

2015

## **Monitoring Change in Casco Bay (2015 State of the Bay Presentation)**

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Friends of Casco Bay  
Casco BAYKEEPER®  
25<sup>th</sup> Anniversary



# State of the Bay Conference

Monitoring Change in Casco Bay  
October 13, 2015



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# What I am going to talk about...



- Water Quality Monitoring
  - *What kinds of data we collect*
  - *What we are seeing, and what we are not seeing, in the data*
  - *How we are adjusting as the Bay changes*
    - *More frequent data collection*
    - *Sediment pH work*



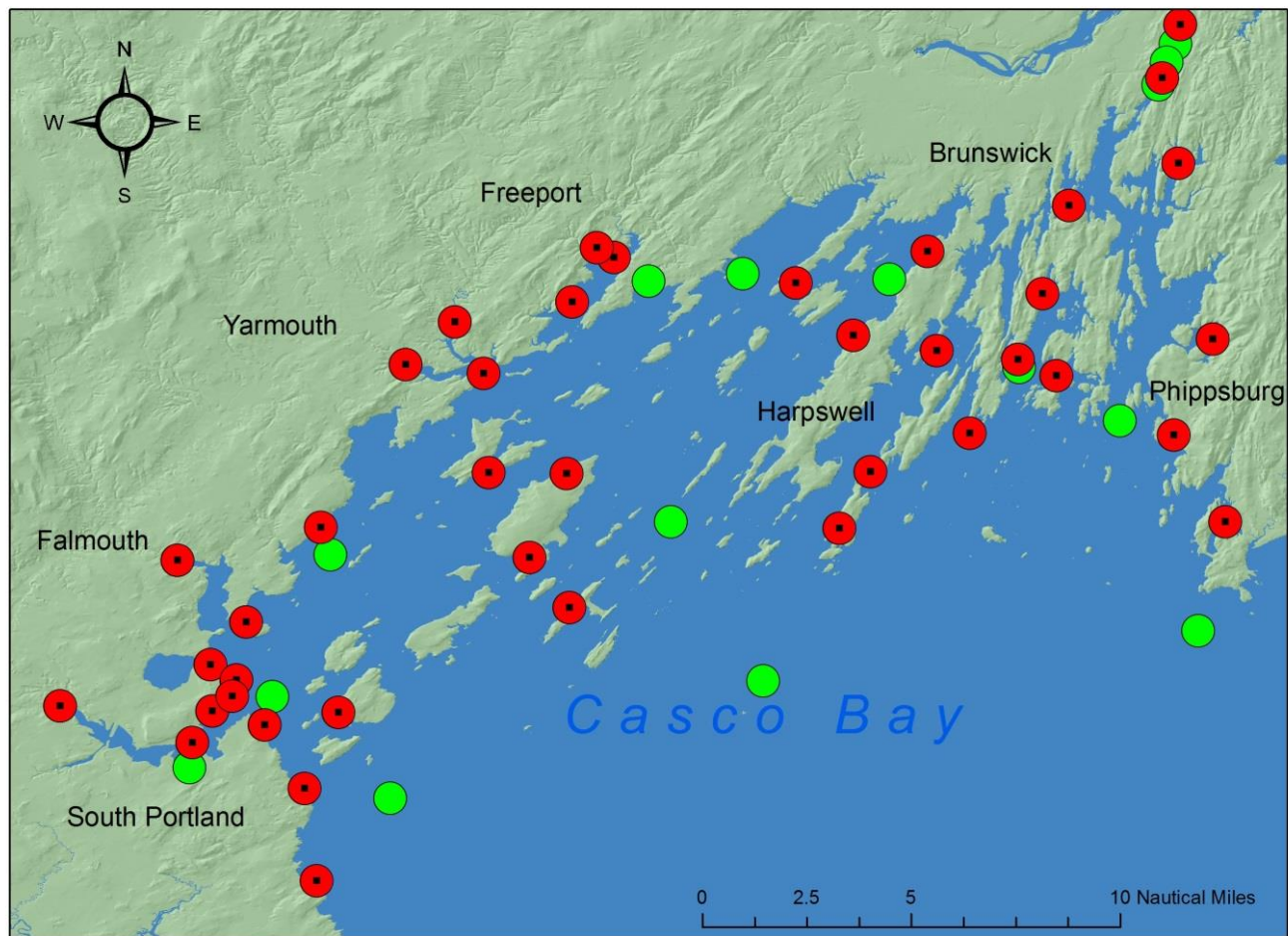
# Water Quality Parameters:



- Water temperature
  - Salinity
  - Dissolved oxygen
  - Secchi depth
  - Total and dissolved nutrients
  - In-situ fluorescence
  - pH and Total Alkalinity
- Issues of concern
    - *Nitrogen Pollution*
    - *Ocean and Coastal Acidification*



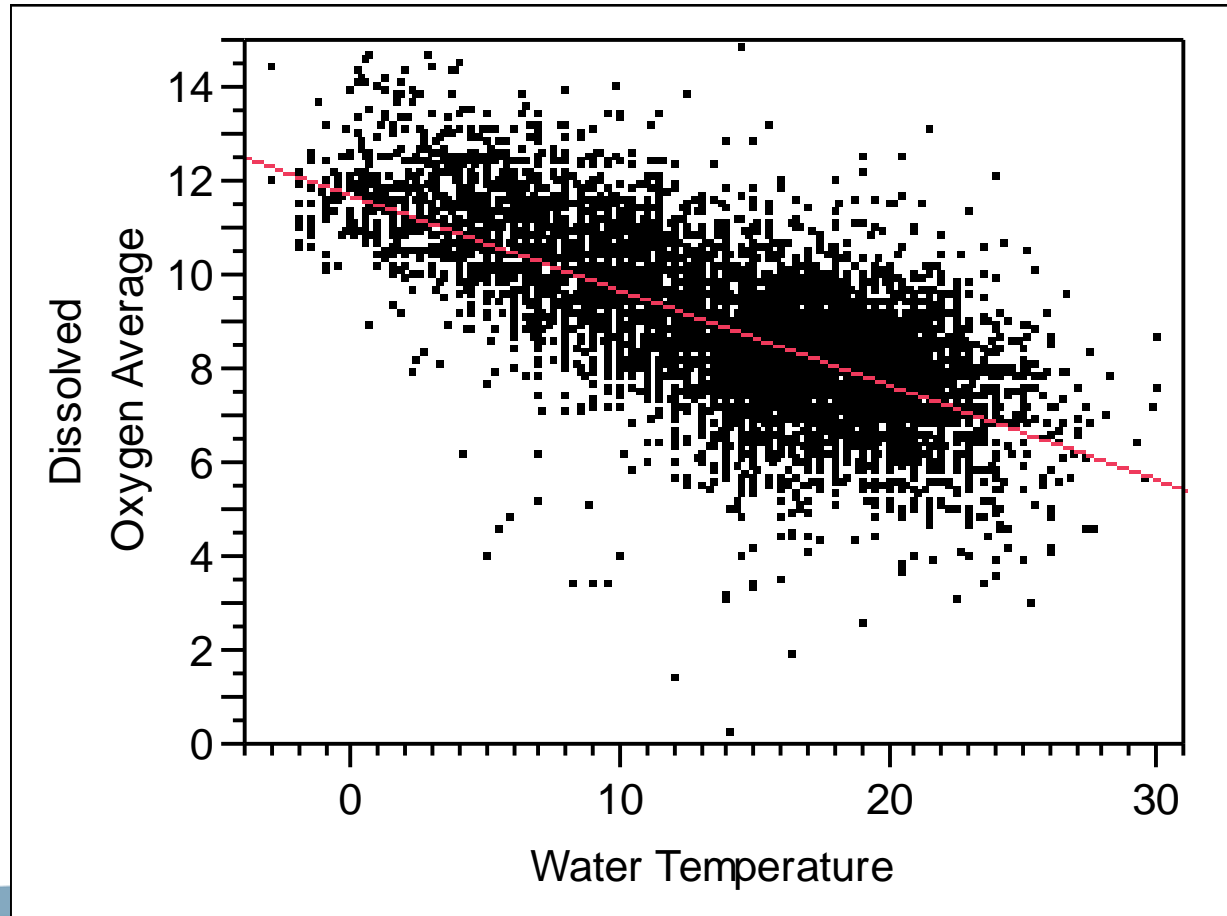
## Friends of Casco Bay Water Quality Monitoring Sites



# What we look for in the data...

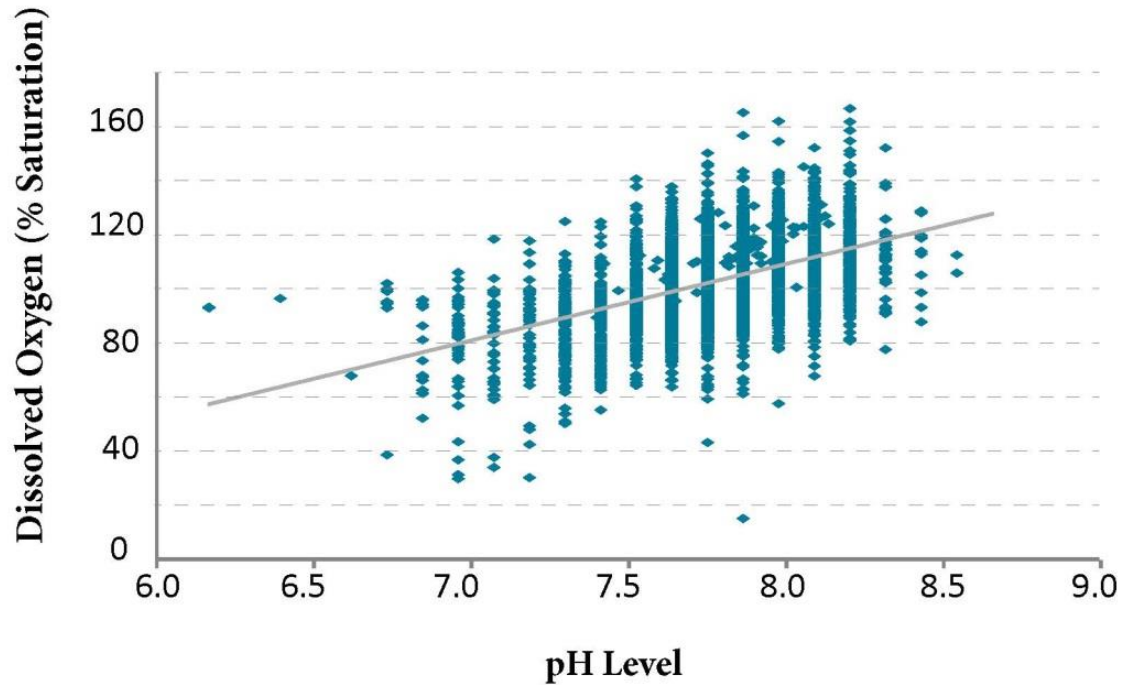


## – Relationships Between Parameters

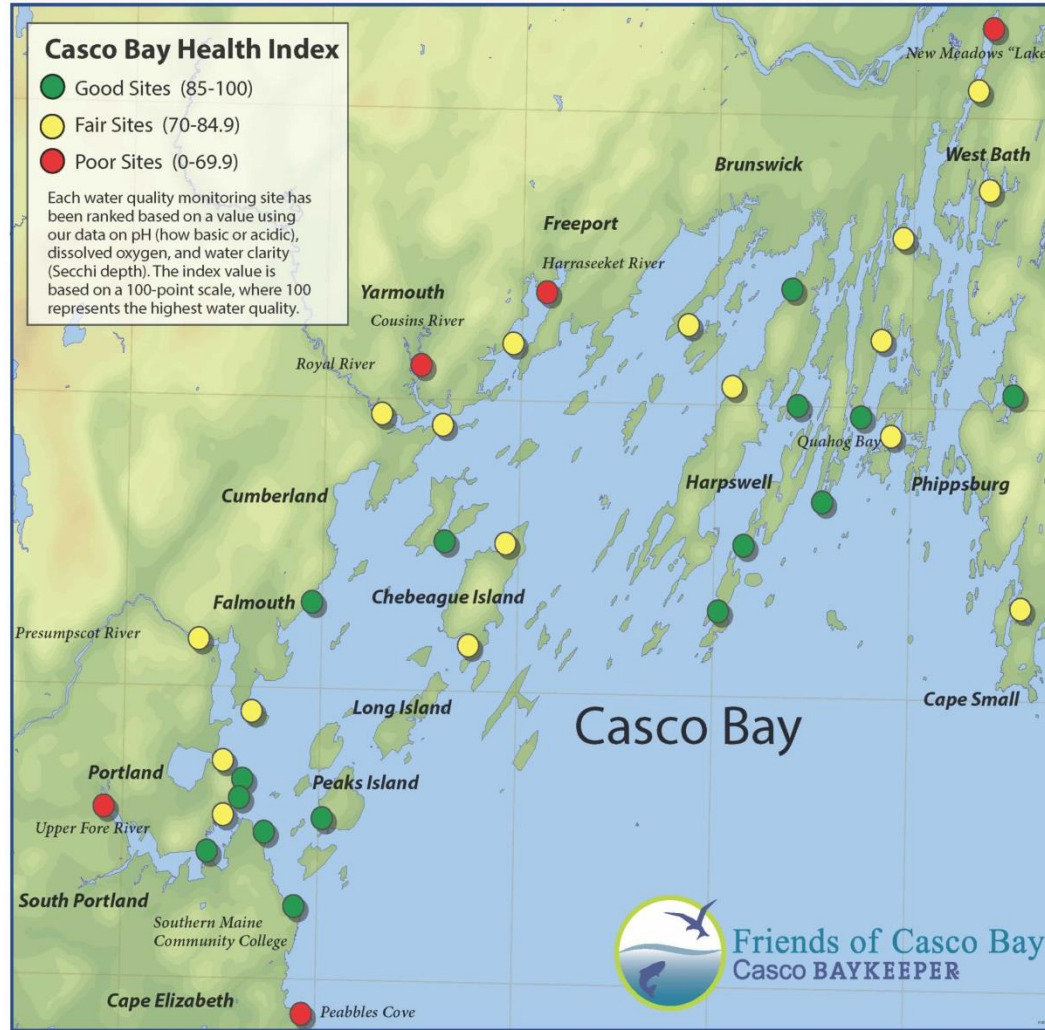




## Relationship Between pH and Dissolved Oxygen



# Spatial Trends

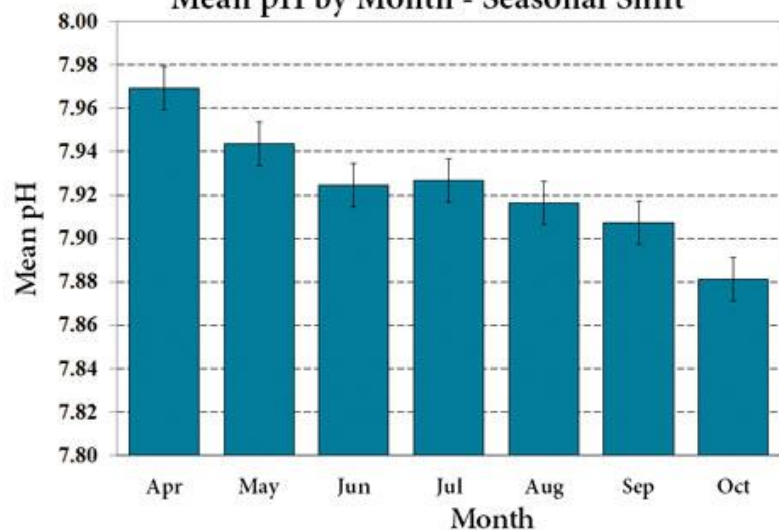




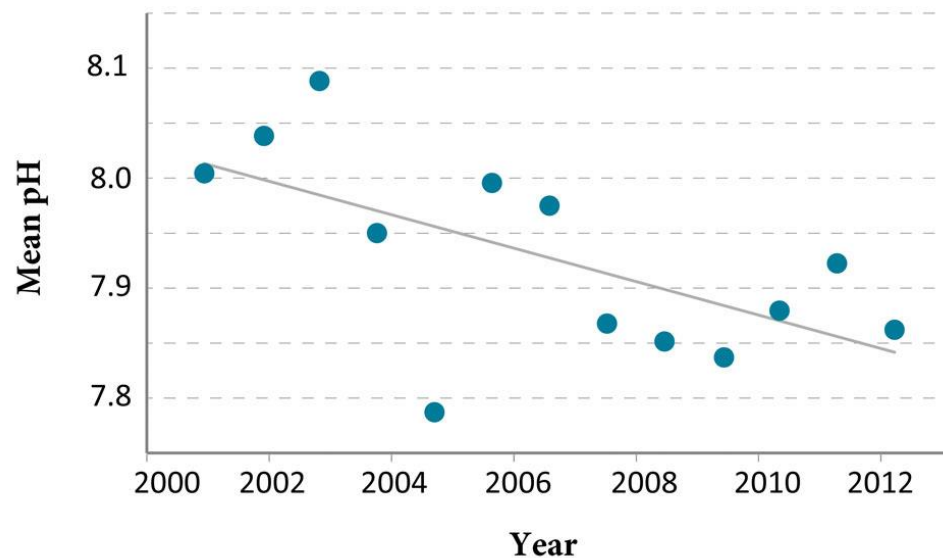
# Temporal Trends



Mean pH by Month - Seasonal Shift



Trend in pH: 2001-2013



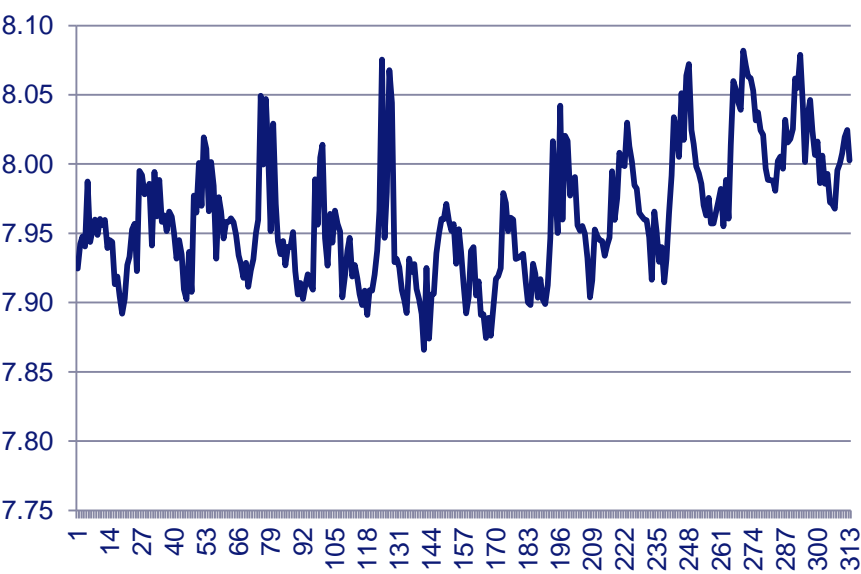
# SMCC Pier – Unattended Data Collection



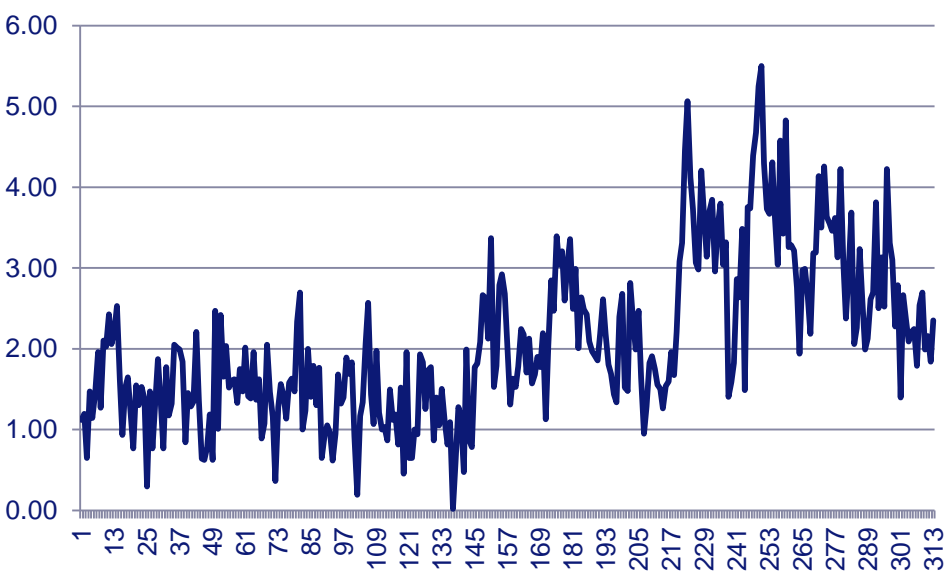


# SMCC Pier Hourly Data - September

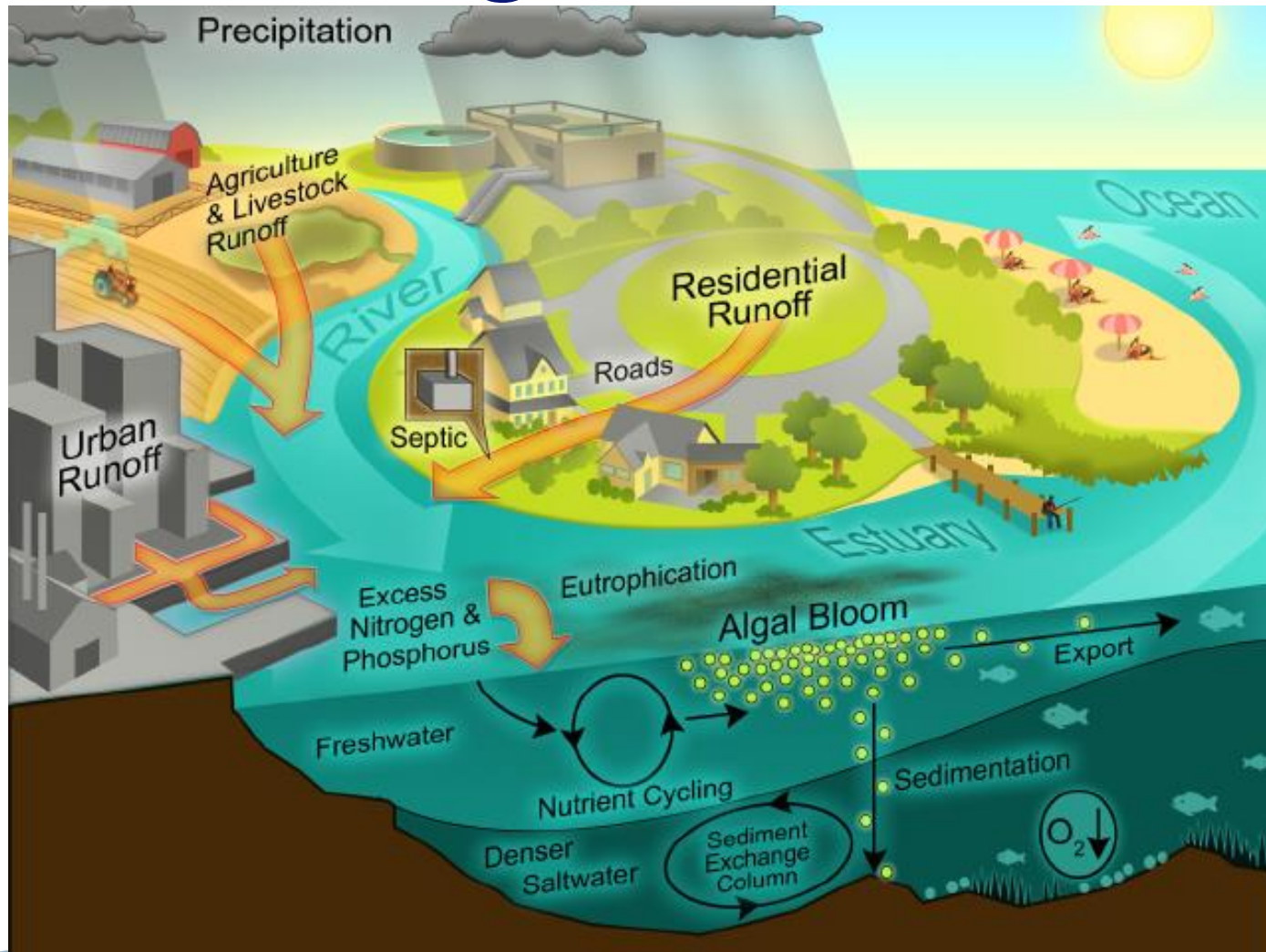
pH



Chlorophyll fluorescence

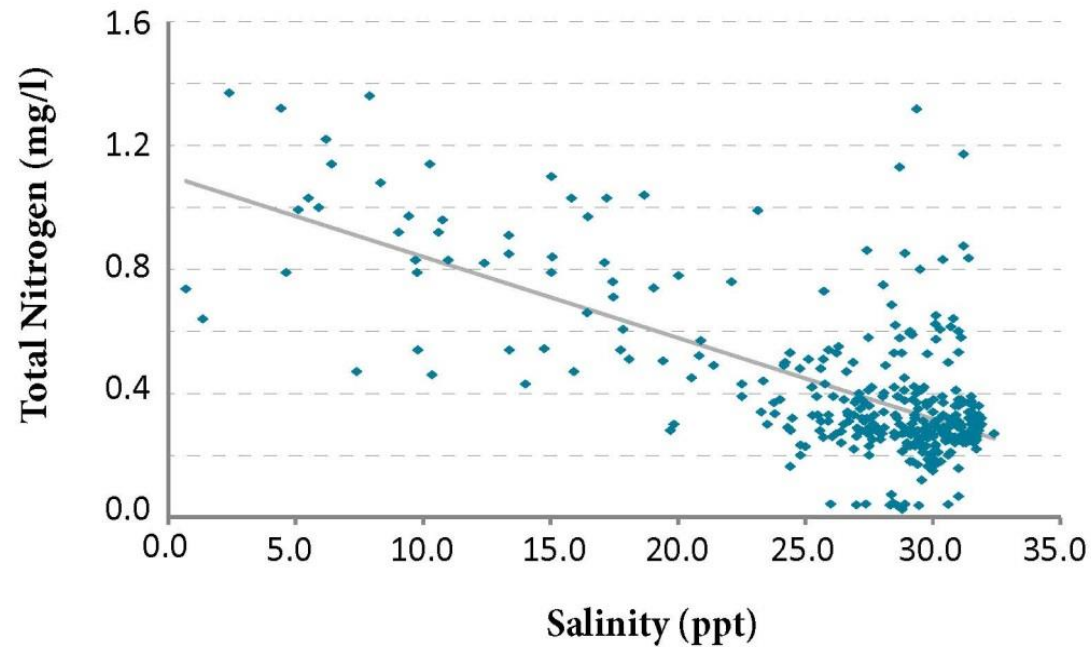


# Nitrogen Pollution





## Relationship Between Total Nitrogen and Salinity



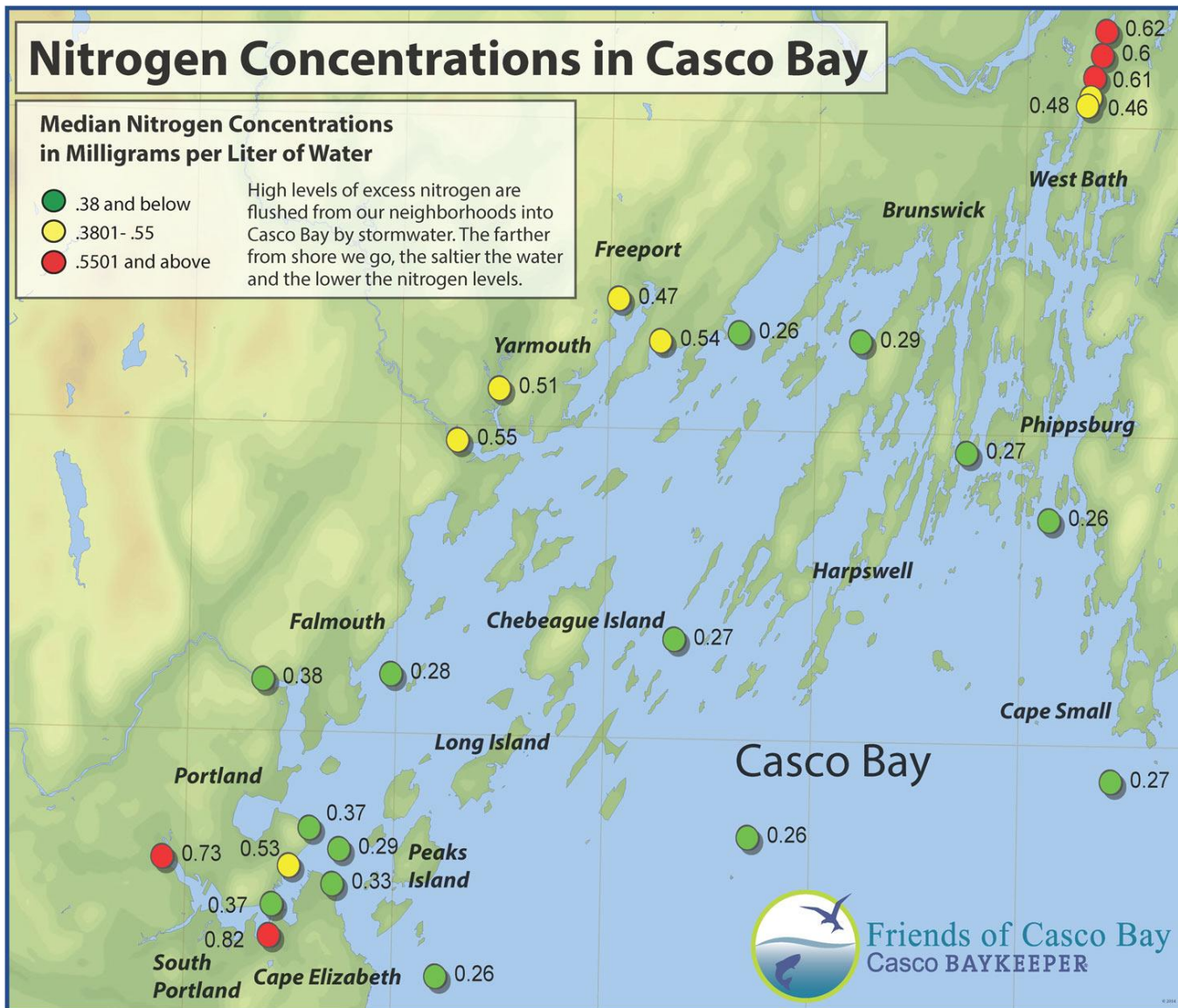


# Nitrogen Concentrations in Casco Bay

## Median Nitrogen Concentrations in Milligrams per Liter of Water

- .38 and below
- .3801 - .55
- .5501 and above

High levels of excess nitrogen are flushed from our neighborhoods into Casco Bay by stormwater. The farther from shore we go, the saltier the water and the lower the nitrogen levels.



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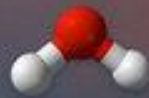
# OCEAN ACIDIFICATION

HOW WILL CHANGES IN OCEAN CHEMISTRY AFFECT MARINE LIFE?

CO<sub>2</sub> absorbed from the atmosphere



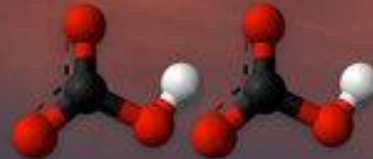
carbon dioxide



water



carbonate ion



2 bicarbonate ions

consumption of carbonate ions impedes calcification





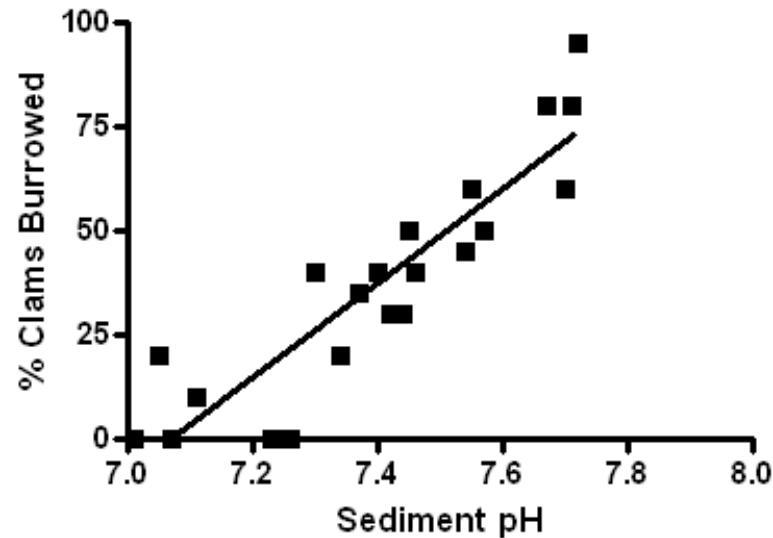






# Green et al, 2009

250-micron *Mercenaria mercenaria*

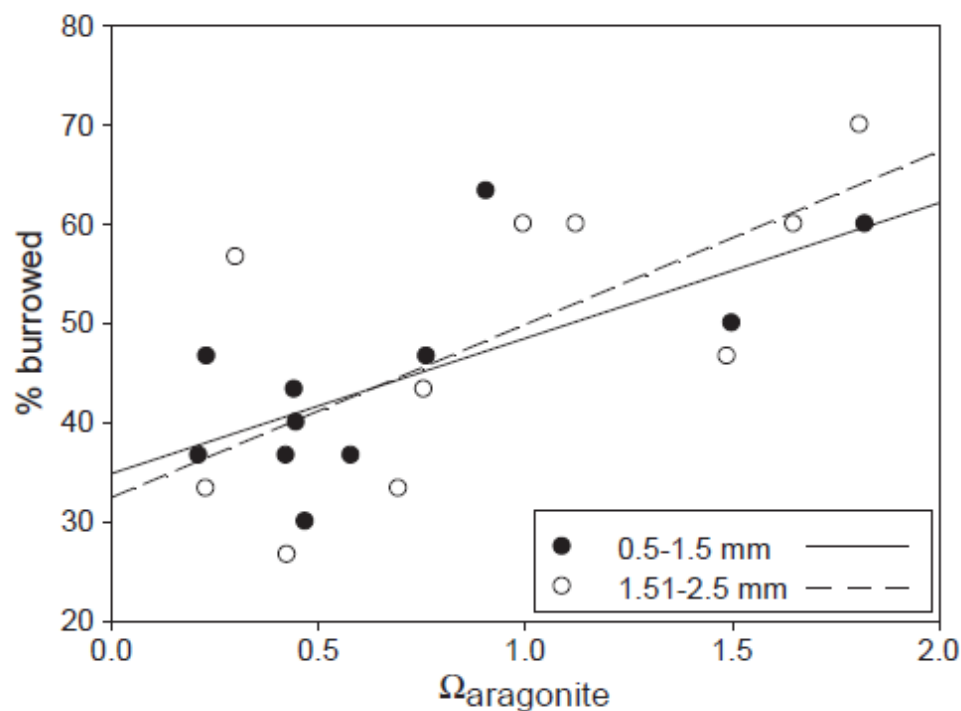


- % Clams Burrowed as a function of sediment pH. Clams were given 5 minutes to burrow after being placed on the sediment surface ( $r^2 = 0.82$ )





# Clements, 2014



**Fig. 4.** The relationship between % of *M. arenaria* burrowed (upright and anchored in sediment) within 20 min and surface-sediment  $\Omega_{\text{aragonite}}$  (top 1 mm) for two size classes of clams (0.5–1.5 mm and 1.51–2.5 mm). \* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .



# Green et al, 2009

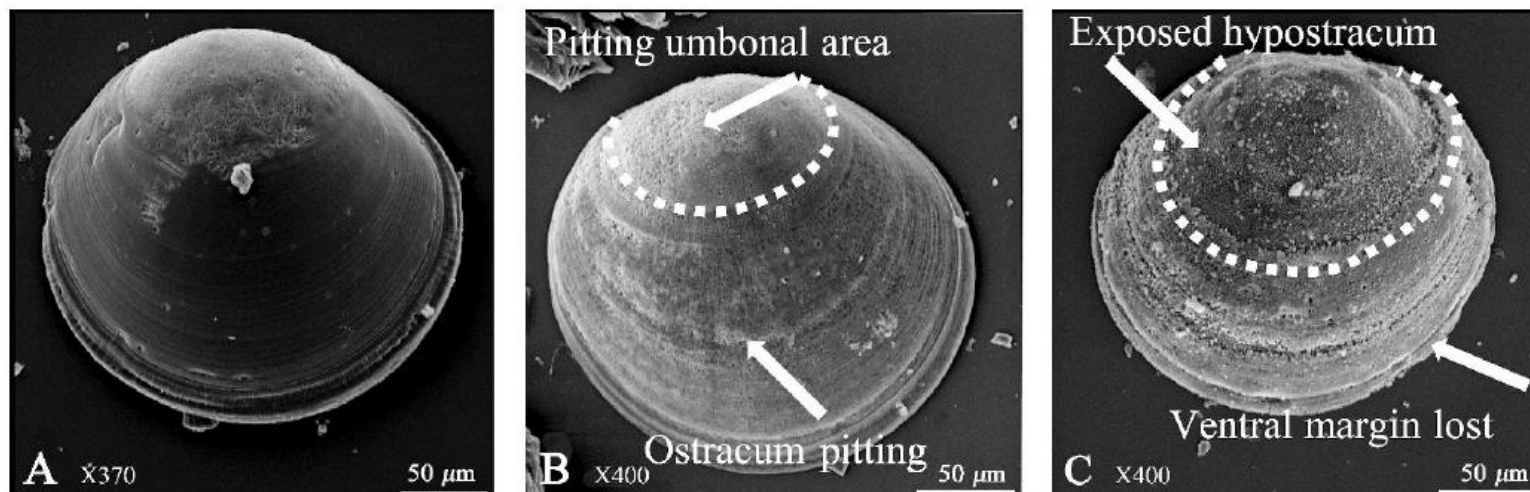


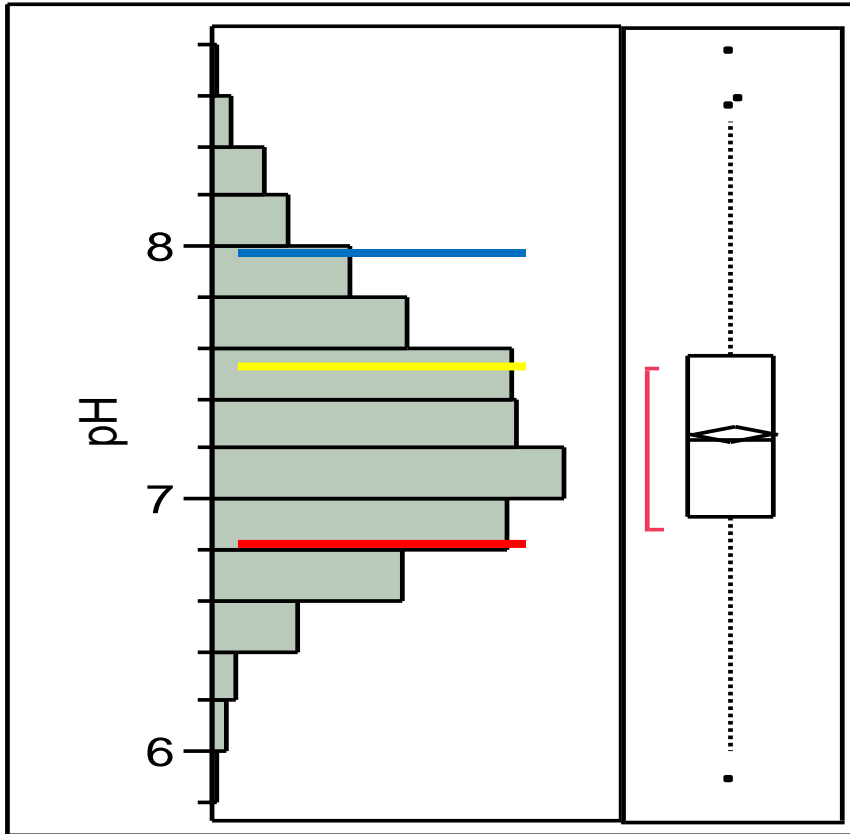
Fig. 7. Scanning electron micrographs (SEM) of representative 0.2-mm *M. mercenaria* reared in sediments maintained at  $\Omega_{\text{aragonite}} = 0.6$ . Clams were removed from sediment plugs at 0, 4, and 7 d (A, B, and C, respectively). Magnification and scale bars are shown, as well as significant effects to various parts of the shell.



# Sediment pH Protocol Development



# Sediment pH Distribution

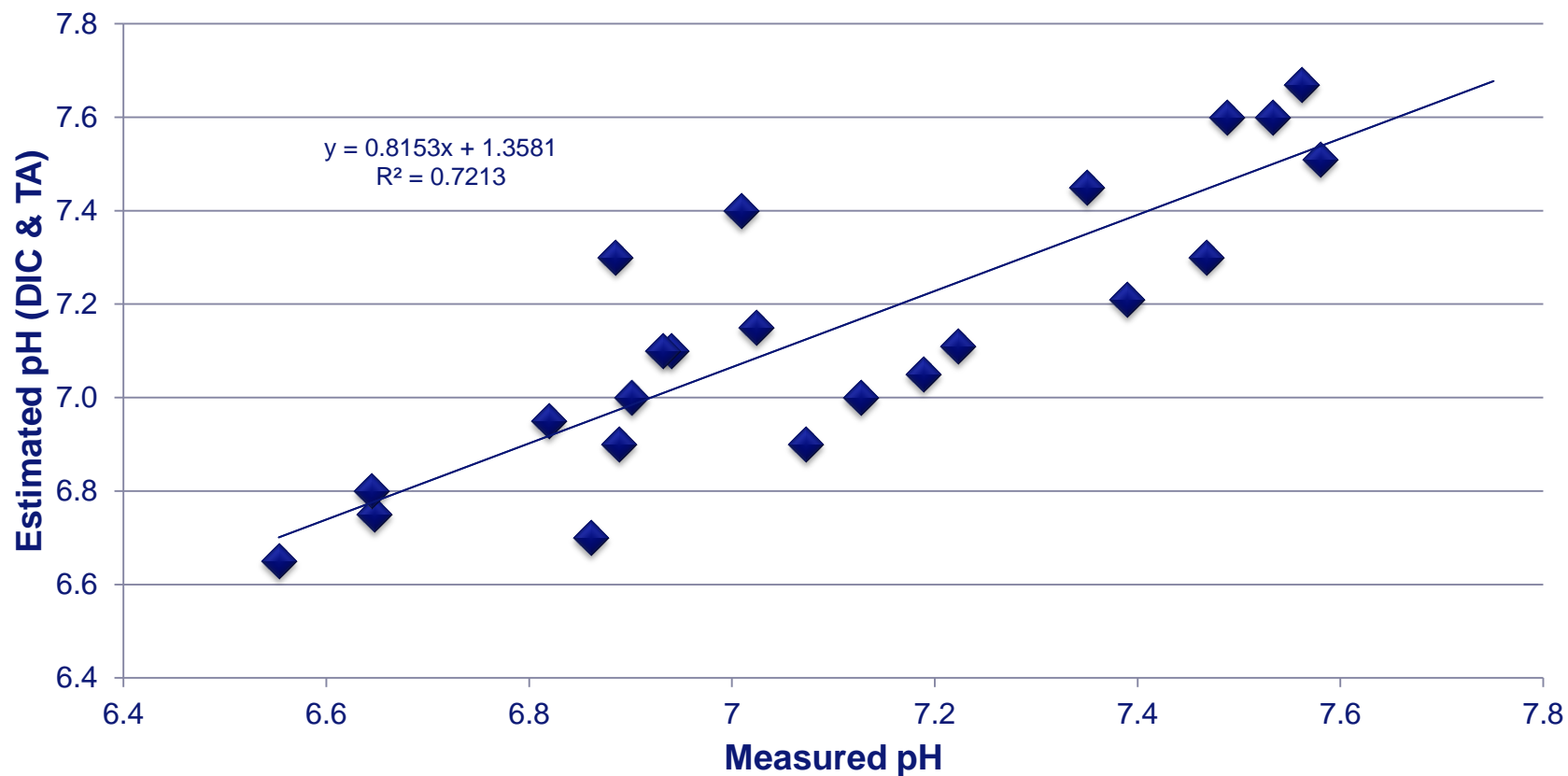


- Two years of sediment pH measurements, 2012-2013
- 1000 measurements
  - 75% fell below 7.5
  - 25% fell below 6.8



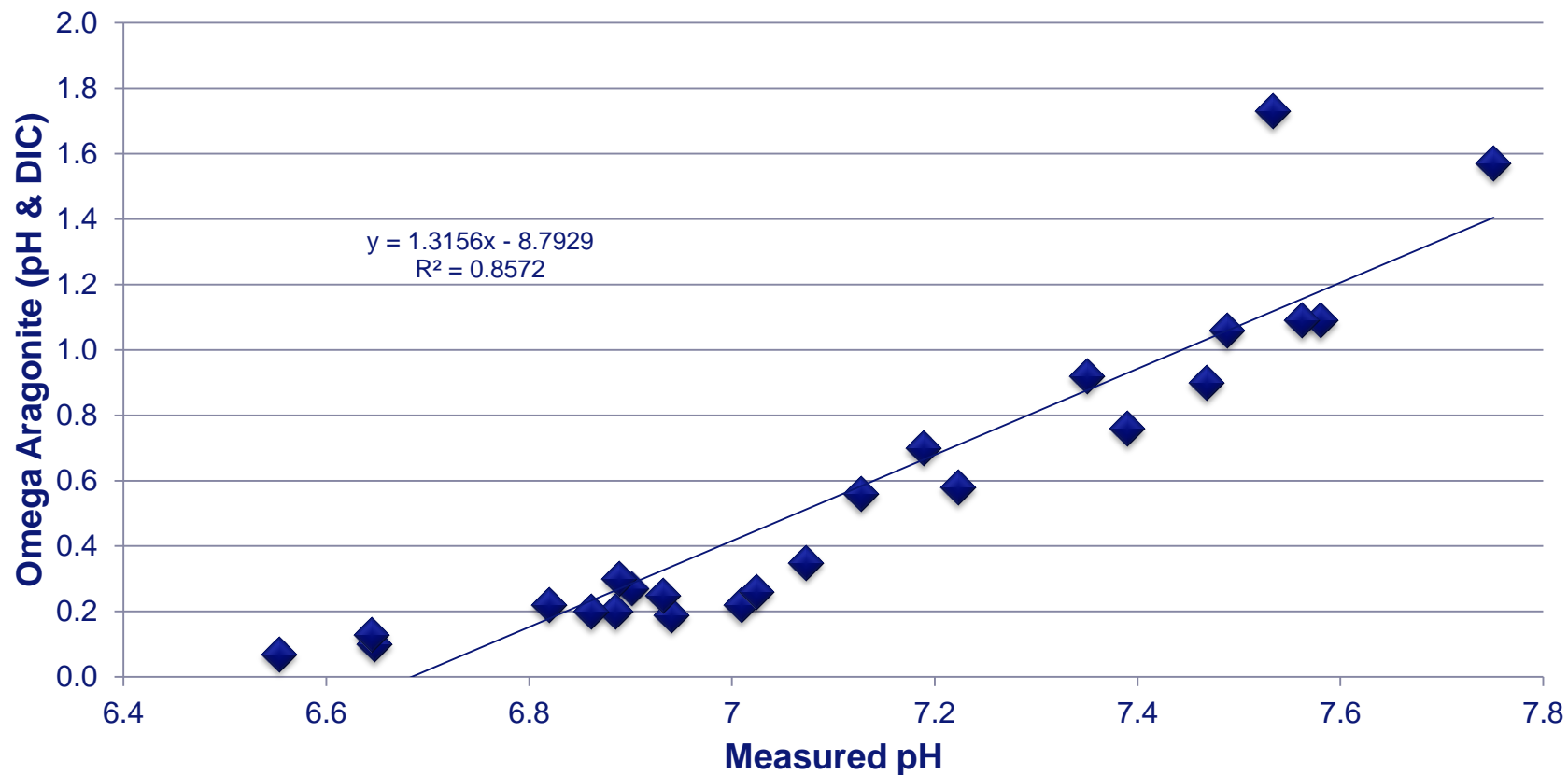


## Measured pH vs. Estimated pH





## Measured pH vs. Omega Aragonite







# Conclusions



- The Bay is changing...
- Friends of Casco Bay will continue to collect the most relevant data to better understand these changes.
- We will continue to focus on Nitrogen Pollution and Coastal Acidification.

