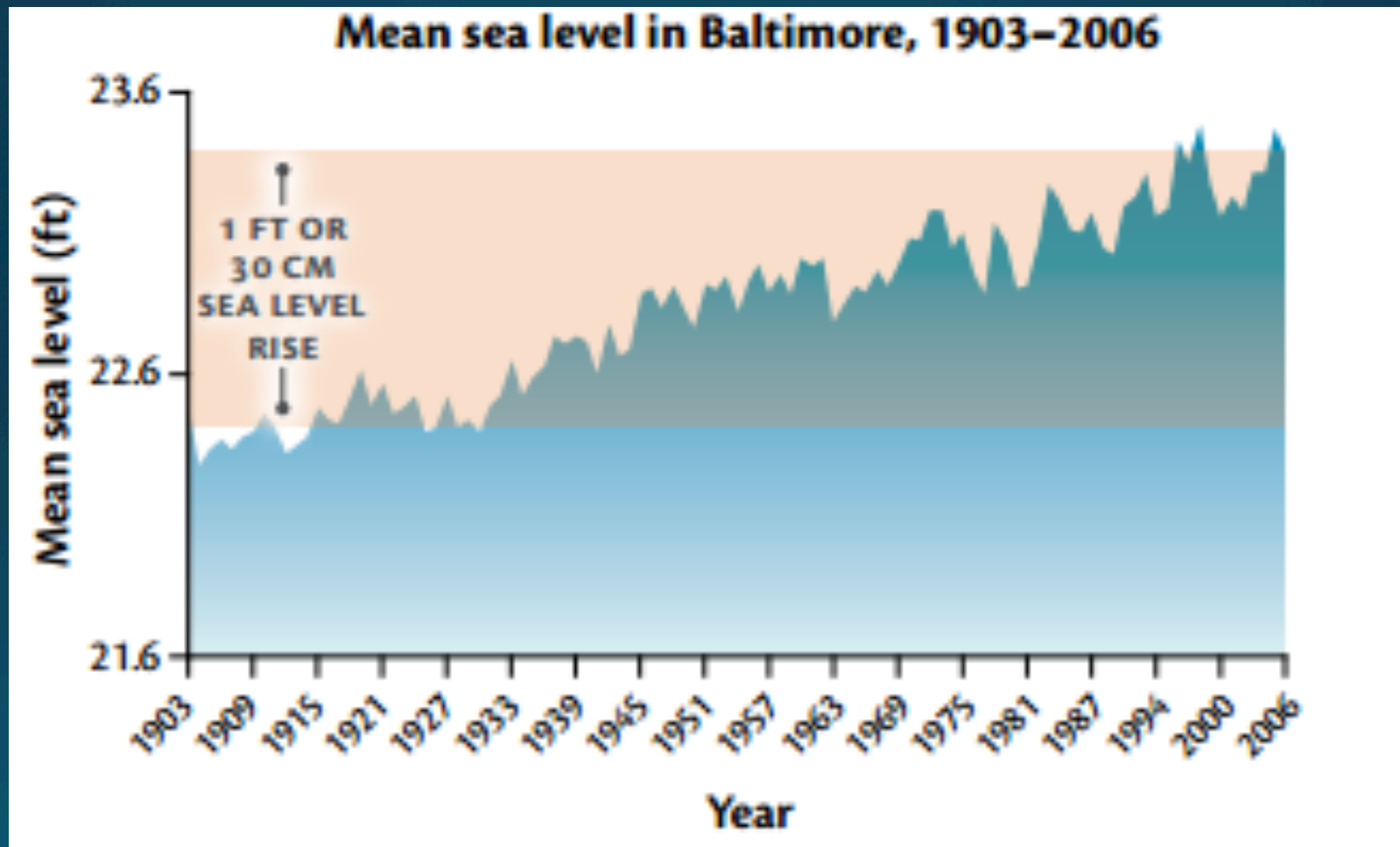
“There are those who say we can't afford to act. But waiting is truly unaffordable. The costs of inaction are catastrophic.”

John Kerry, 3/31/2014

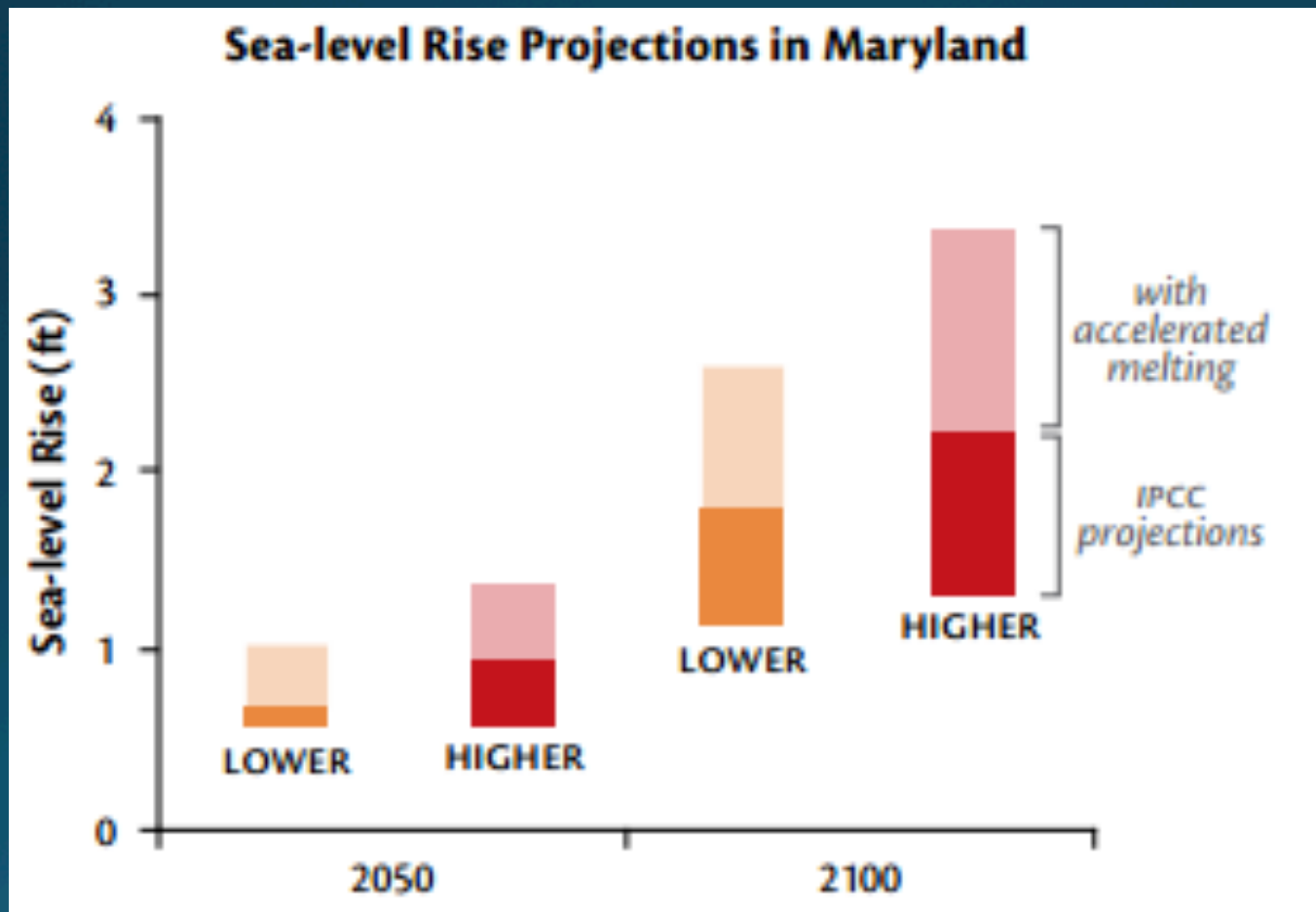
So what about the Chesapeake



Sea level rise

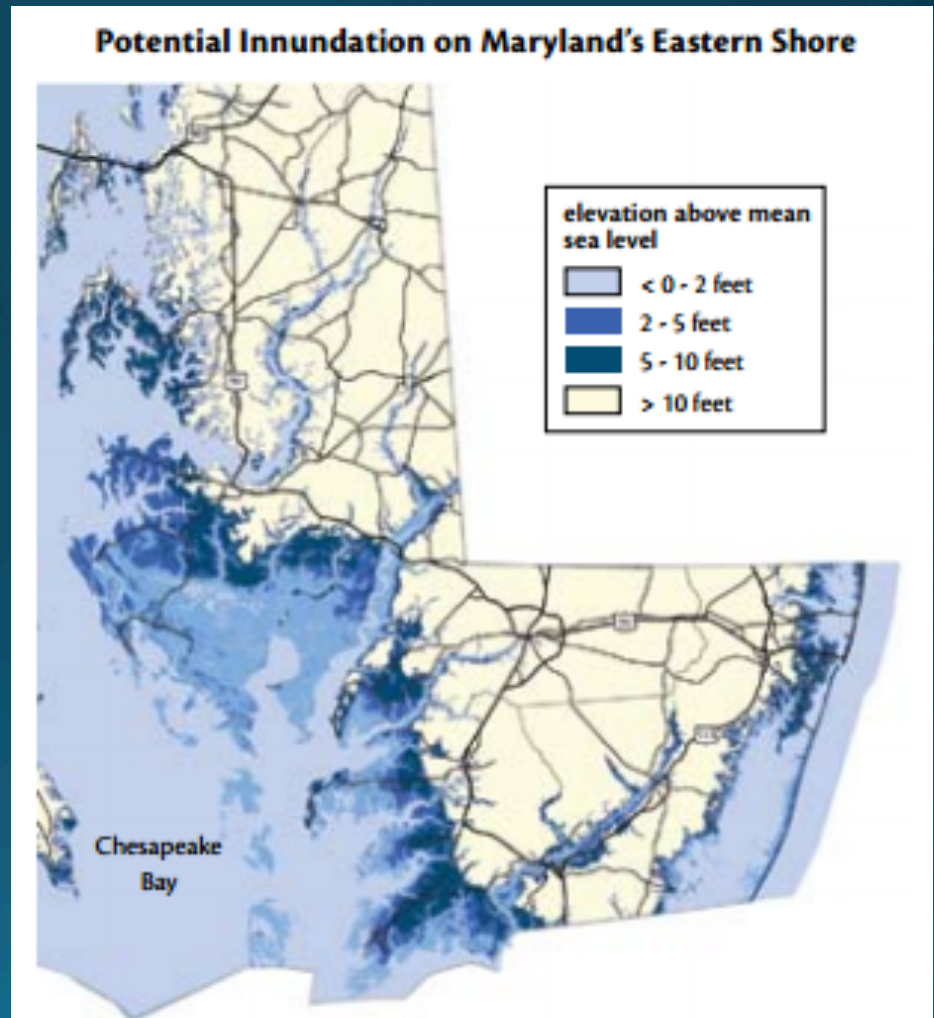


Future sea level change

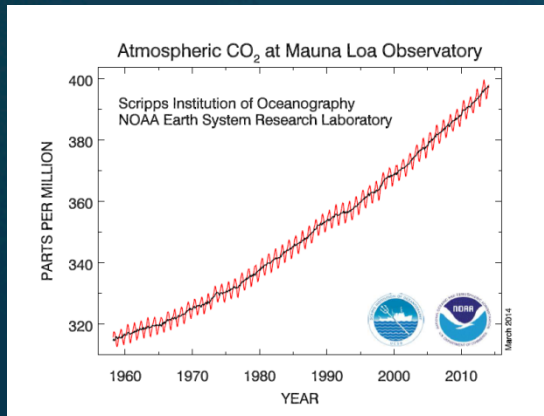


Is 2-5' a big deal?

- A large fraction of coastal CB is less than 5 above sea level
- Significant impacts locally
 - (CBL is 8ft about sea level)
- Marshland provides important buffer to storm surge



Ocean Acidification



pH in the Chesapeake Bay

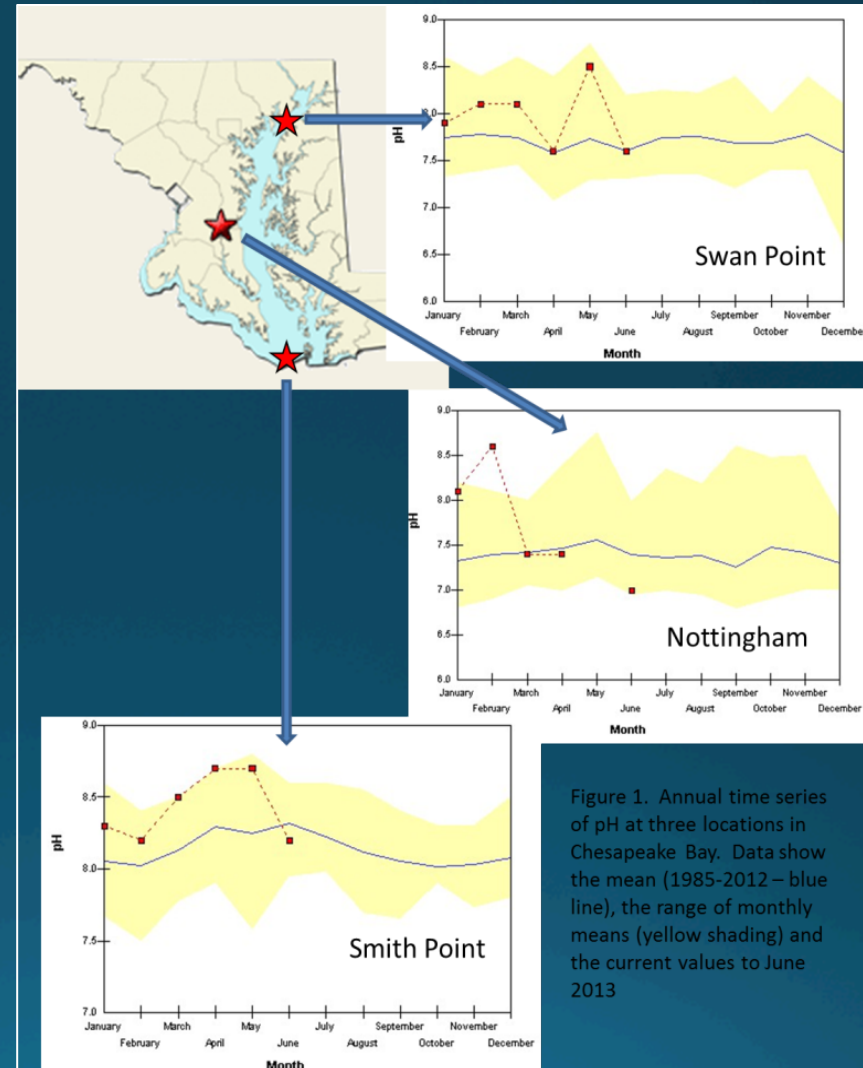
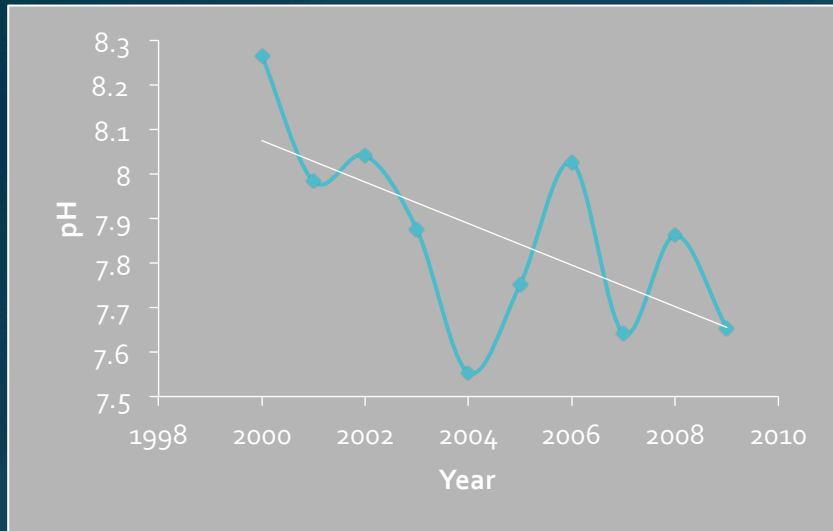
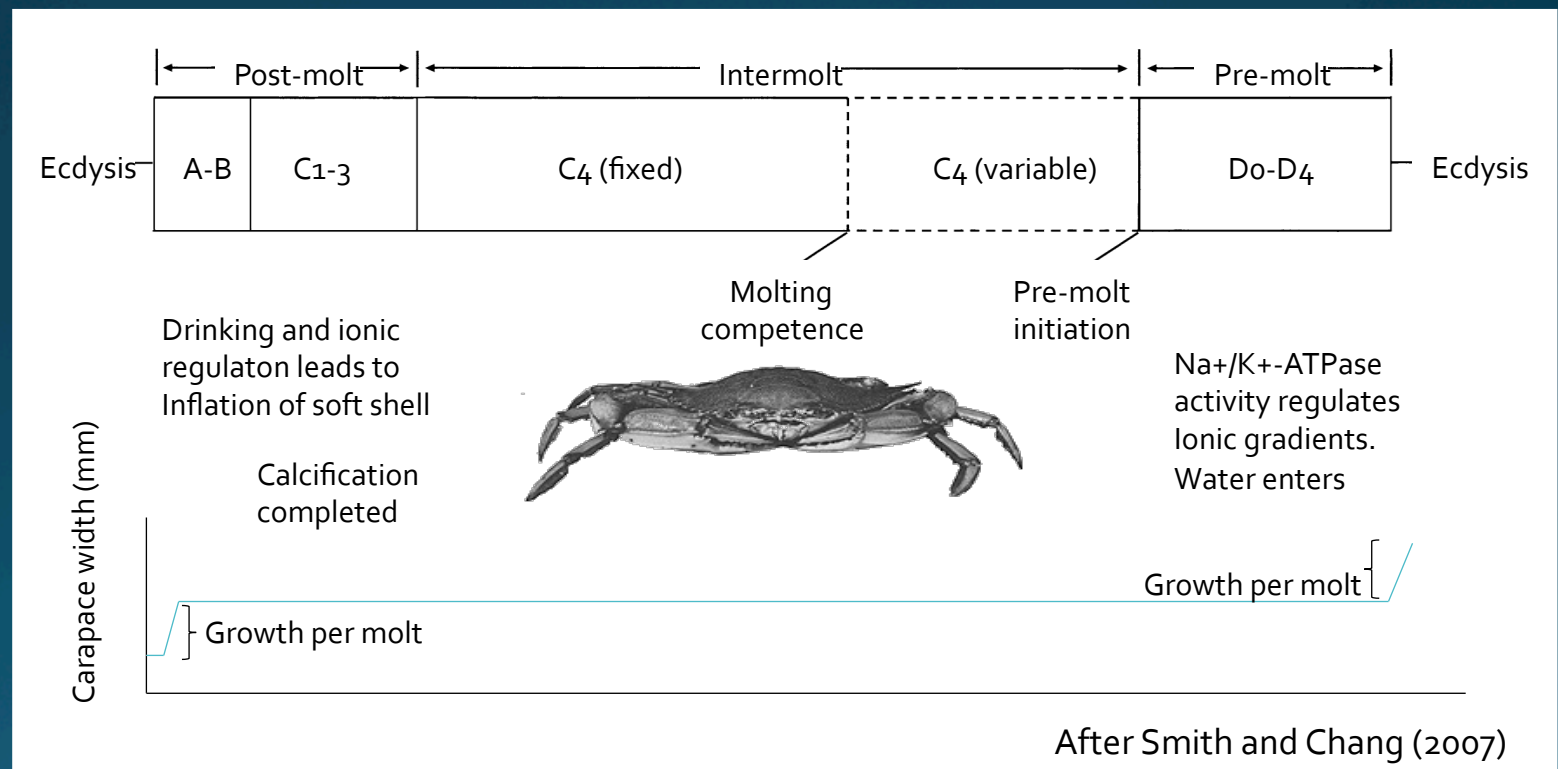
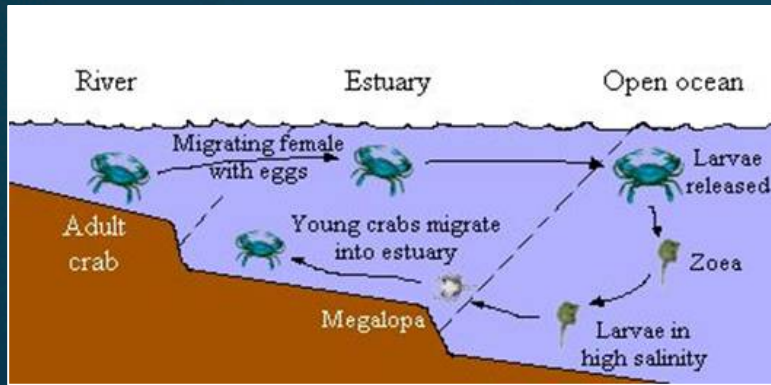
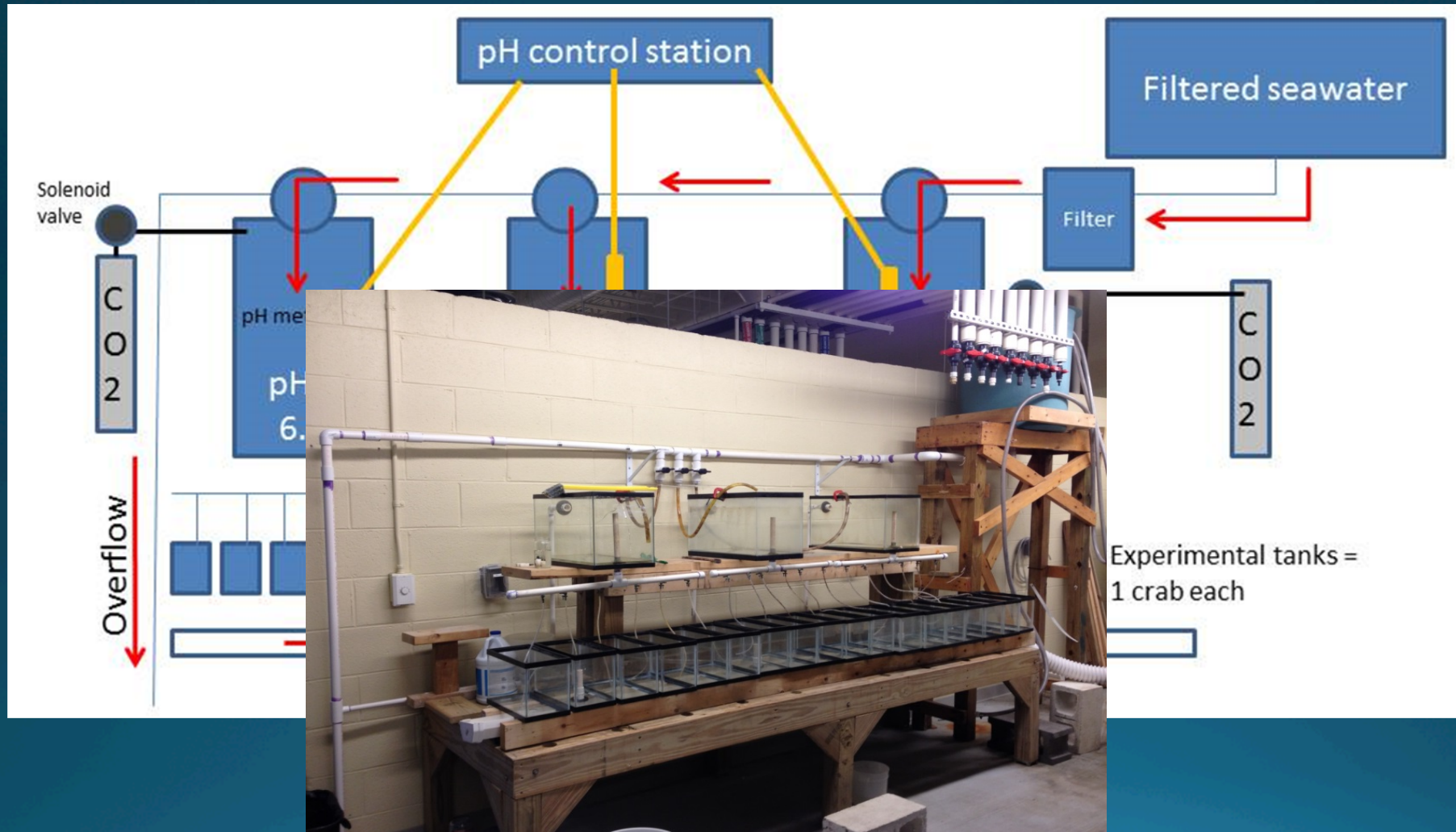


Figure 1. Annual time series of pH at three locations in Chesapeake Bay. Data show the mean (1985-2012 – blue line), the range of monthly means (yellow shading) and the current values to June 2013

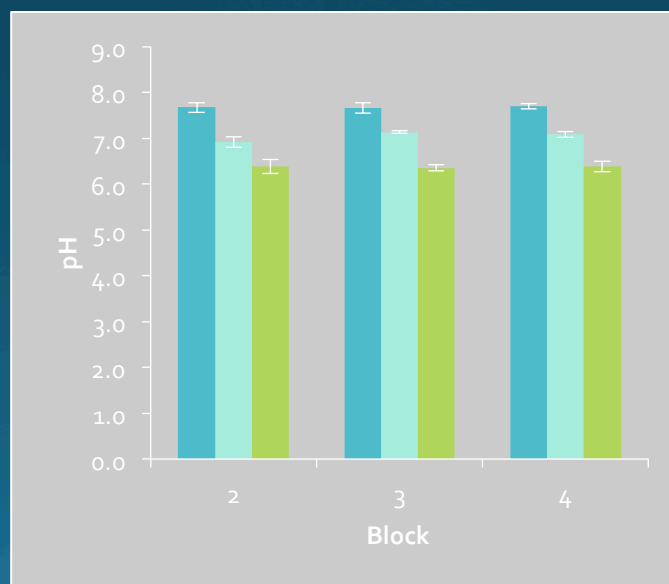
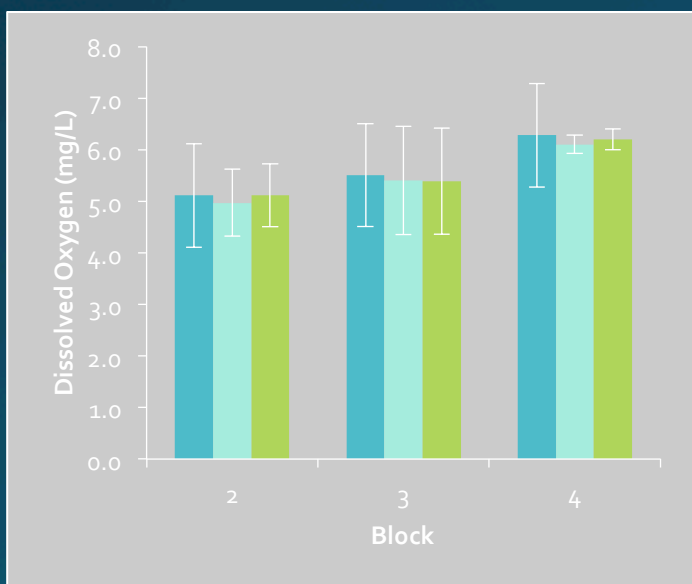
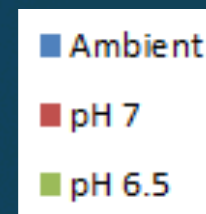
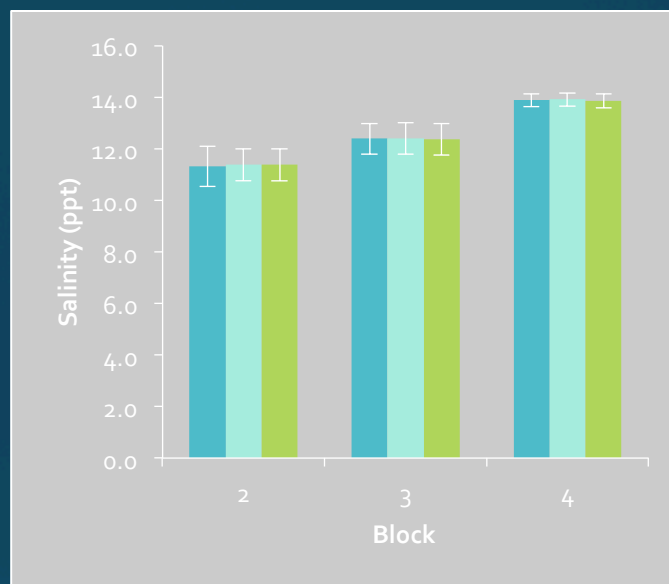
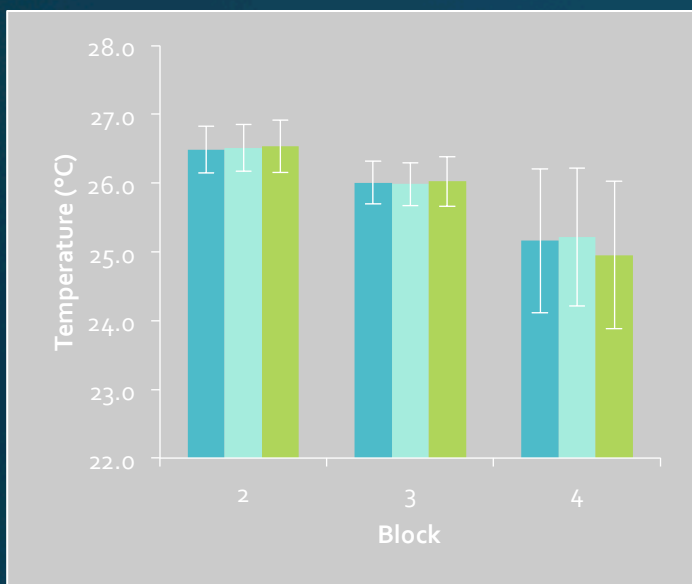
Blue Crab Growth



Methods: Experimental Conditions

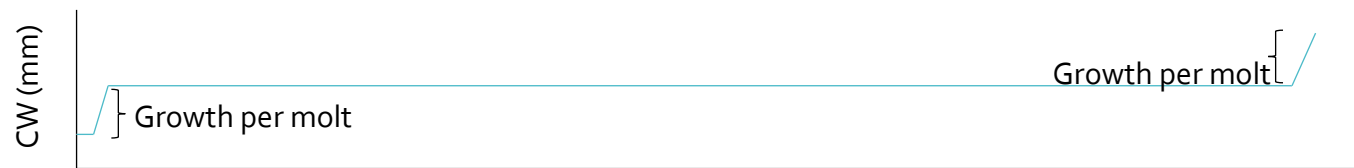
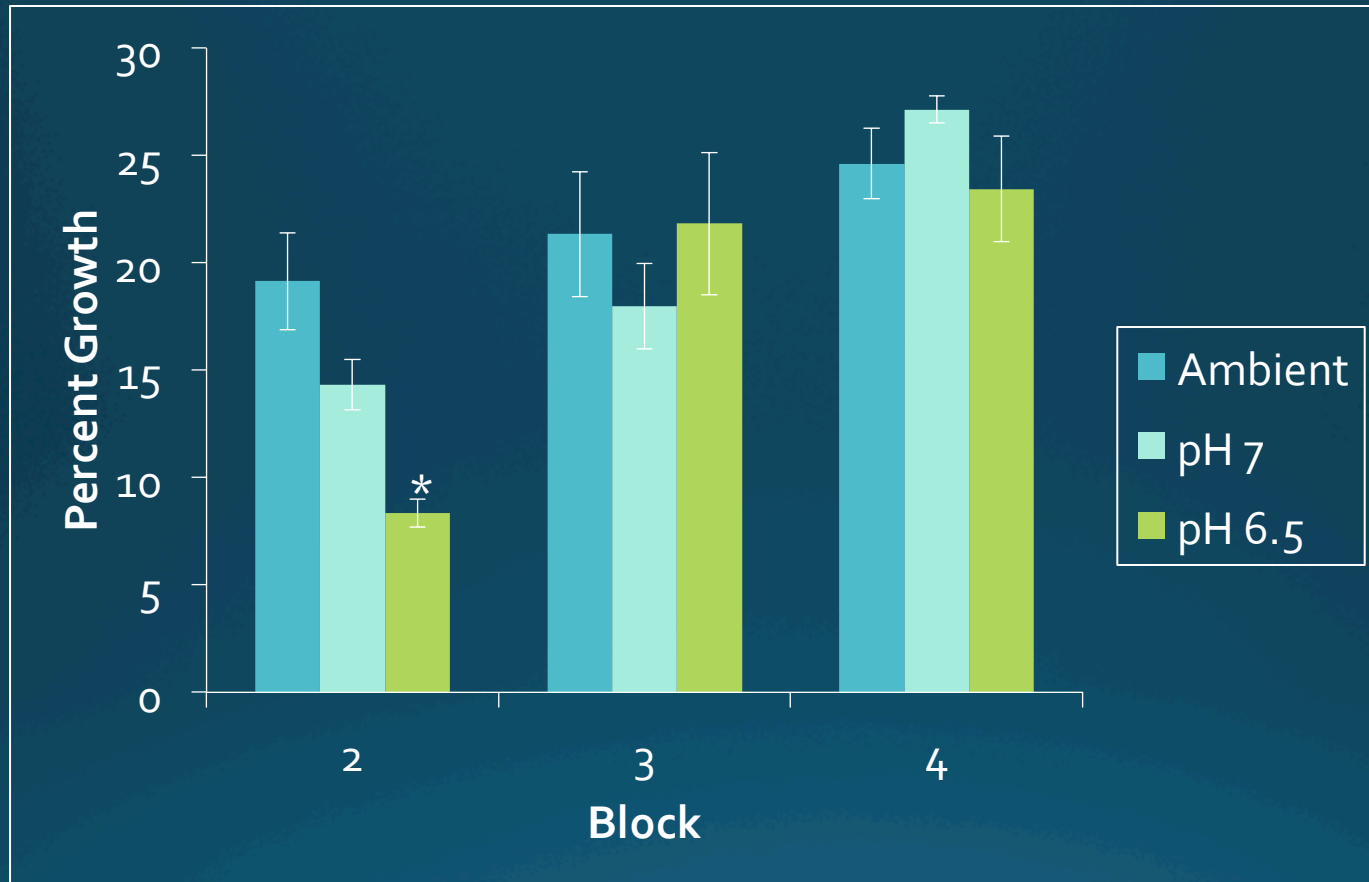


Results: Experimental Conditions

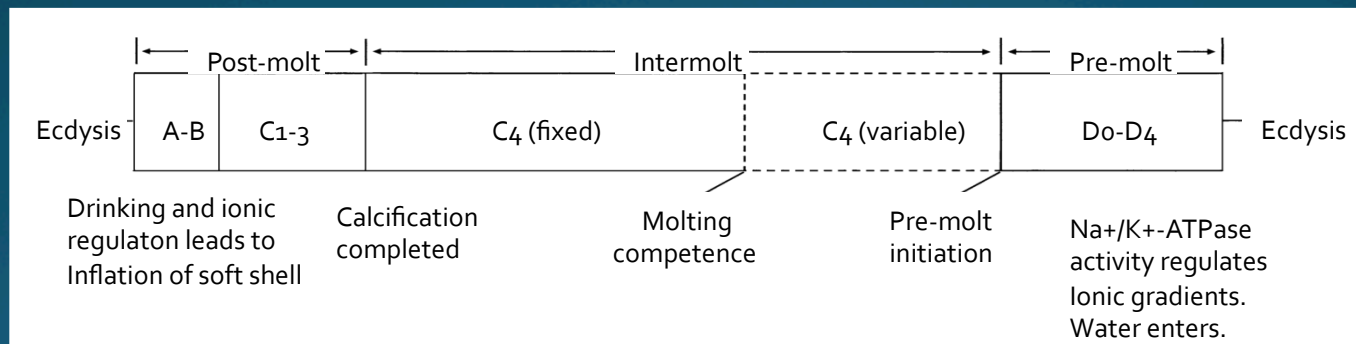
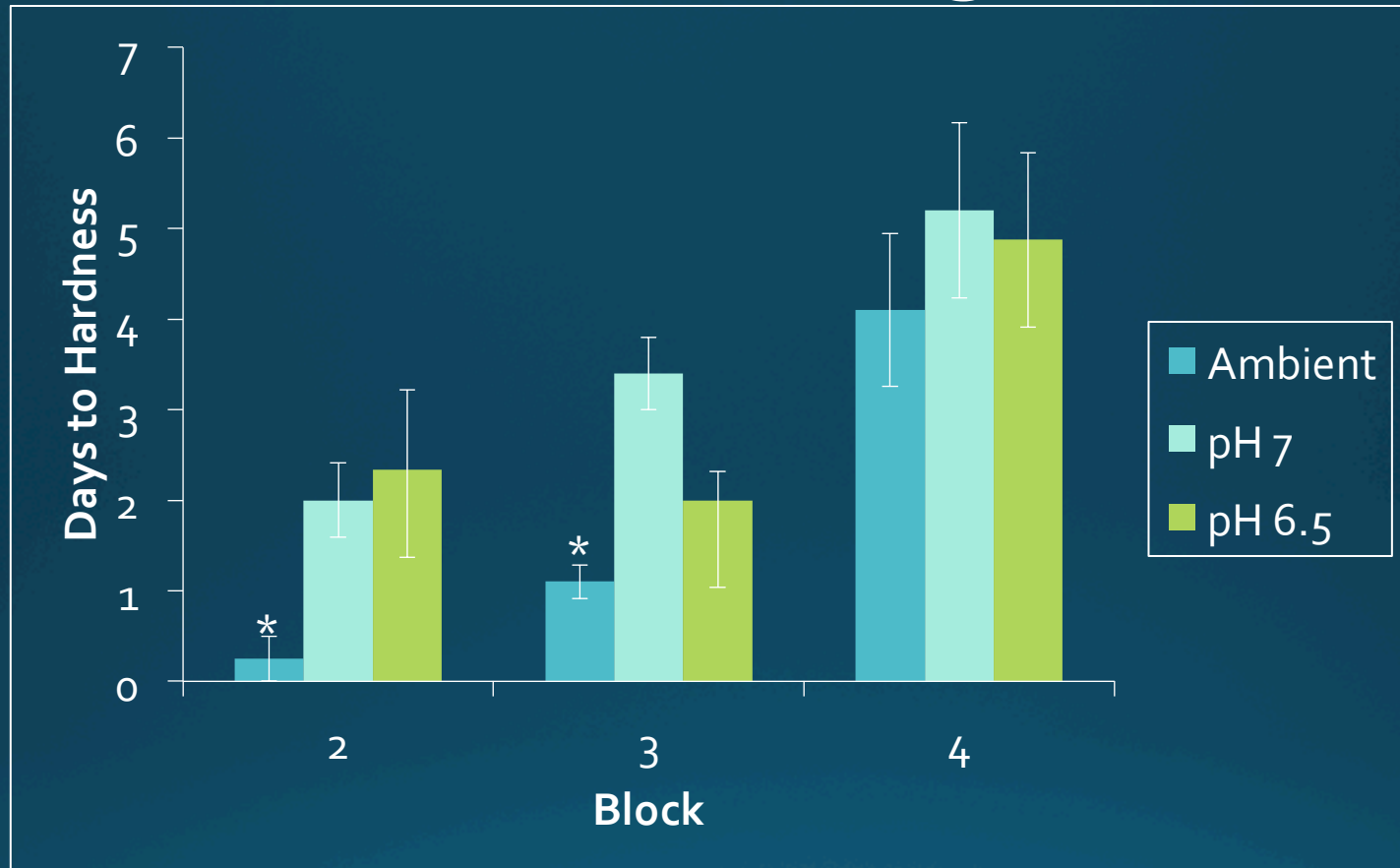


Tmt	Mean TA ($\mu\text{mol/kg sw}$)	SD
Ambient	1753.5	4.8
pH 7	1761.4	5.9
pH 6.5	1739.2	7.2

Results: Crab Growth



Results: Crab Hardening Time



Impact of Acidification is Complicated

Impact	Benefit	Drawback
Longer soft shell phase	None	Predation vulnerability
		Energetic cost (maintenance of homeostasis)
Shorter intermolt period	Bigger	Molt more frequently (energetic cost, predation vulnerability)

Future Experiments:

- Quantify impact of acidification on length of intermolt period.
- Determine energetic cost of molting in an acidic environment.

Questions?

