



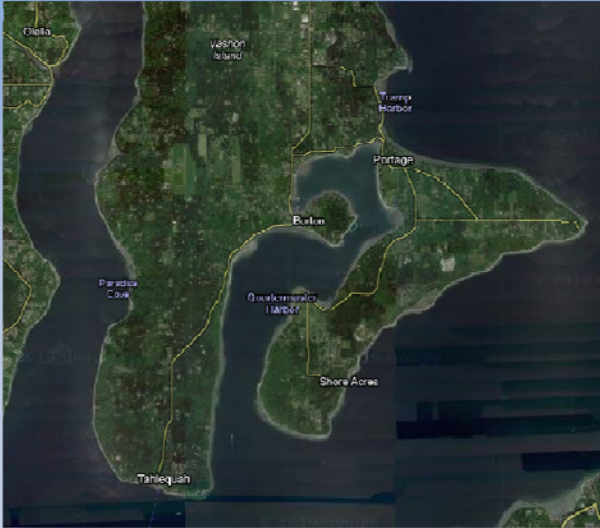
Effects of the 2009 El Niño event on Sea Surface Temperatures and *Alexandrium catenella* populations inside Quartermaster Harbor with investigation into the Pacific Decadal Oscillation

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Quartermaster Harbor



Picture of Quartermaster Harbor from Google Earth

- Located between Vashon Island and Maury Island
- Cut off from Admiralty Inlet
- Approximately 5 miles long covering nearly 1200 acres
- Known *A. catenella* 'Hot Bed'
 - More than 12,000 cysts cm^{-3}



Picture of Dockton Harbor taken from 48 North

Alexandrium catenella



- Dinoflagellate
- 9-13 degrees Celsius
 - Stratification
- Cells contain saxitoxin
 - Linked to PSP

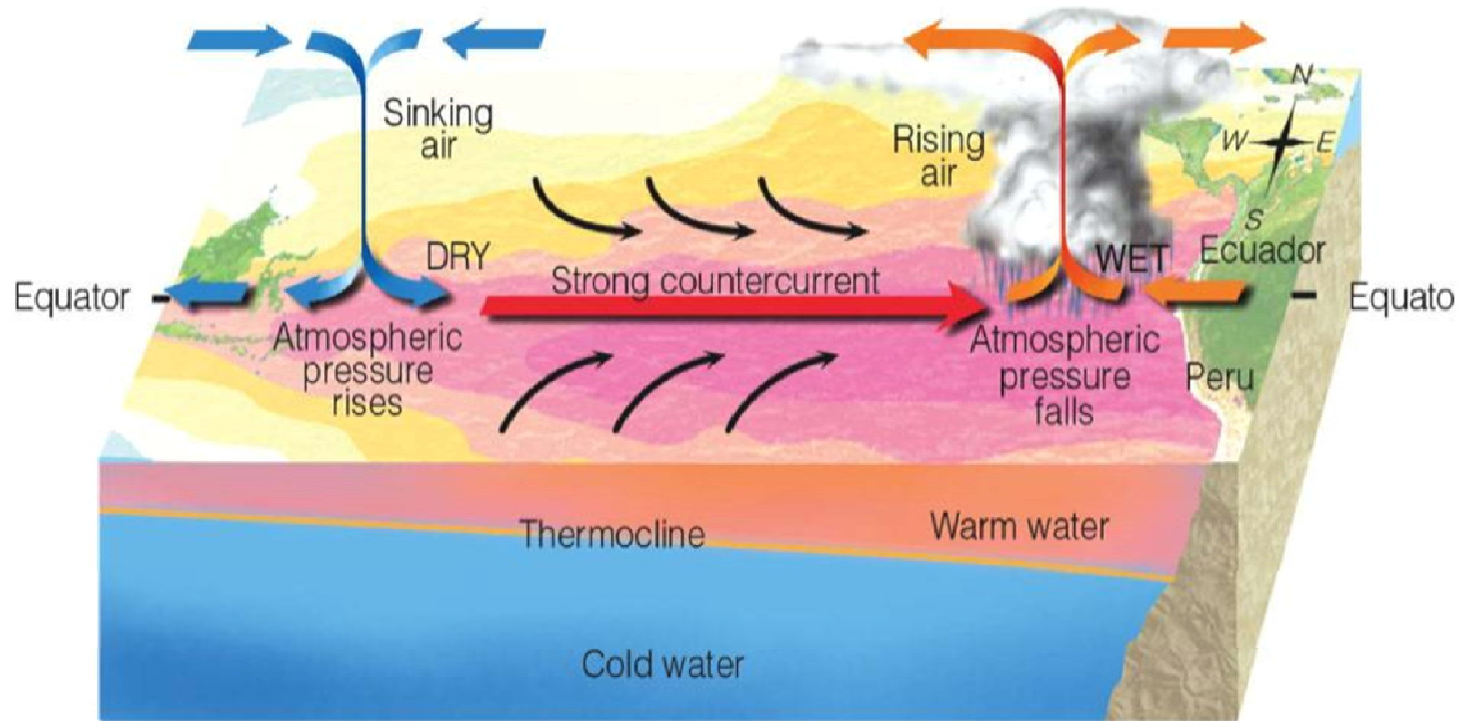
Purpose

- Investigate whether El Niño events could be used as an indicator of PST
- Previous Qualitative Studies
 - Increased SSTs
 - Increased Stratification
 - Greater levels of PST
- Recent Studies By Moore *et al.* (2009 & 2010)
 - No significant difference in PSTs
 - Closer links to shifts in the Pacific Decadal Oscillation
 - Other limiting factors of growth

Theory

El Niño would display a an increase in SSTs through increased SATs in Quartermaster Harbor compared to a 2008 base year, but have negligible affects on *Alexandrium catenella* populations. Similar effects would be displayed in the shifting of PDO from a 'cold' phase in 2009 to 'warm' phase in 2010.

El Niño

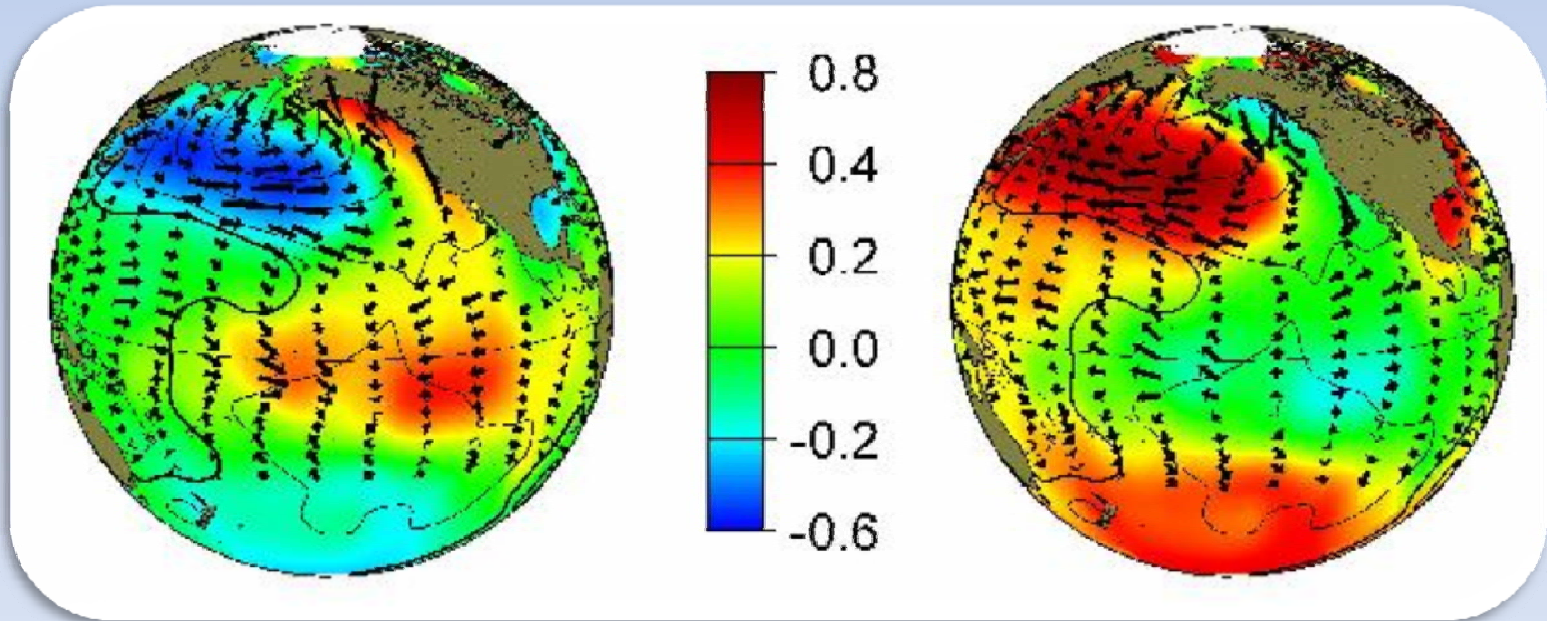


(b) El Niño Conditions

Pacific Decadal Oscillation (PDO)

Warm (Positive)

Cold (Negative)



Originally Taken From JISAO.washington.edu from work by Professor Mantua

Local Effects In Northwest

El Niño

vs

PDO

- Decreased Precipitation
 - Spring And Summer
 - Typically 9 Months
 - Increased Temperature
 - Extreme Weather
 - Drought in summer
 - Flooding in late fall
- Slightly Decreased Precipitation
 - Year round
 - Persist for decades
 - Increased temperature
 - SAT & SST
 - Not as extreme

Materials and Methods

- Conductivity, Temperature, Depth (CTD)
 - Also tests DO/Trans
 - Approximately monthly
 - Samples twice per second
- Weather Data (Campbell Scientific)
 - Precipitation
 - Wind speed & direction
 - Barometric Pressure
 - Temperature



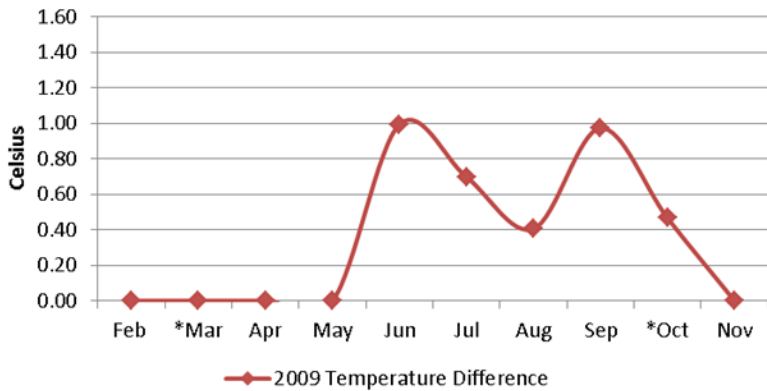
Seabird 19 Model CTD

Materials and Methods

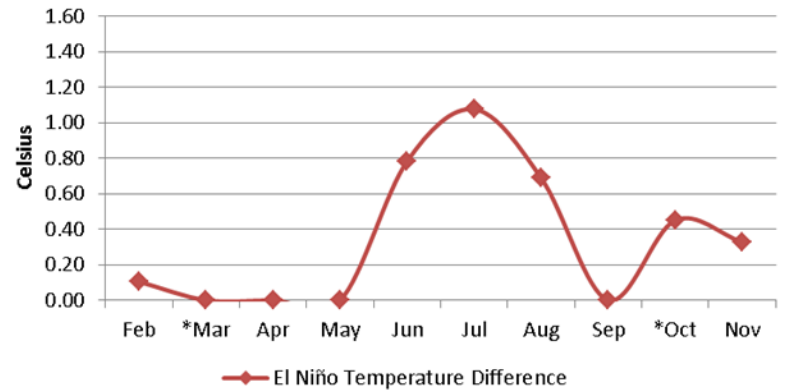
- Populations
 - Surface & thermocline
 - Niskin Bottle
 - Surface Drag Net
 - 5 & 25 micron filter
 - Counted
 - .1 mL Palmer Moloney slide
 - Standard microscopy

Results

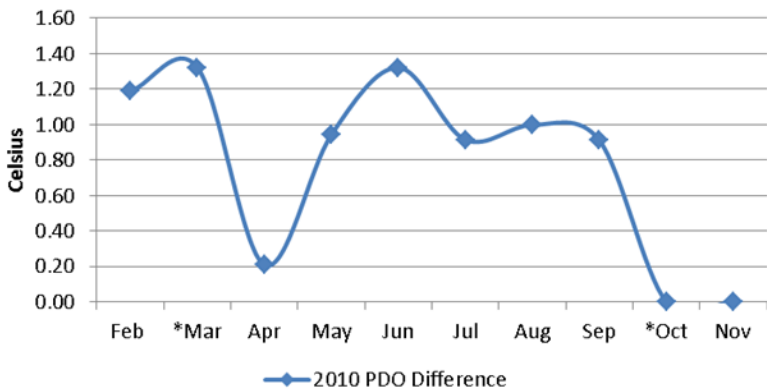
Thermocline SST Difference 08'-09'



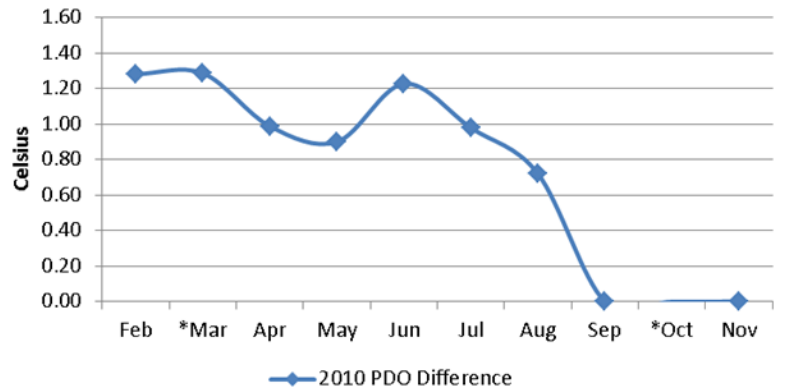
Bottom SST 08'-09'



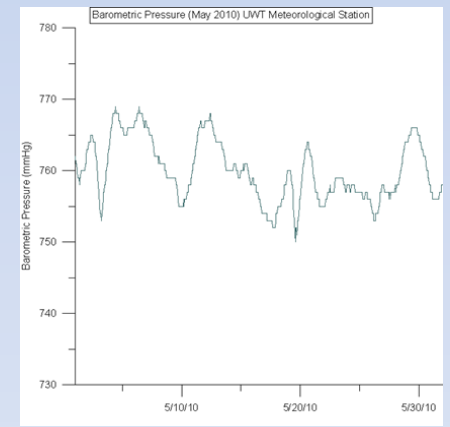
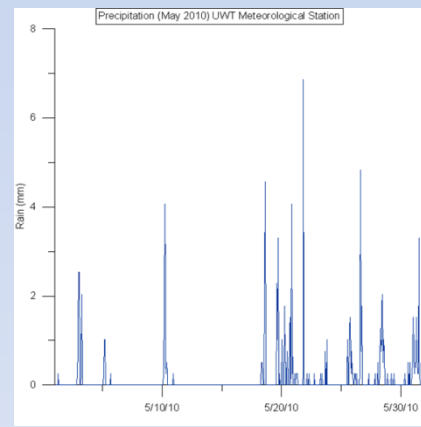
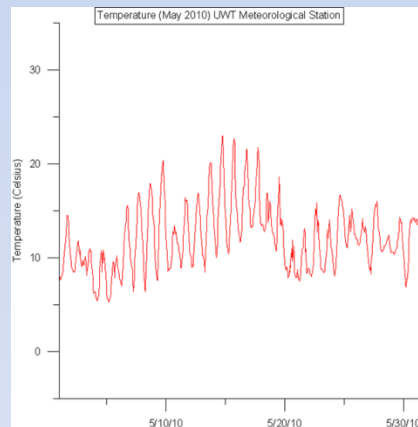
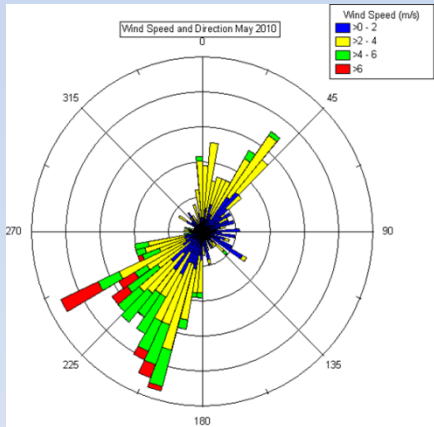
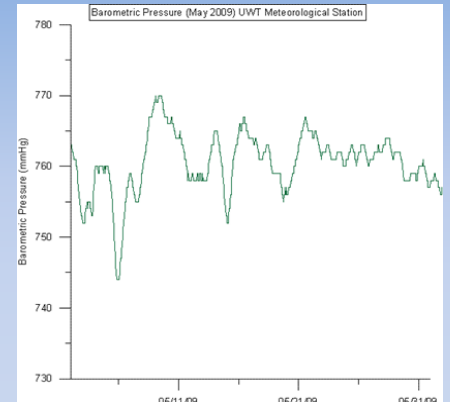
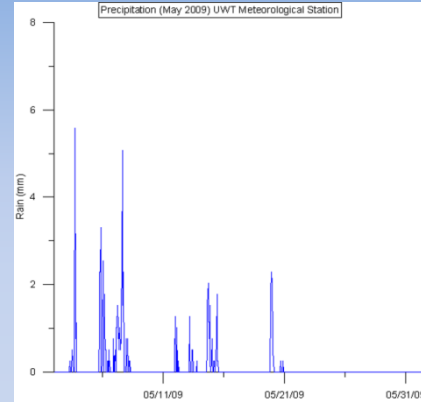
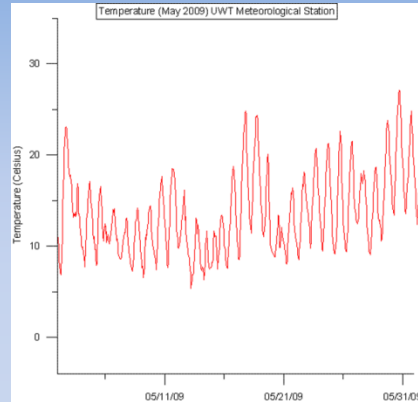
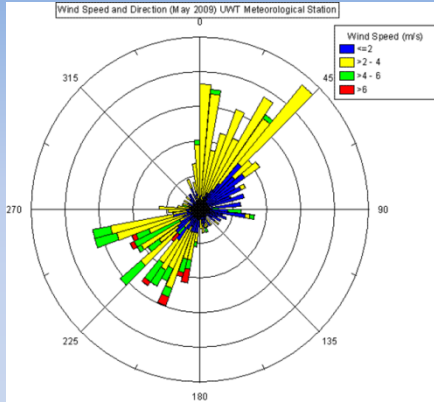
Thermocline SST 08' & 10'



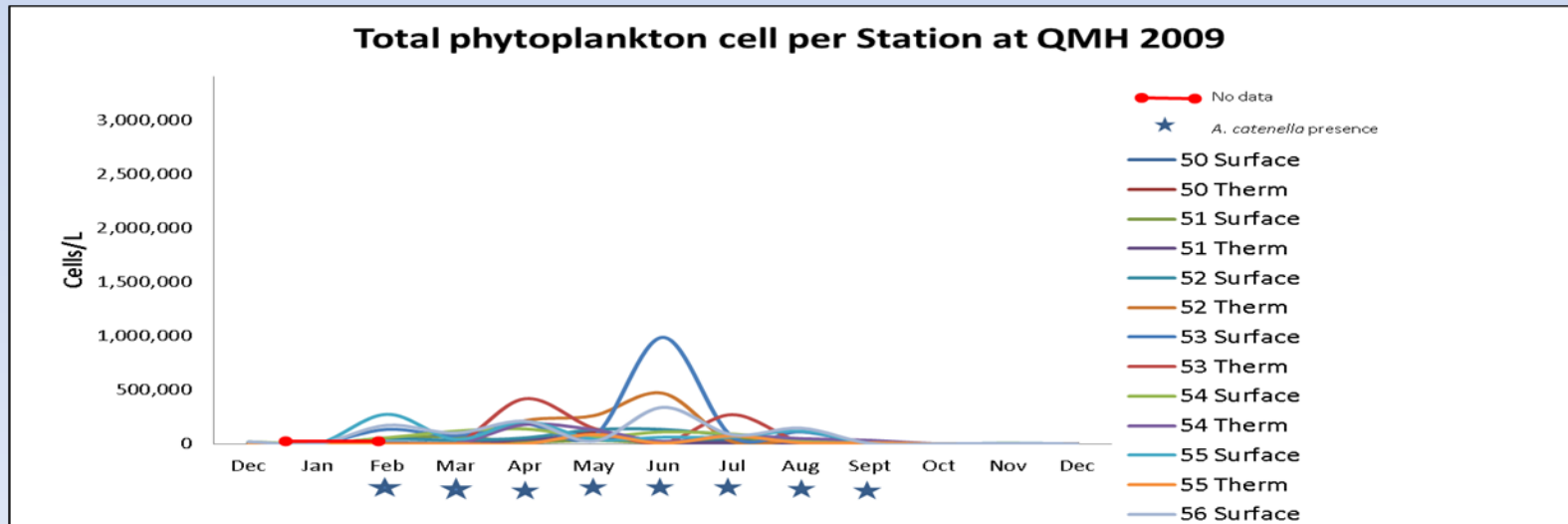
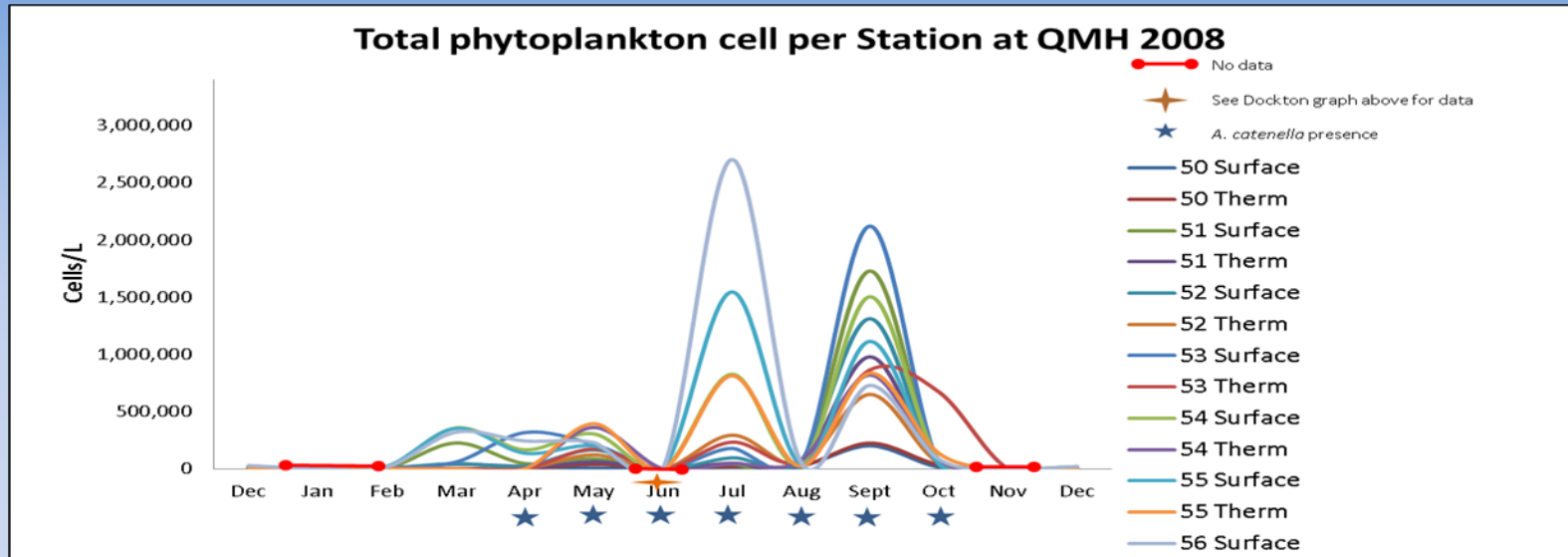
Bottom SST 08' & 10'



Results



Results



Discussion

- Difference in 2008 vs 2009 SSTs
- No real significant Difference between 2009 & 2010
 - PDO Shift?
- Reduced populations compared to base year
 - Shows earlier but leaves earlier
 - Possibly other limiting factors
- Some holes in the data
 - Bouy data compiled and reviewed this summer
 - Hopefully a more accurate picture

Conclusion

- NEED MORE DATA!
 - More base years
 - More El Niño years
 - More comparison studies over multiple PDO cycles
- As of current data, trend supports Stephanie Moore *et al.* 2010 theory of El Niño

Acknowledgments

- Professor Julie Masura
- Dr. Cheryl Greengrove
- Nanette, Julianne, Jeff Chrush & Chris
- Stephanie Moore (NOAA)

QUESTIONS??



I ❤️ Nudibranchs

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