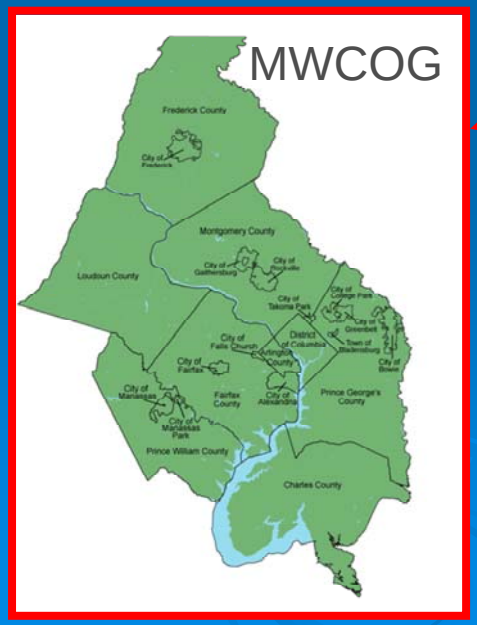
Cleaning up the Chesapeake Bay in a warmer world

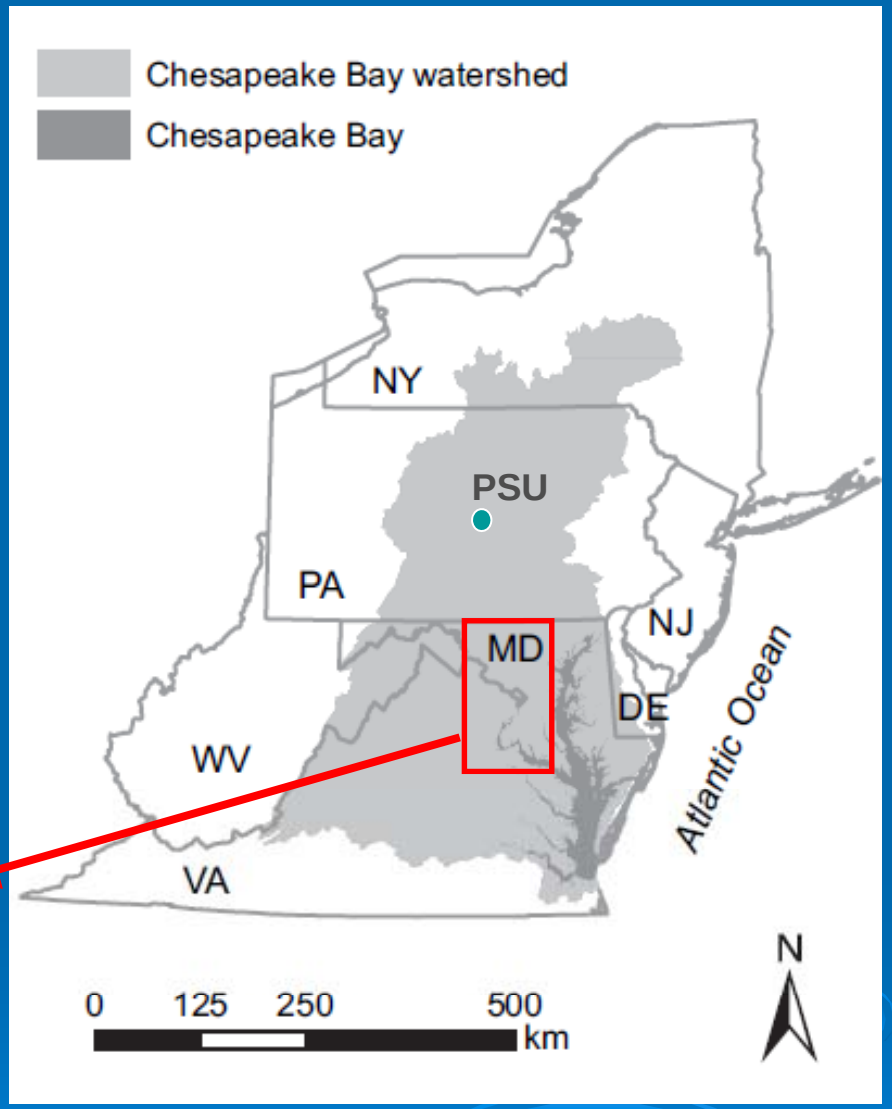
Raymond Najjar
Department of Meteorology
The Pennsylvania State University

Metropolitan Washington Council of Governments

Climate Impacts Symposium

May 21, 2012





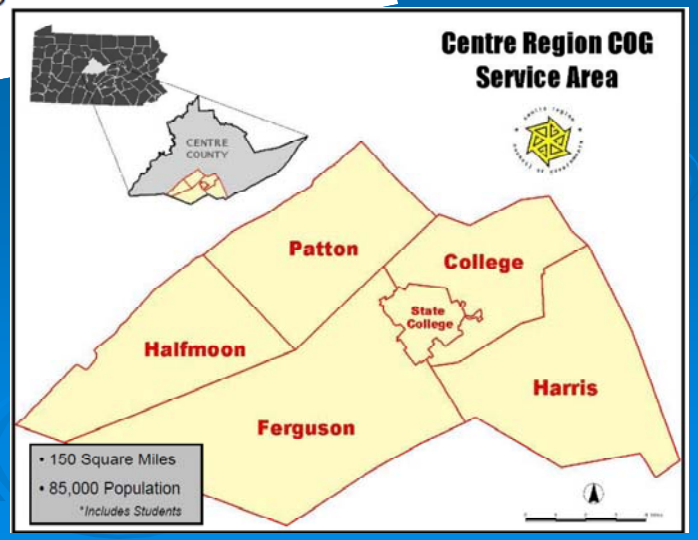
COGs *Rock!*

Press Release

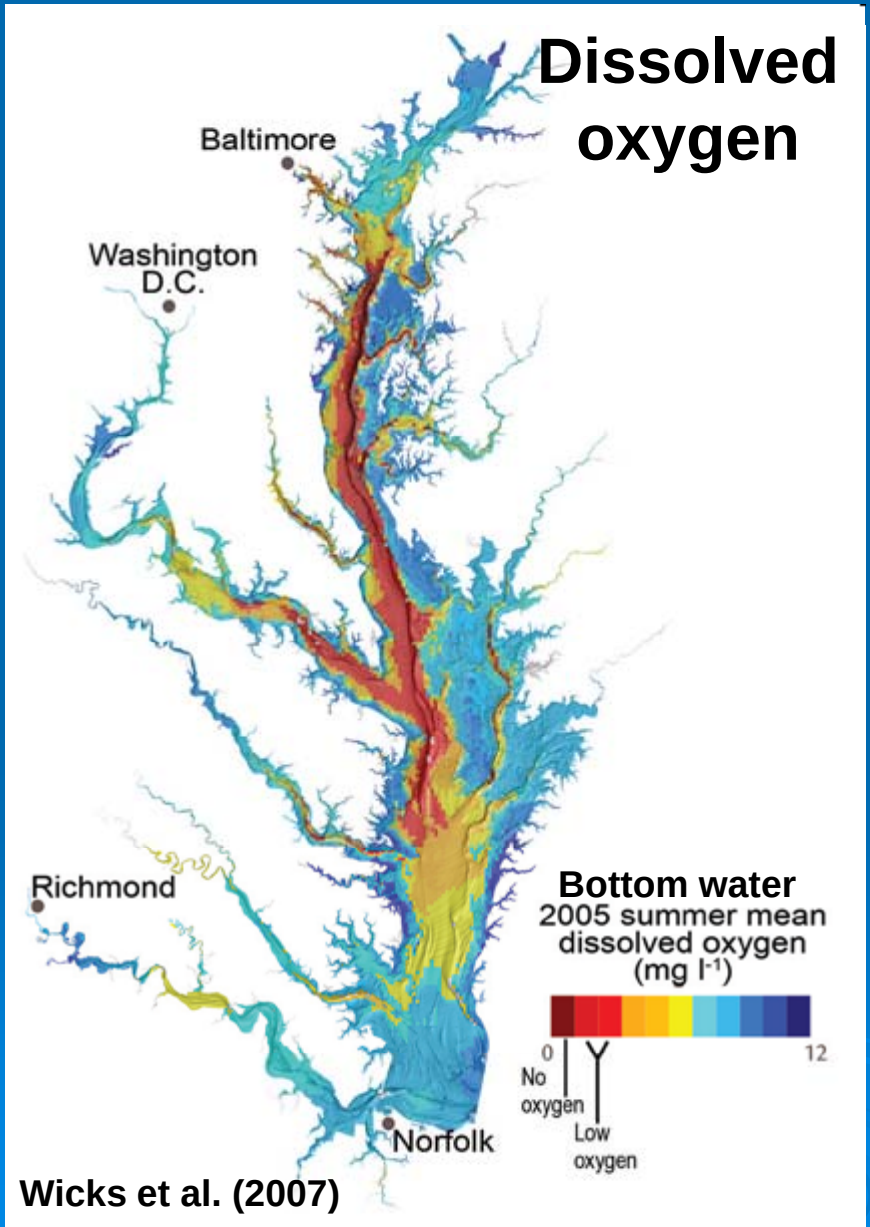
State College – Centre Region
is named a Bronze Level Bicycle Friendly Community
by the League of American Bicyclists

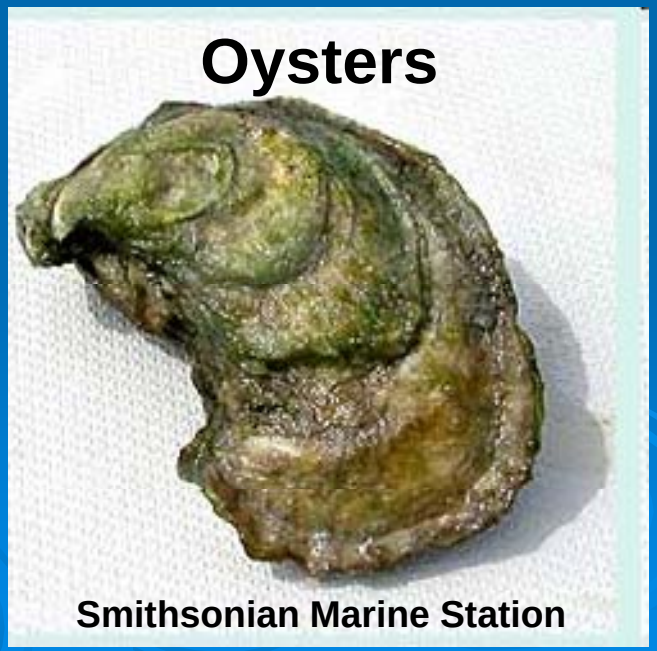
Washington, D.C. – May 15, 2012 – May is National Bike Month with hundreds of events and thousands of riders celebrating bicycling nationwide. And a growing number of U.S. communities are taking steps to encourage residents to ride all year round — including the Centre Region. The League of American Bicyclists has announced the latest round of Bicycle Friendly Communities (BFC) and the State College–Centre Region area was named a Bronze Level BFC. The Centre Region COG applied for the designation on behalf of six municipalities (the Townships of College, Halfmoon, Harris, Ferguson and Patton, and the Borough of State College).

MWCOG BFCs:
Alexandria, Arlington,
Frederick, Washington

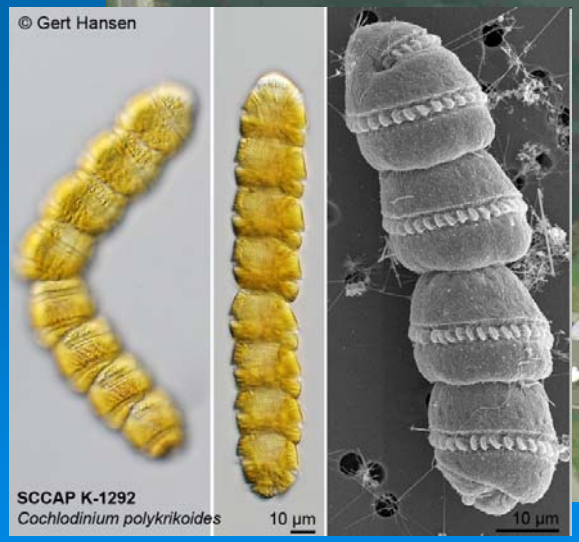


Three key indicators of Chesapeake Bay Health





Cochlodinium bloom (Aug 2007)

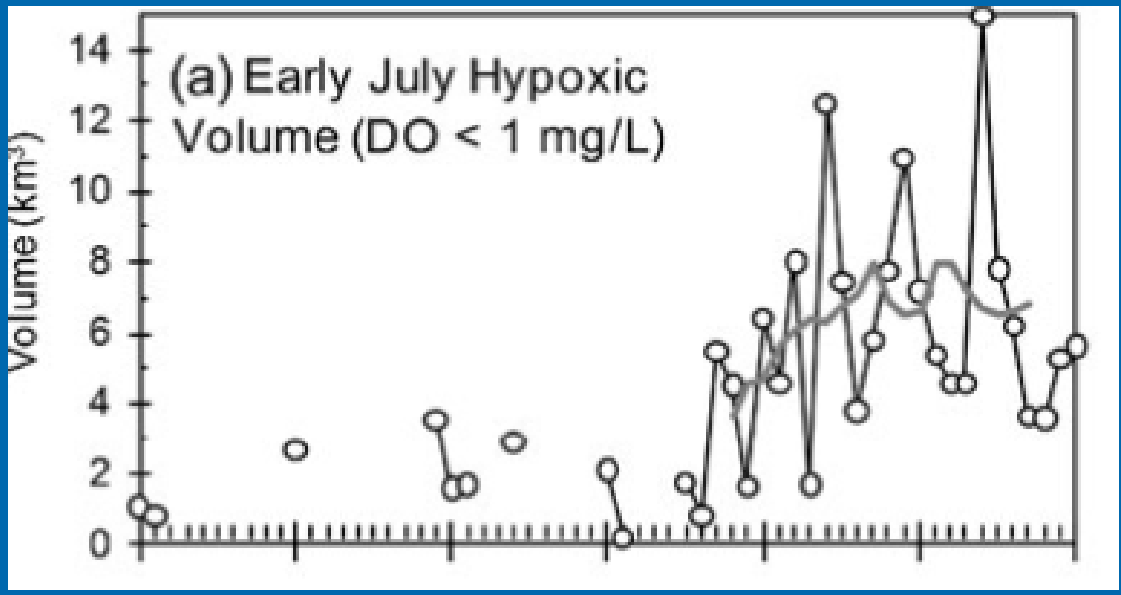


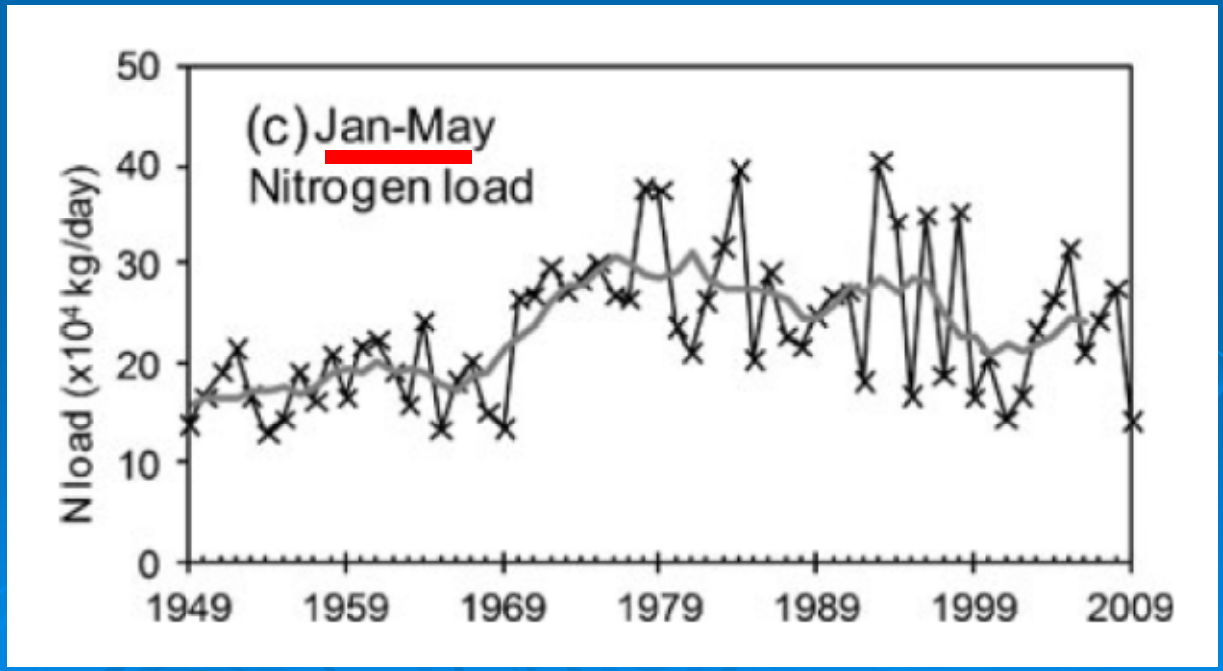
Courtesy Margie Mulholland

60 years of

hypoxic volume

and nitrogen loading





Murphy et al. (2011)

Projected Climate Change in the Chesapeake Region

Virtually certain (>99%):

- Higher CO_2
- Higher sea level

Very likely (90-99%):

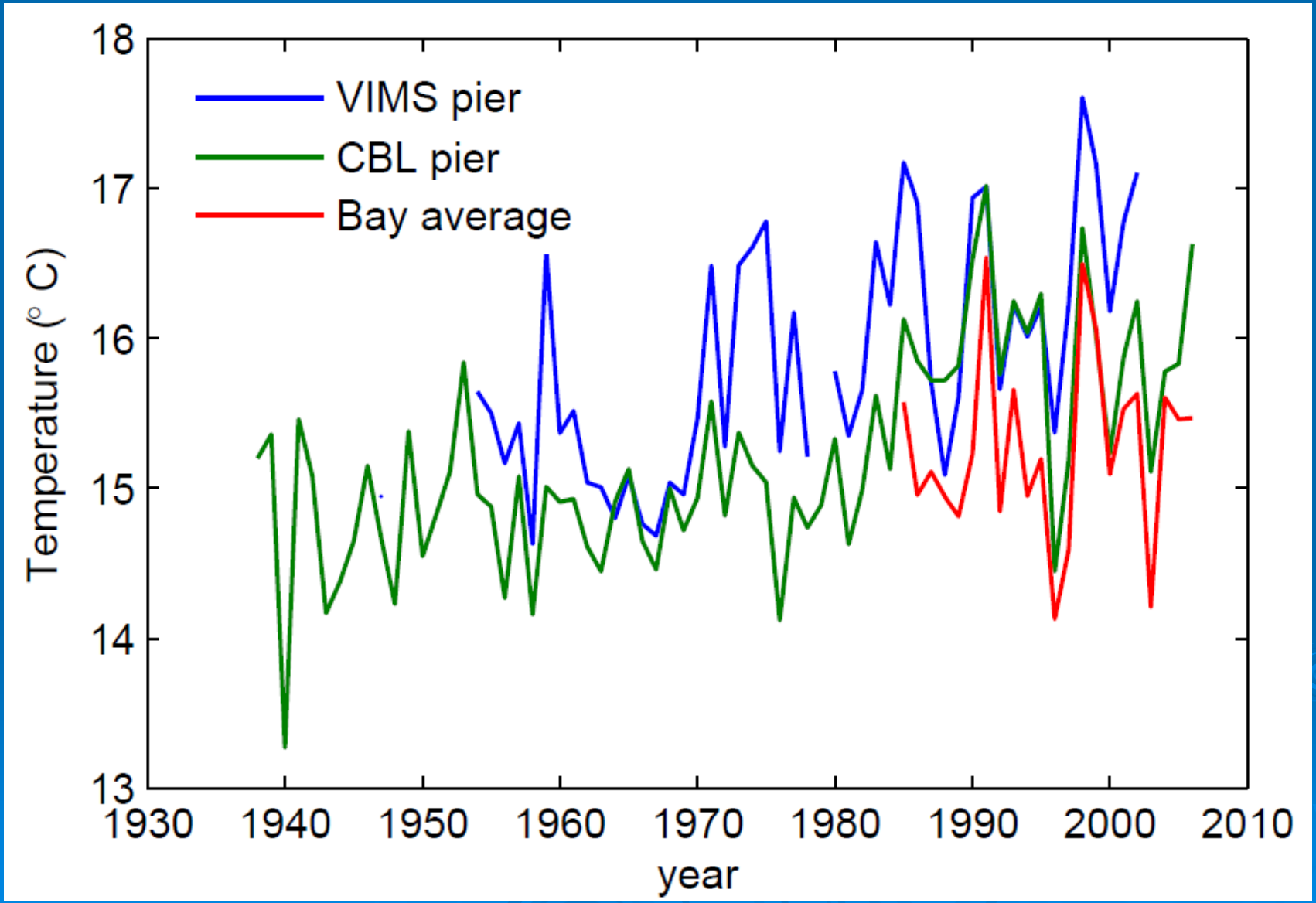
- Warmer
- Higher winter & spring precipitation

Likely (66-90%):

- More intense precipitation
- Flashier streamflow
- Increased winter streamflow
- Increased storm intensity

Najjar et al. (2010), Boesch (2008)

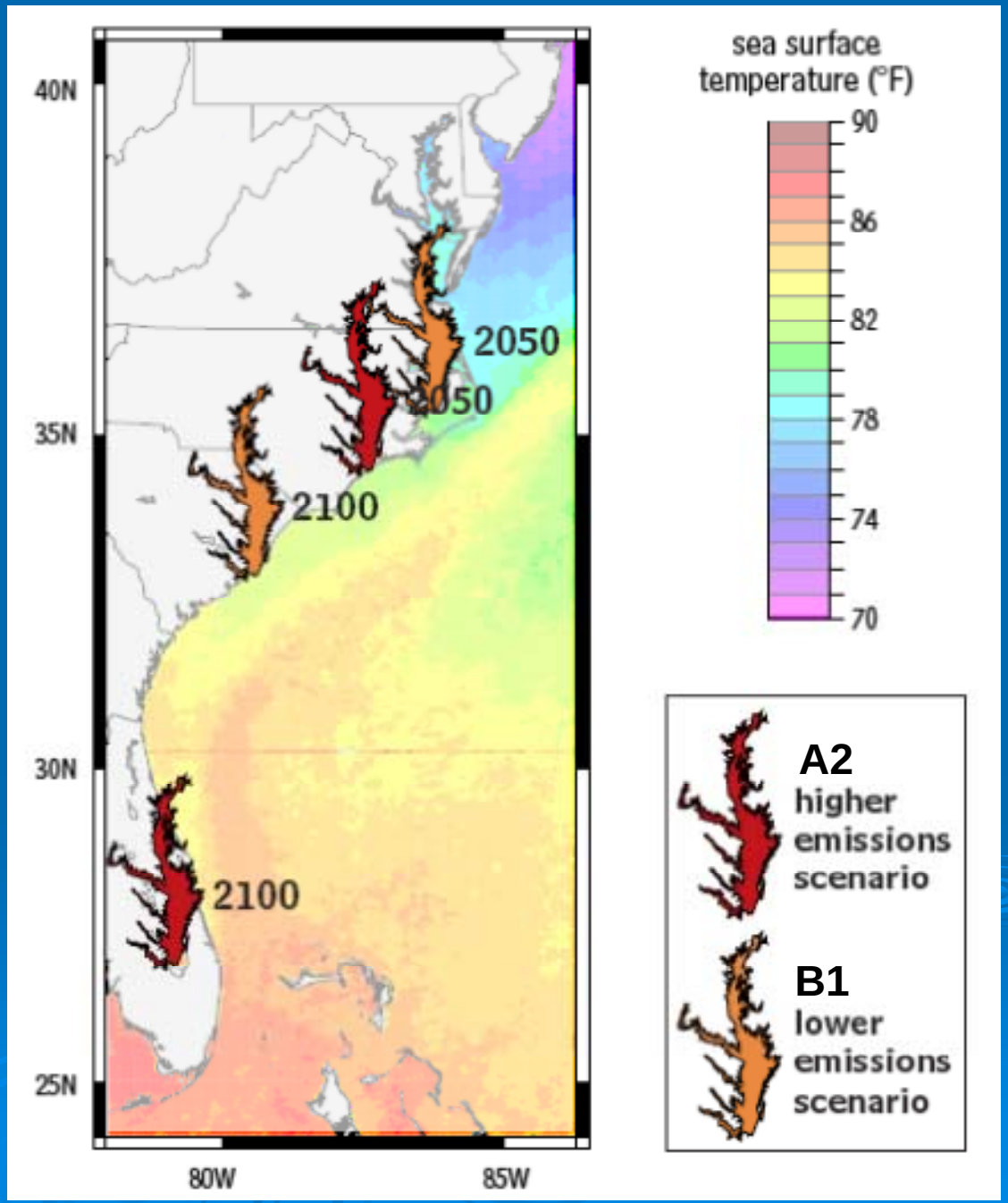
Chesapeake Bay is warming



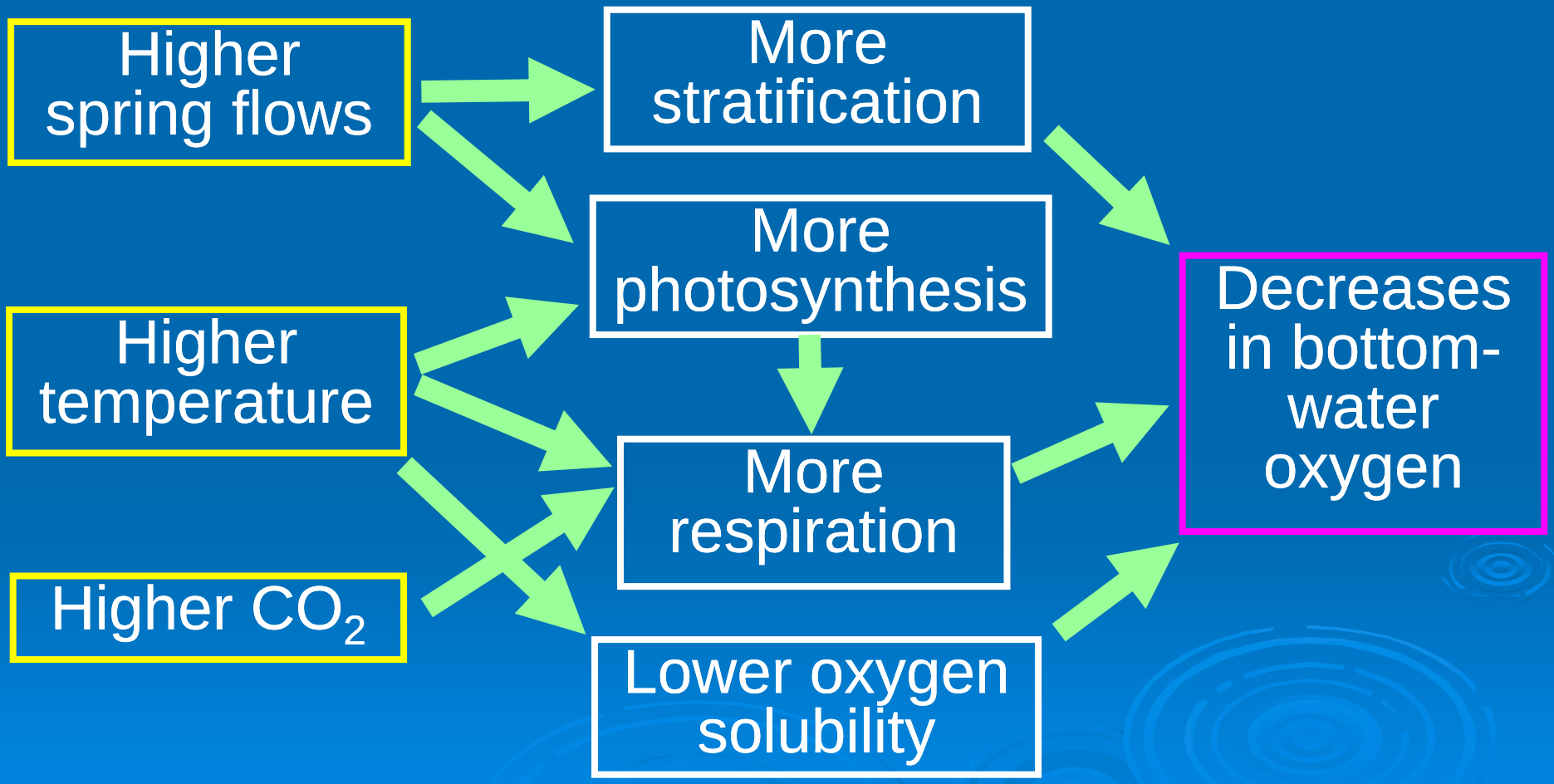
Source: CBP & VIMS archive, Kaushal et al. (2010)

Moving estuary analogue: summer temperature change

Boesch (2008)



Multiple impacts on bottom-water dissolved oxygen

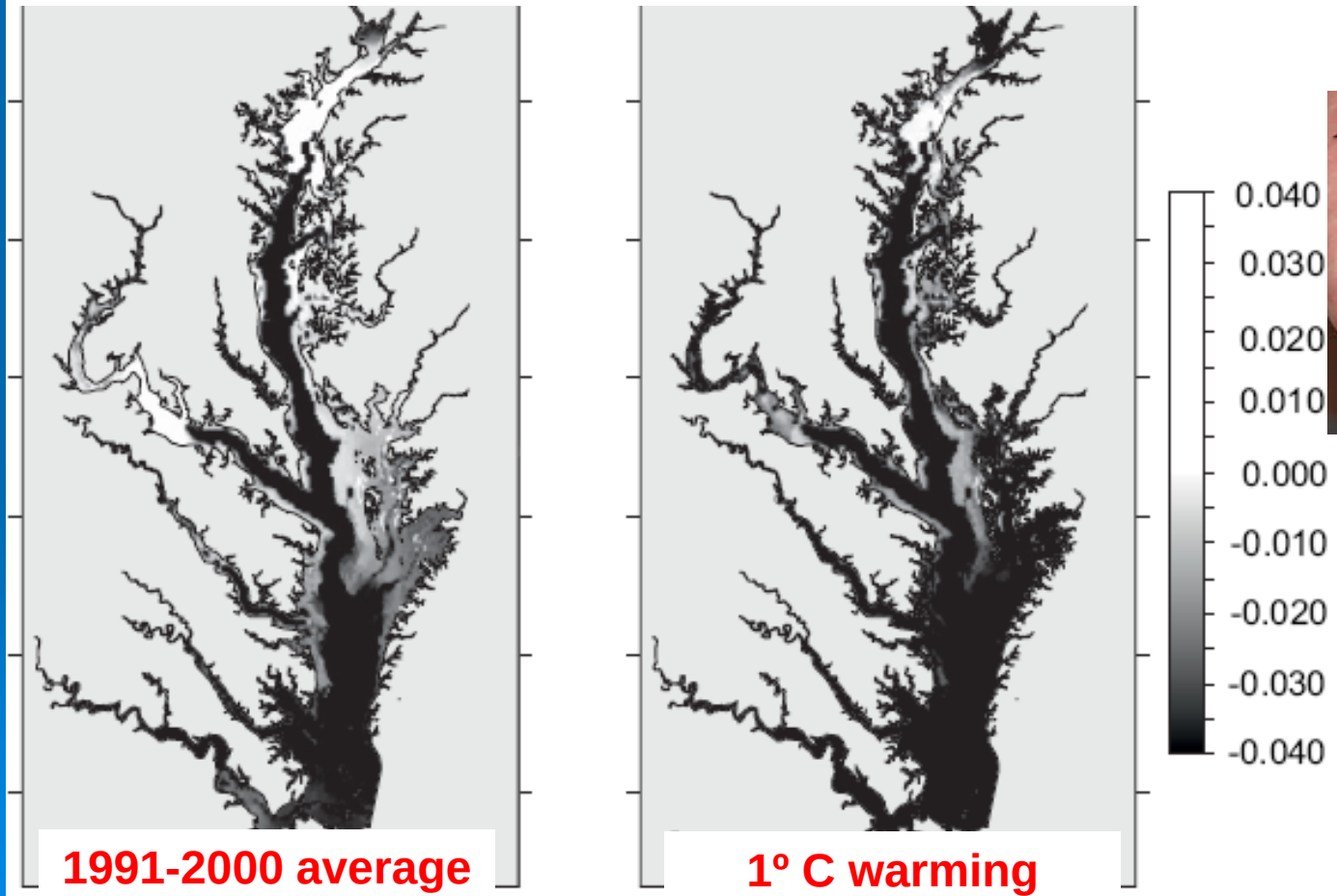


Temperature-O_2 synergistic impact (oxygen squeeze)

Coastal Fisheries Reform Group

Instantaneous potential production

for young-of-the-year Atlantic Sturgeon, July bottom water



1991-2000 average

1º C warming

Dave Conover

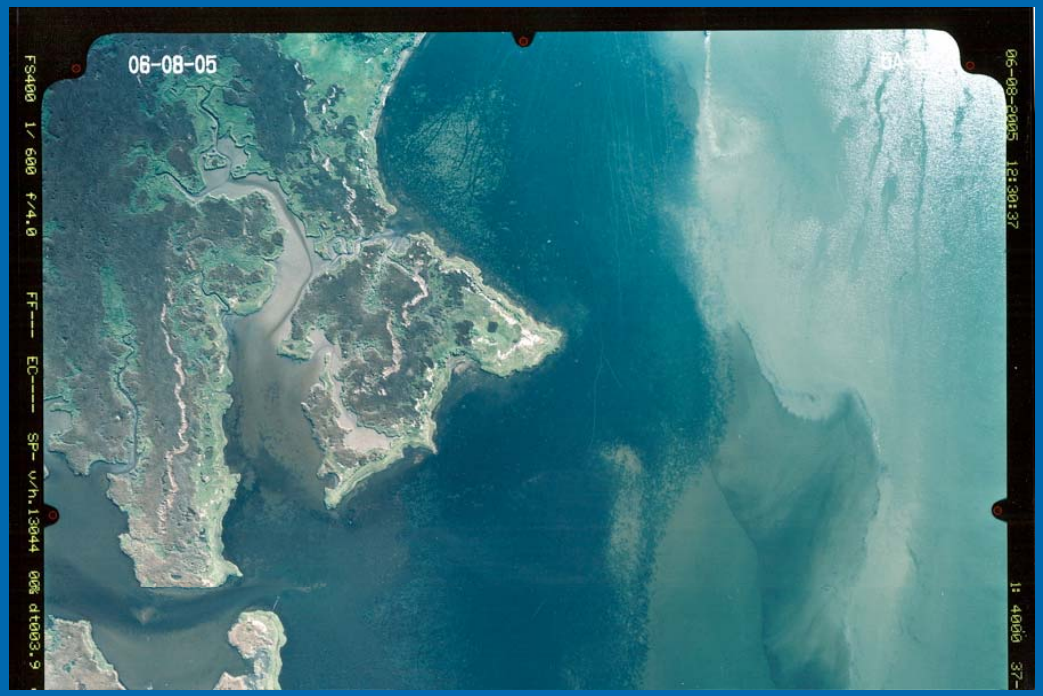
Niklitschek & Secor (2005)

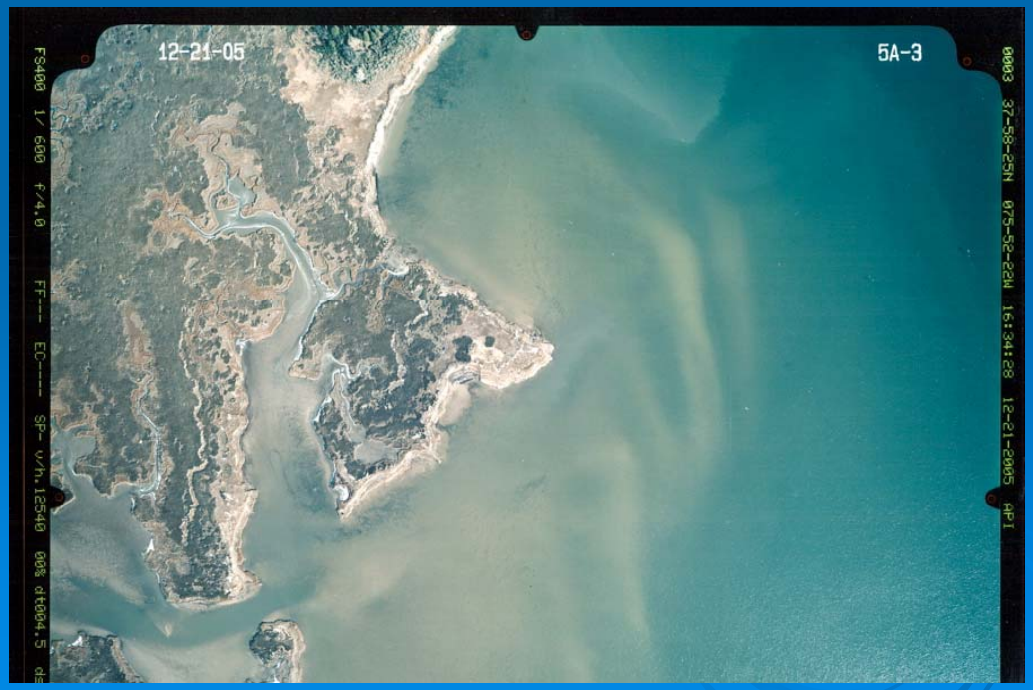
Submerged vegetation: an important habitat

Snails on seagrass

Sea turtle at a grass bed

http://www.vims.edu/about/photo_galleries/sav





Lower-bay seagrass

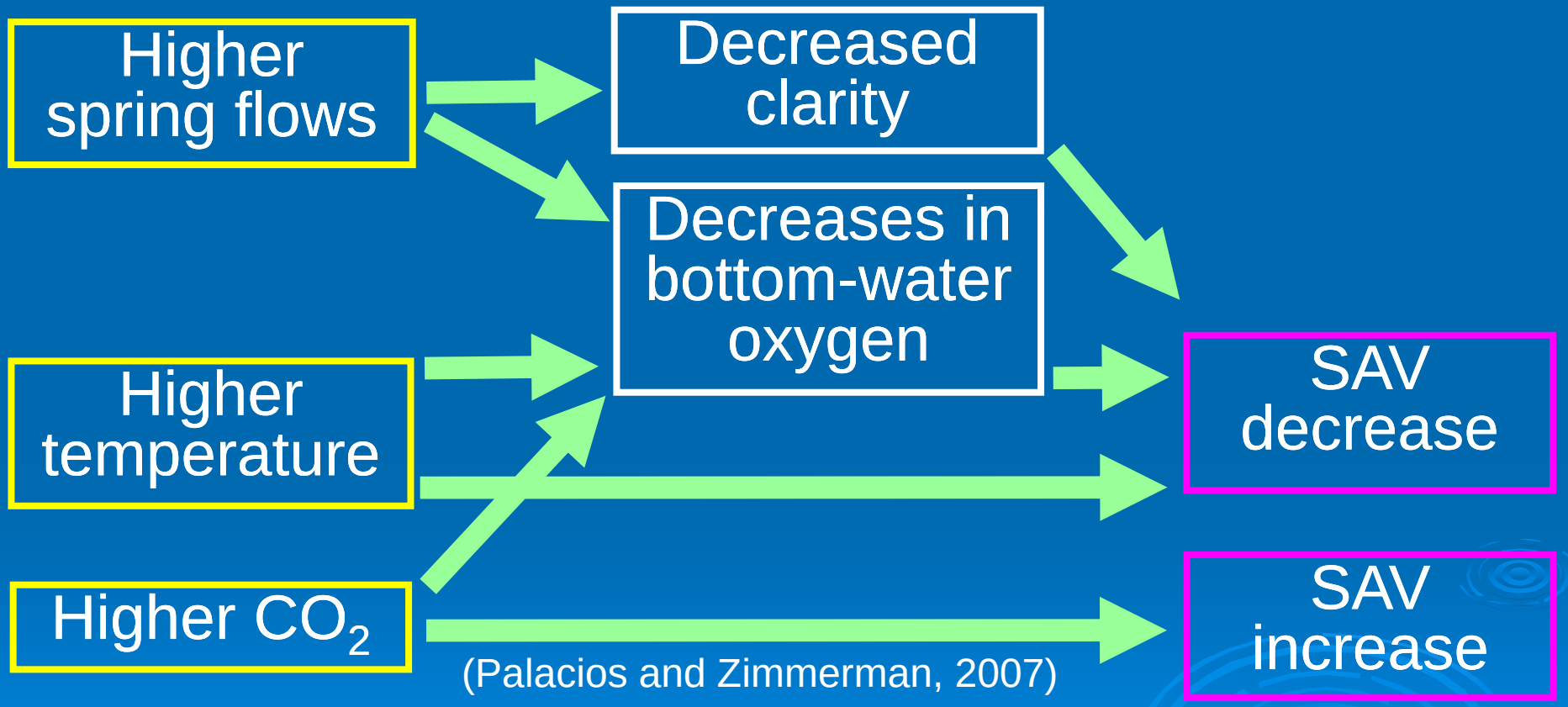
June 2005

Hot summer

December 2005

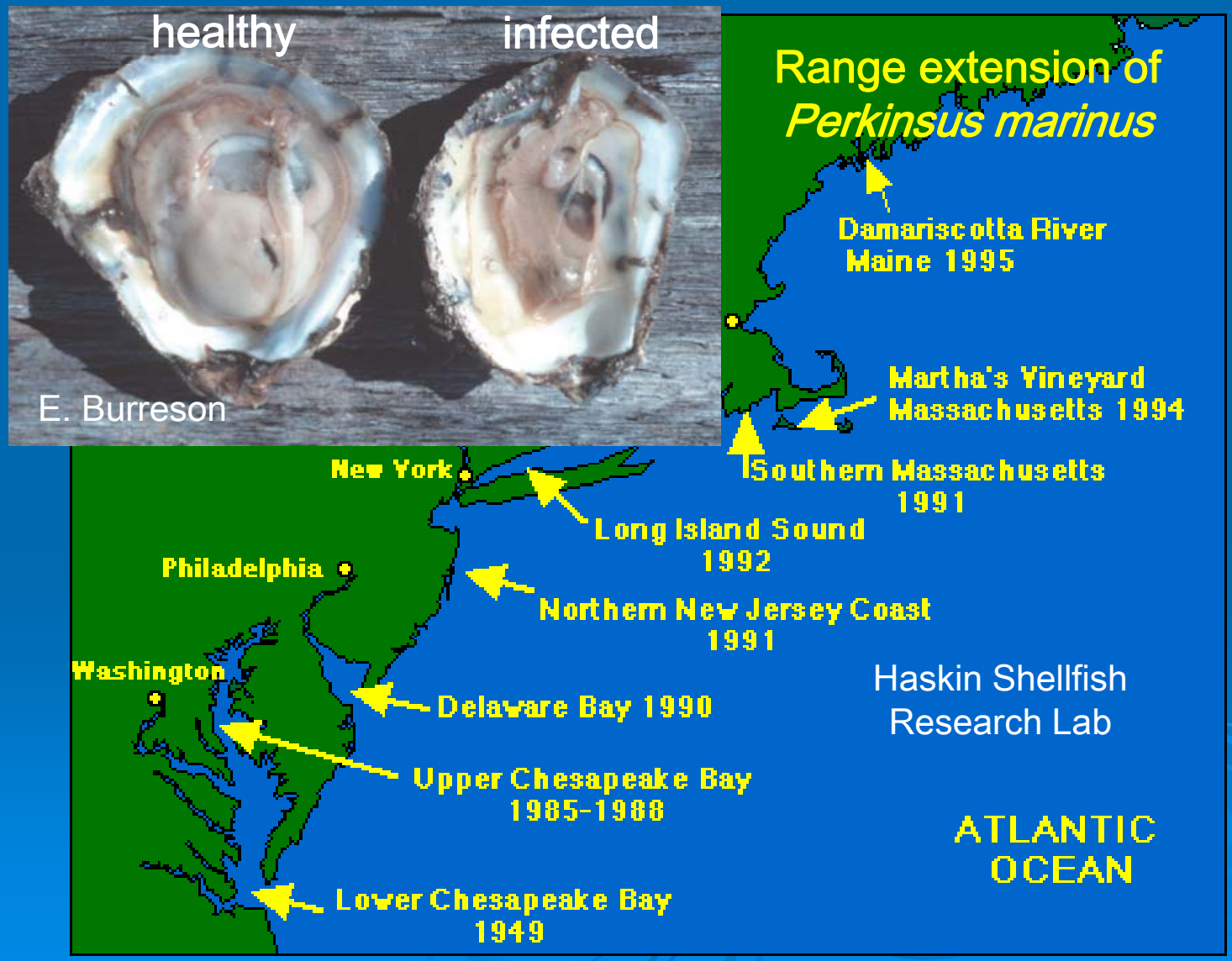
http://www.vims.edu/about/photo_galleries/sav

Multiple impacts on Eelgrass

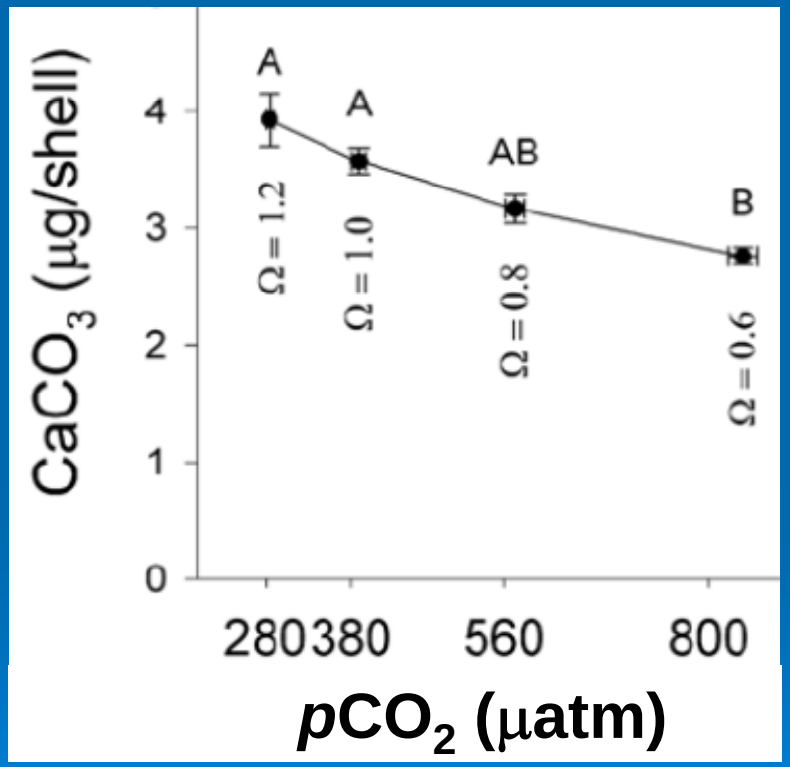


(Palacios and Zimmerman, 2007)

Oyster disease has spread in response to winter warming



Impact of ocean acidification on oyster larvae (*C. virginica*) calcification



Miller et al. (2009)

Smithsonian Marine Station

Policy recommendations

- Recognize climate change in restoration effort
- Short-term: *Manage the unavoidable* → adapt
- Long-term: *Avoid the unmanageable* → reduce emissions

Thank you

References

Boesch, D.F., (editor) 2008. Global Warming and the Free State: Comprehensive Assessment of Climate Change Impacts in Maryland. Report of the Scientific and Technical Working Group of the Maryland Commission on Climate Change. University of Maryland Center for Environmental Science, Cambridge, Maryland.

Kaushal, S.S., Likens, G.E., Jaworski, N.A., Pace, M.L., Sides, A.M., Seekell, D., Belt, K.T., Secor, D.H., Wingate, R., 2010. Rising stream and river temperatures in the United States. Frontiers in Ecology and the Environment doi:10.1890/090037.

Miller, A.W., Reynolds, A.C., Sobrino, C., Riedel, G.F., 2009. Shellfish face uncertain future in high CO2 world: Influence of acidification on oyster larvae calcification and growth in estuaries. PLoS ONE 4, 1-8.

Murphy, R.R., Kemp, W.M., Ball, W.P., 2011. Long-term trends in Chesapeake Bay seasonal hypoxia, stratification, and nutrient loading. Estuaries and Coasts 34, 1293–1309.

Najjar, R.G., Pyke, C.R., Adams, M.B., Breitburg, D., Hershner, C., Kemp, M., Howarth, R., Mulholland, M., Paolisso, M., Secor, D., Sellner, K., Wardrop, D., Wood, R., 2010. Potential climate-change impacts on the Chesapeake Bay. Estuarine, Coastal and Shelf Science 86, 1-20.

Niklitschek, E.J., Secor, D.H., 2005. Modeling spatial and temporal variation of suitable nursery habitats for Atlantic sturgeon in the Chesapeake Bay. Estuarine, Coastal and Shelf Science 64, 135-148.

Palacios, S.L., Zimmerman, R.C., 2007. Response of eelgrass Zostera marina to CO2 enrichment: possible impacts of climate change and potential for remediation of coastal habitats. Marine Ecology Progress Series 344, 1-13.

Wicks, C., D. Jasinski, and B. Longstaff. Breath of Life: Dissolved Oxygen in Chesapeake Bay. Oxford, MD: EcoCheck, 2007.