

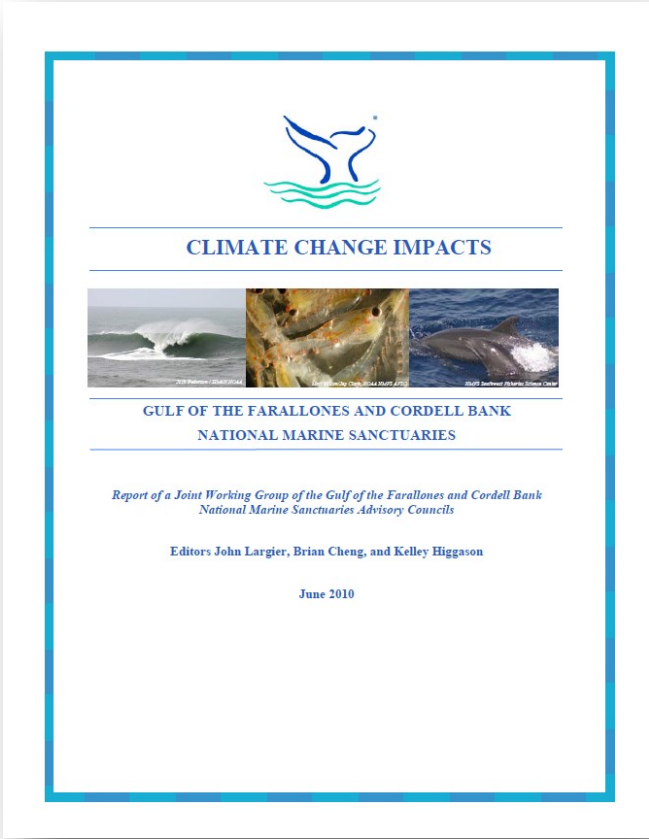
Climate Indicators in the Sanctuary

Meredith Elliott, Danielle Lipski, Jan Roletto, and Jaime Jahncke

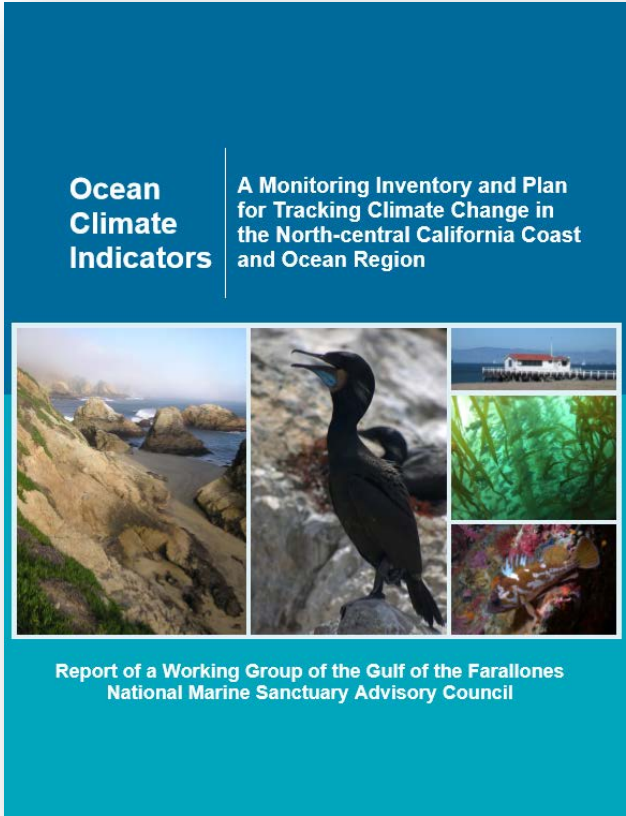
GFNMS SAC Retreat

October 1, 2020

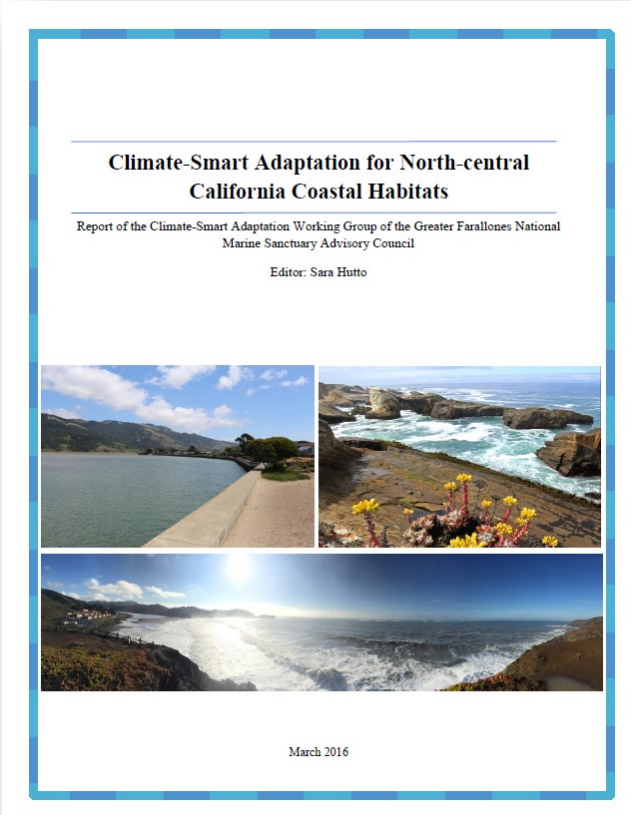
Choosing the Climate Indicators



Largier et al. 2010

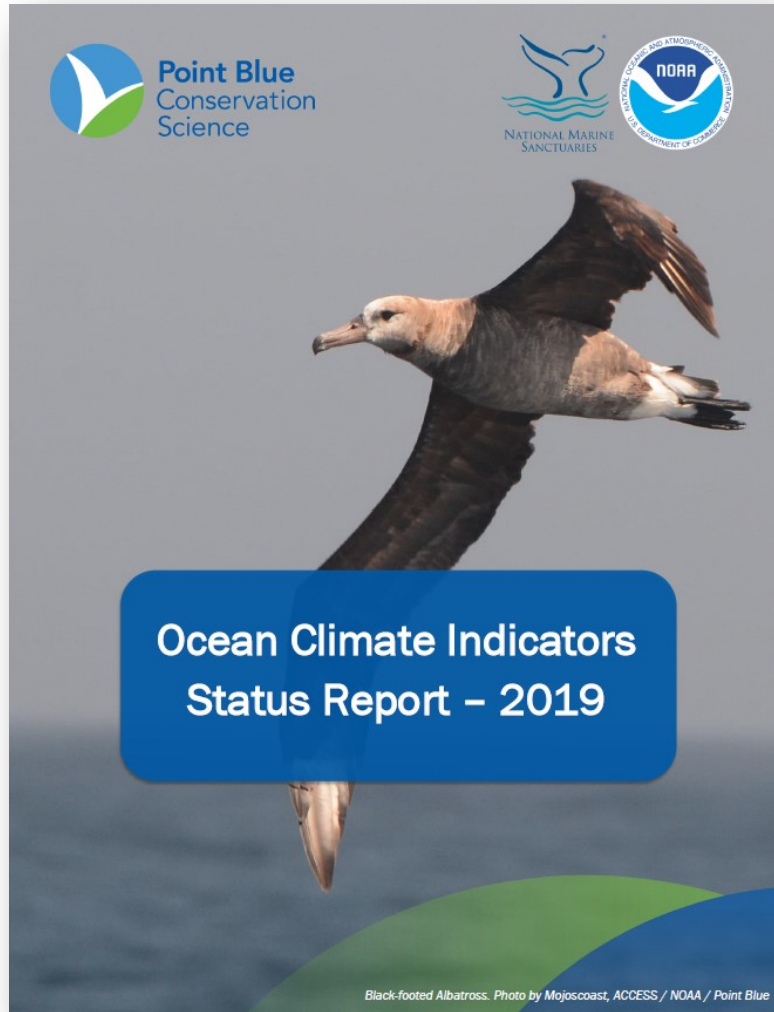


Duncan et al. 2013

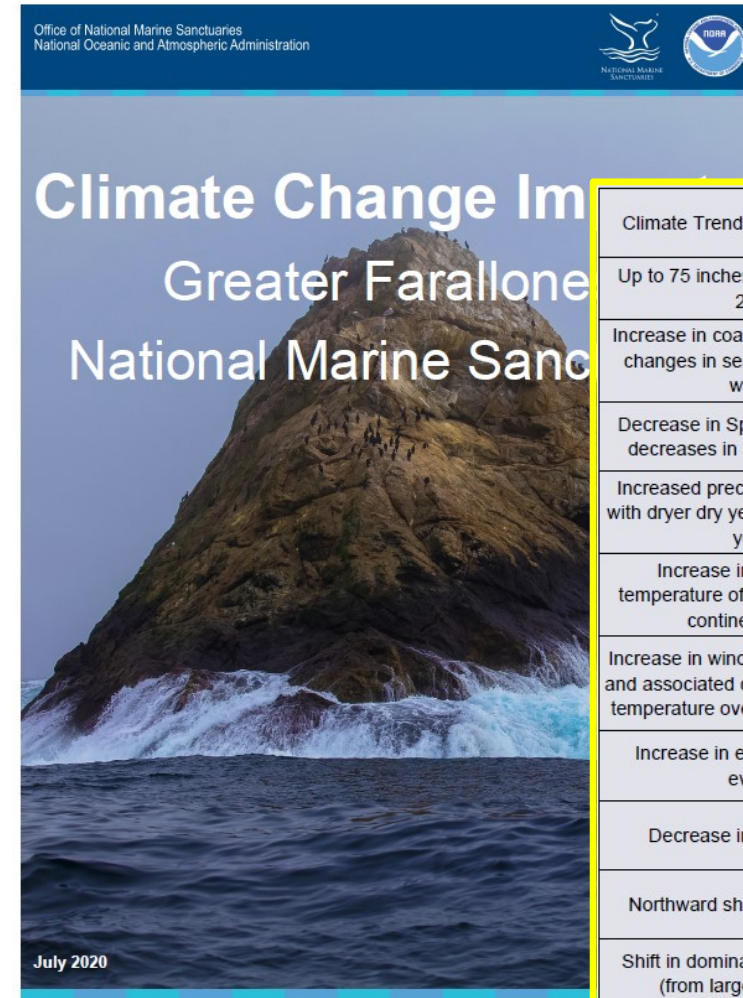


Hutto et al. 2016

Monitoring the Climate Indicators



Elliott et al. 2020



ONMS 2020

Climate Trend from 2010 report	Change since 2010 report	Source
Up to 75 inches sea level rise by 2100	↔	4
Increase in coastal erosion due to changes in sea level and storm waves	↔	7
Decrease in Spring runoff due to decreases in Sierra snowpack	↑	57
Increased precipitation variability with dryer dry years and wetter wet years	↗	14,15,60
Increase in sea surface temperature offshore and on the continental shelf	↑	34
Increase in winds driving upwelling and associated decrease in surface temperature over continental shelf	↔	35,36
Increase in extreme weather events	↔	7,14,15,60
Decrease in seawater pH	↑	65,72
Northward shift in key species	↗	40,48
Shift in dominant phytoplankton (from larger to smaller)	↗	40
Climate impacts compounded by other human impacts	↔	

ACCESS

Research that supports marine wildlife conservation and healthy marine ecosystems to inform management, policy and conservation in central CA

Founders:



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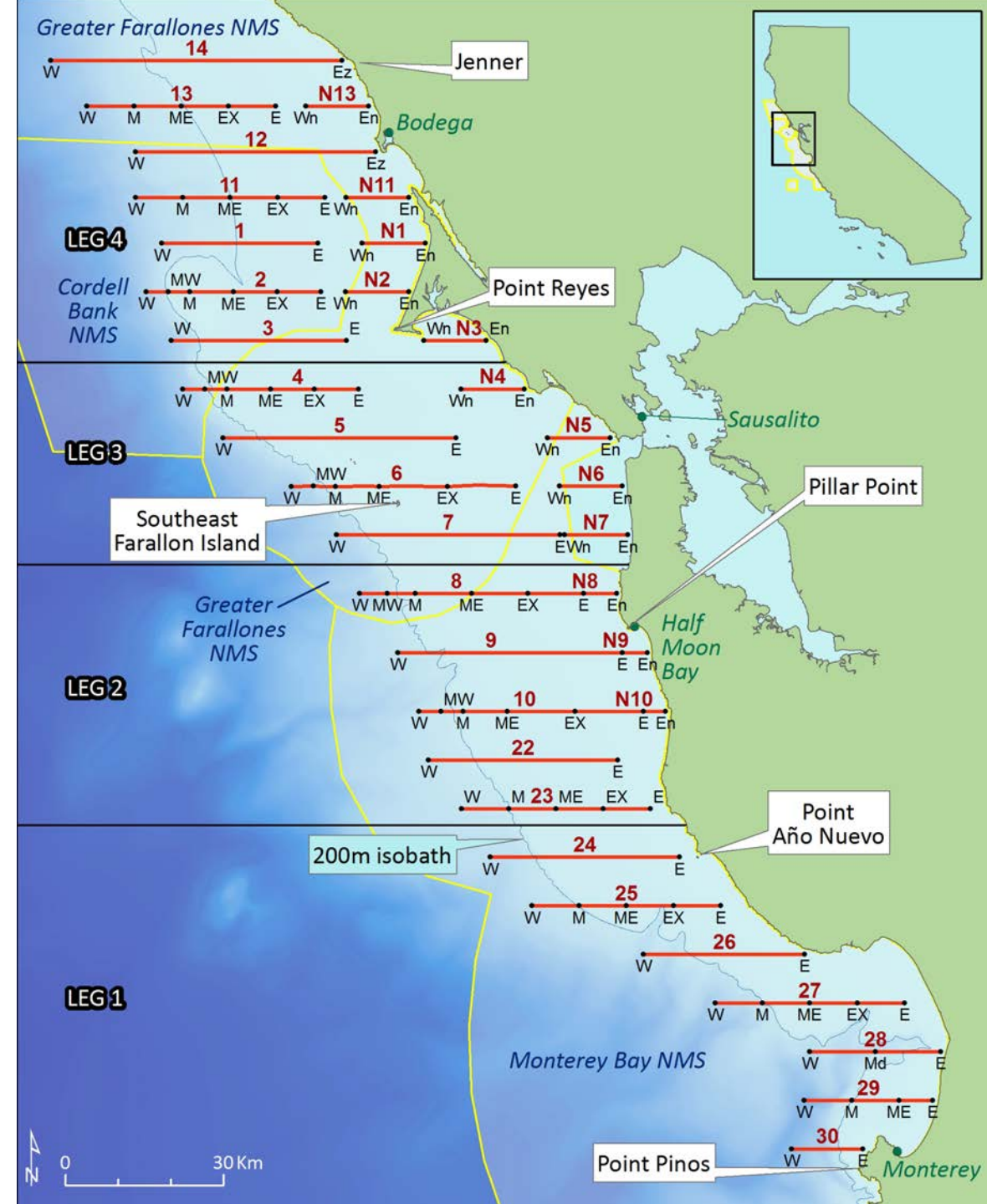
HAWAII PACIFIC UNIVERSITY
HOLONA ME KA OIHO



POMONA
COLLEGE

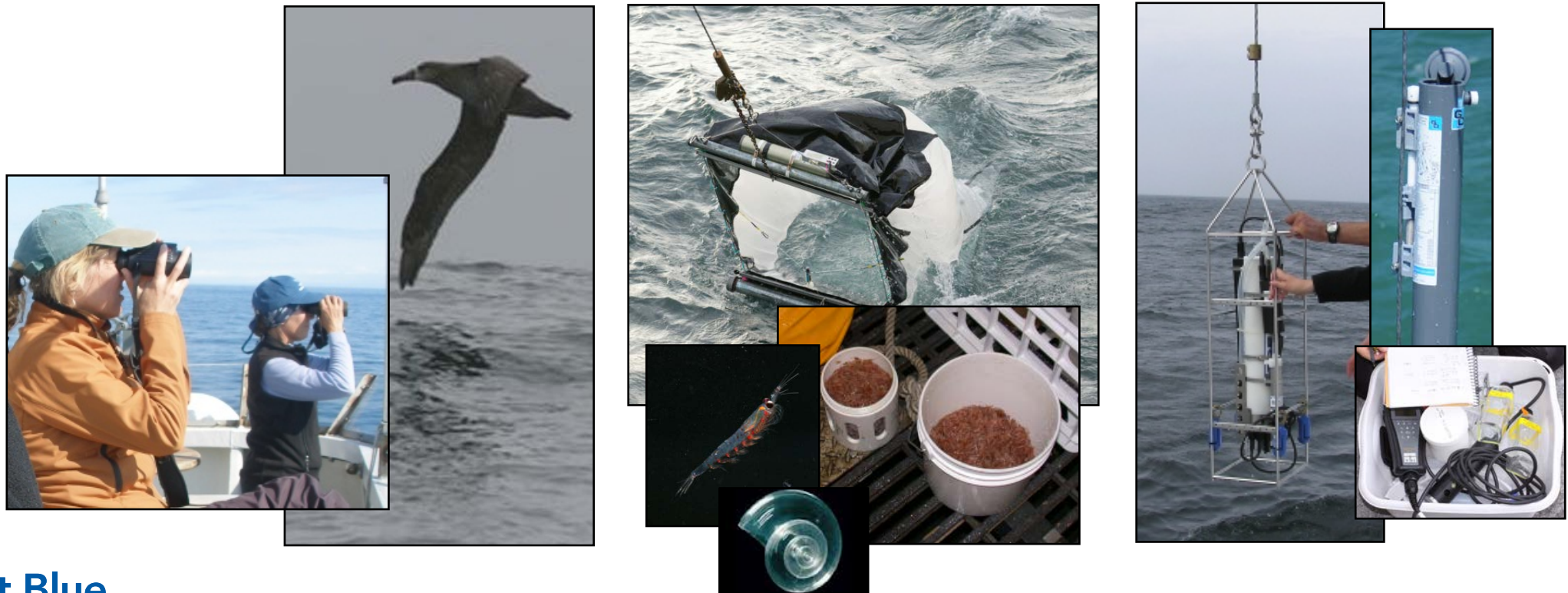


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Research takes ecosystem approach

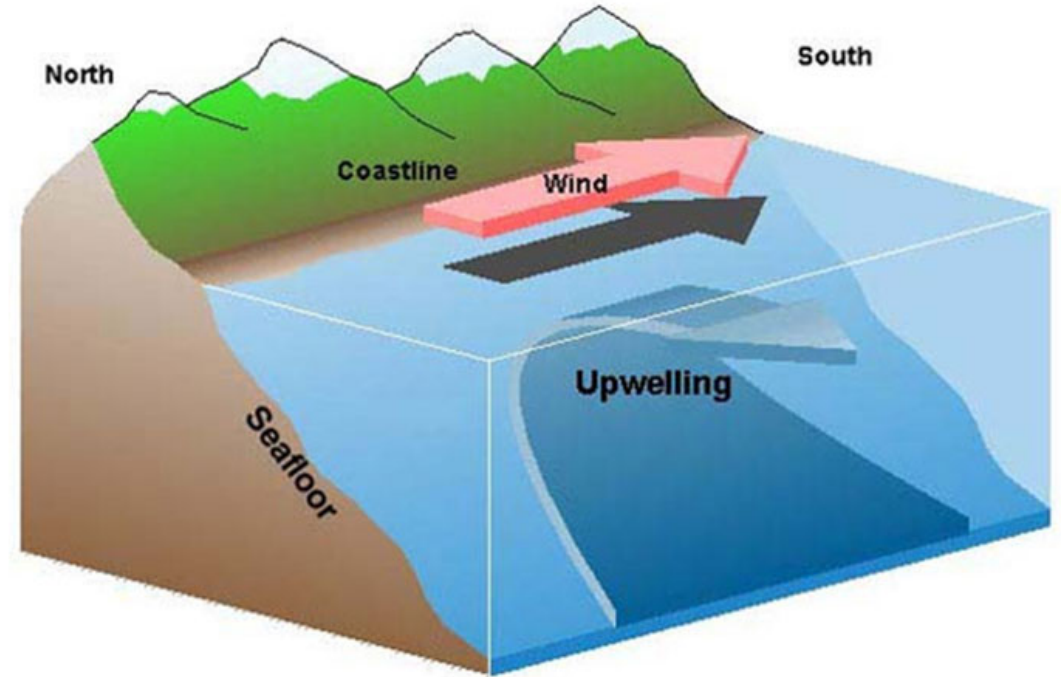
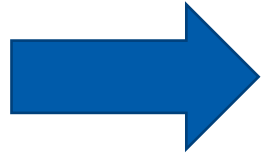
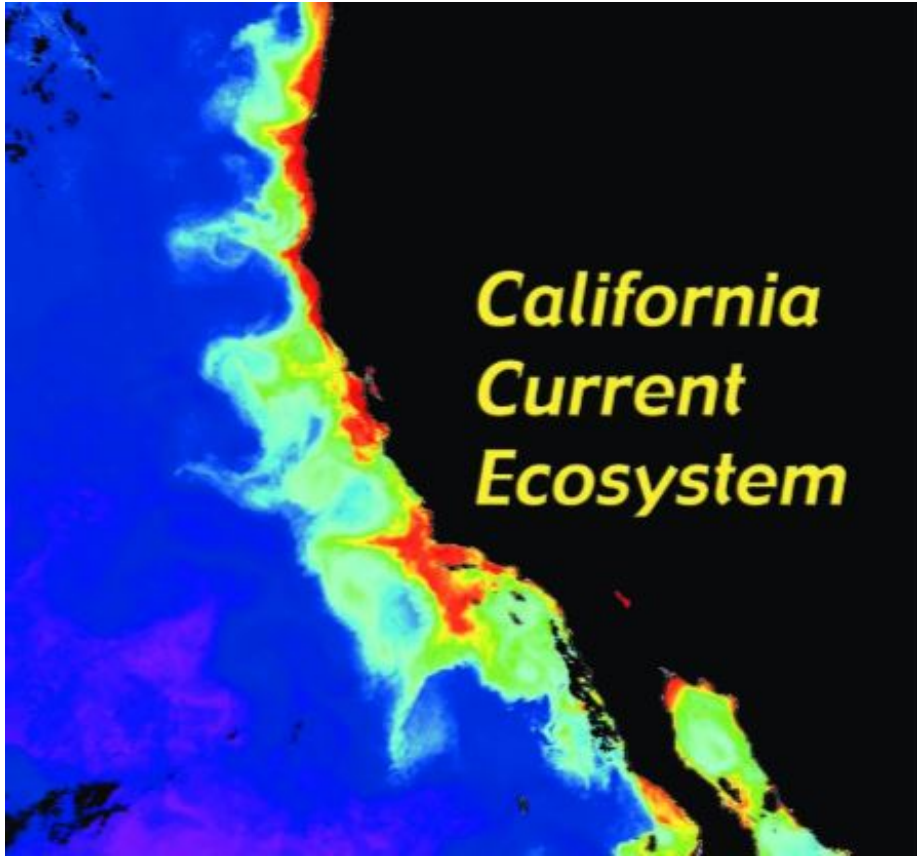
- Birds/mammals (standardized strip and line transects)
- Zooplankton/fish (hydroacoustics and nets)
- Oceanography (CTD, OA, nutrients, and continuous TSG)



ACCESS data includes:

Dataset	Years	Description	Collaborations
<u>CONTINUOUS DATA</u>			
Water properties (TSG)	2004 – present	Surface temperature, salinity, and fluorescence	NASA
Hydro acoustics	2004 – present	Acoustic abundance of krill and fish	
Bird and mammals	2004 – present	Strip and line transect counts of birds and mammals	EOS
<u>STATION DATA</u>			
Water properties (CTD)	2004 – present	Temperature, salinity, dissolved oxygen, fluorescence, etc.	BML, CeNCOOS, EOS, NASA
Nutrients	2005 – present	Surface nitrates, phosphates, and silicates	CeNCOOS, EOS
Acidification	2010 – present	pH and total alkalinity	BML, EOS
Phytoplankton	2010 – present	Phytoplankton species in surface waters	SFEI
Zooplankton (hoop nets)	2004 – present	Zooplankton species in surface waters (<50 m)	BML, CeNCOOS, EOS
Krill (Tucker trawls)	2004 – present	Krill species and age classes in deep waters	BML, CeNCOOS, EOS

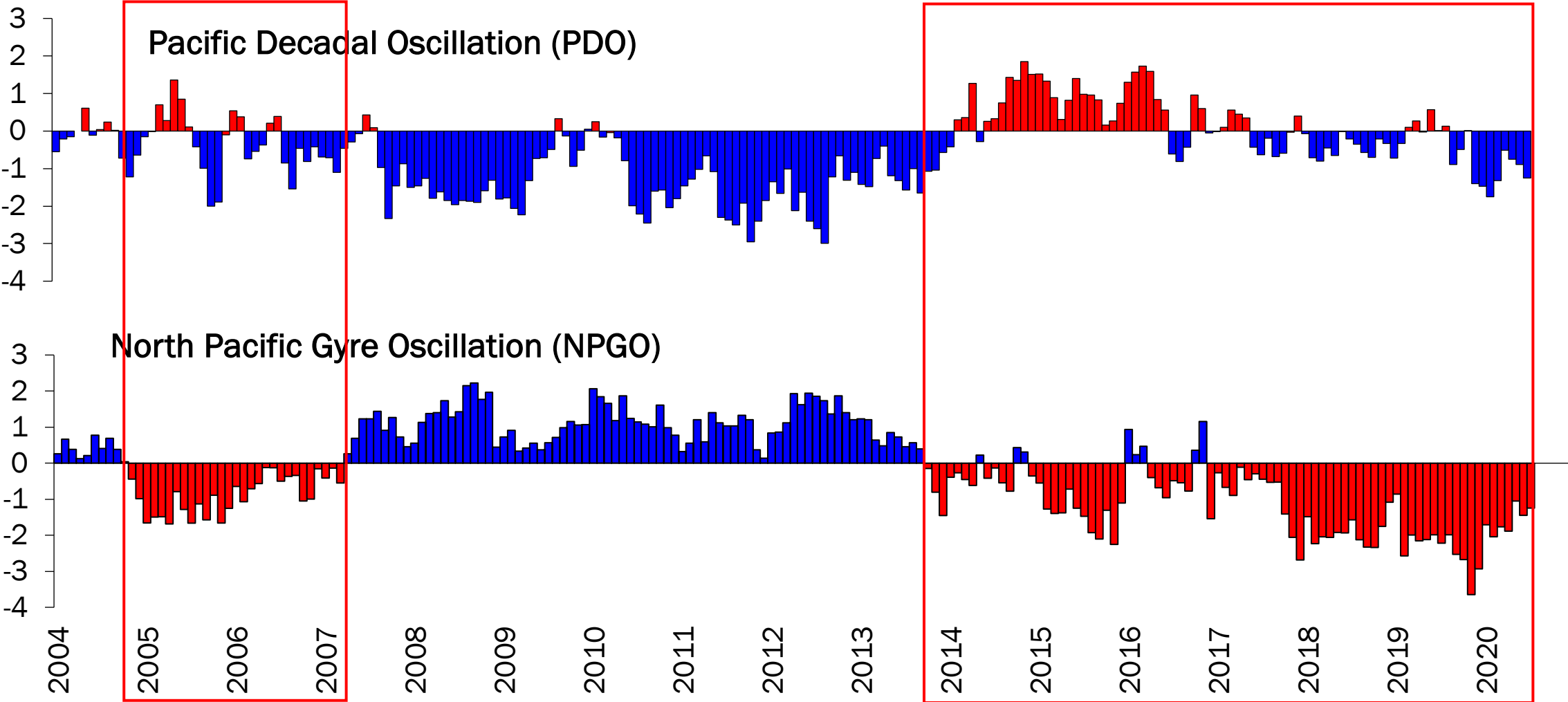
California Current Ecosystem



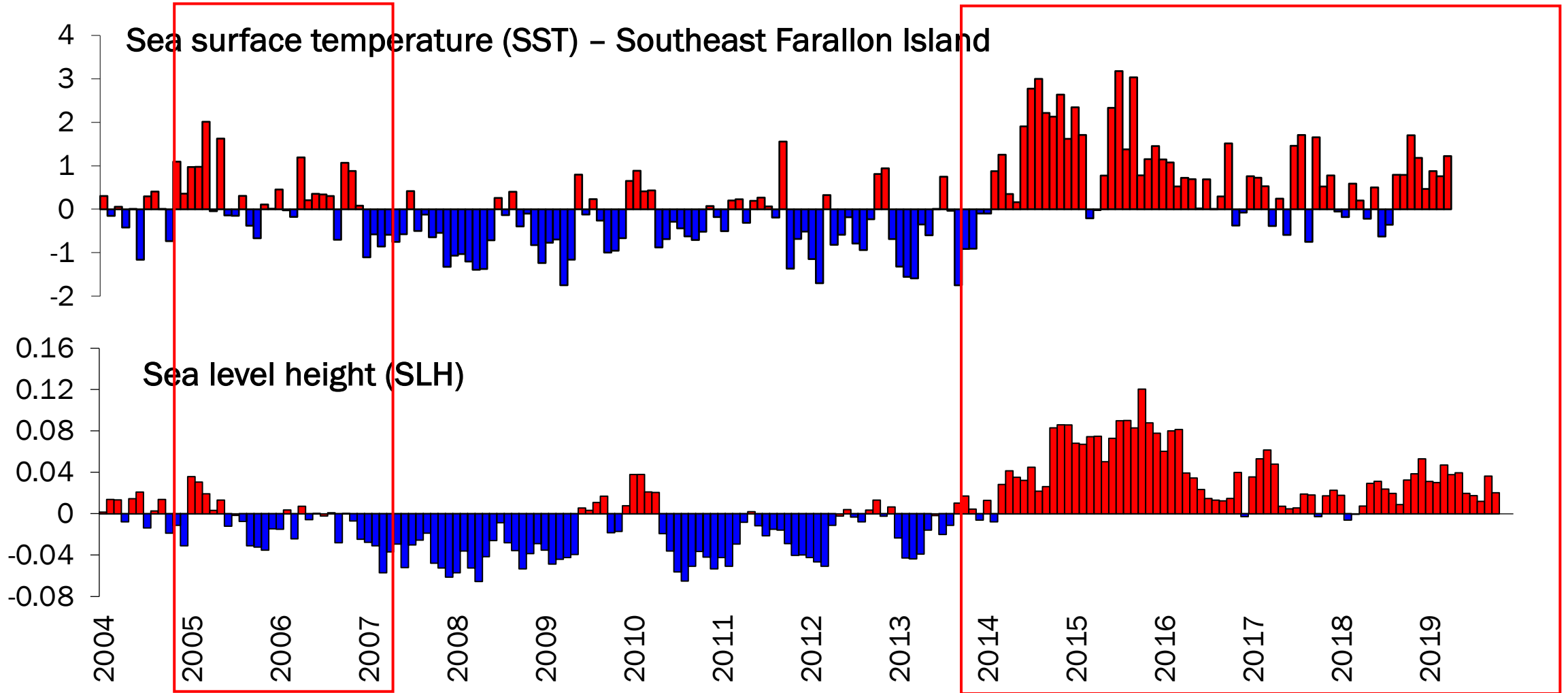
<https://lternet.edu/site/california-current-ecosystem-lter/>

<https://oceanexplorer.noaa.gov/facts/upwelling.html>

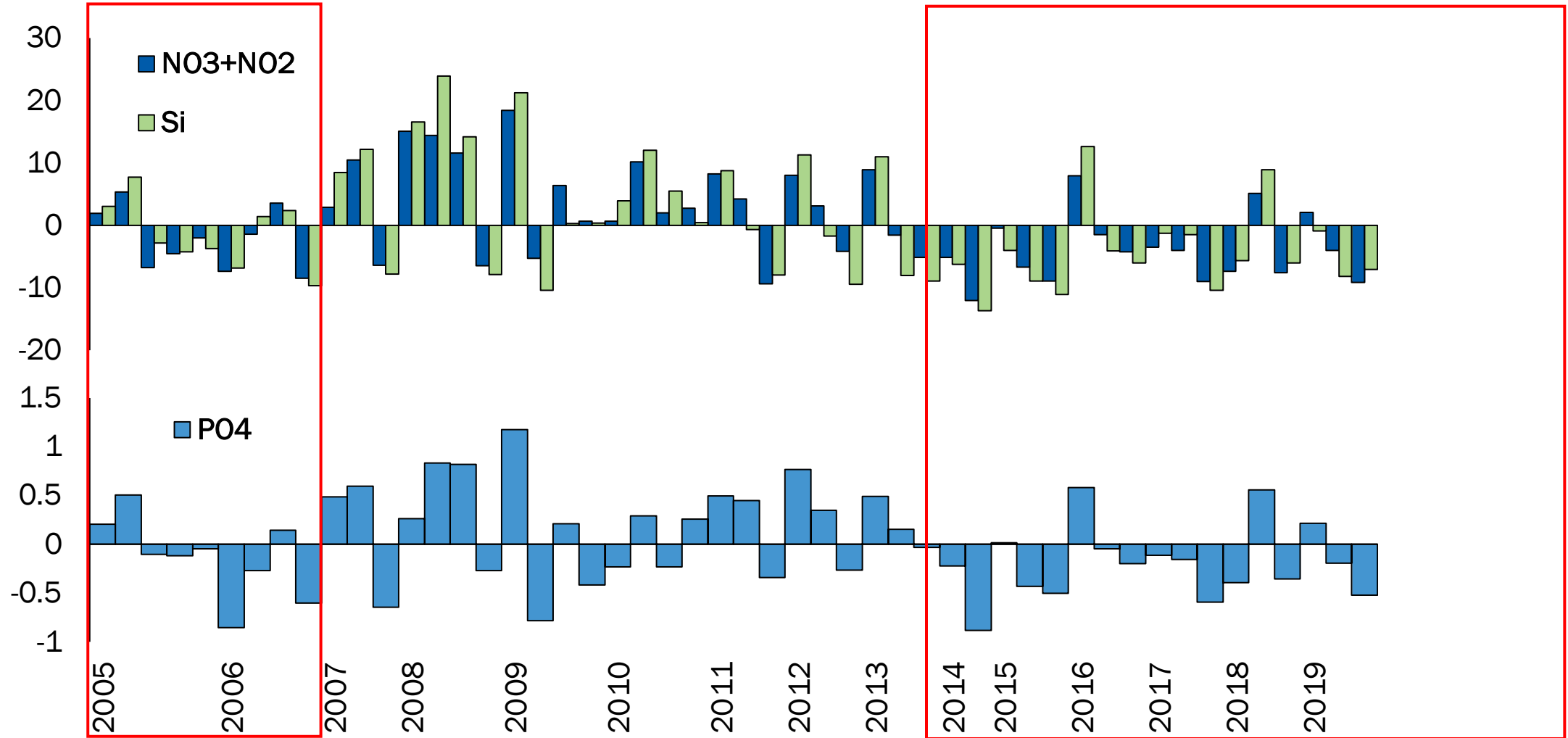
Climate indices: PDO and NPGO



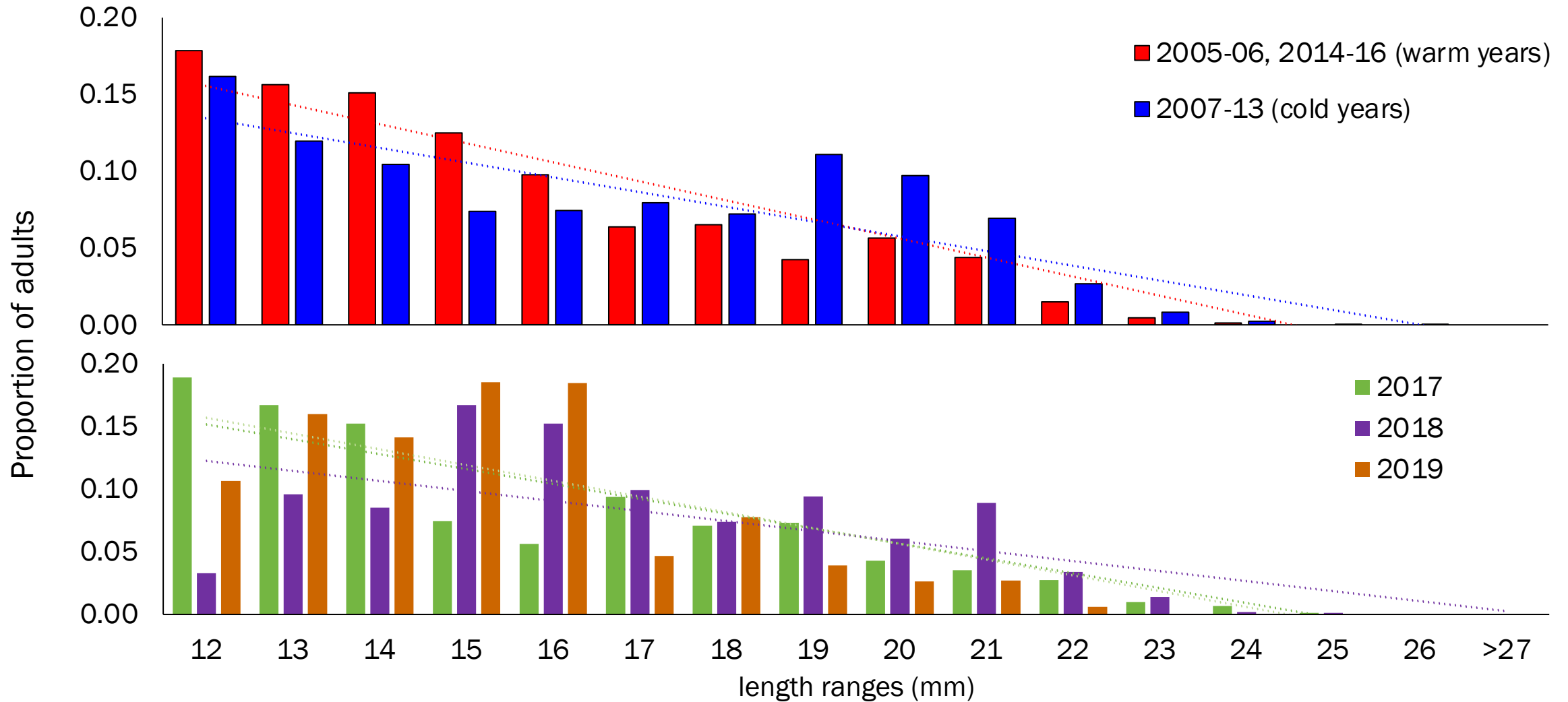
Regional indices: SST and SLH



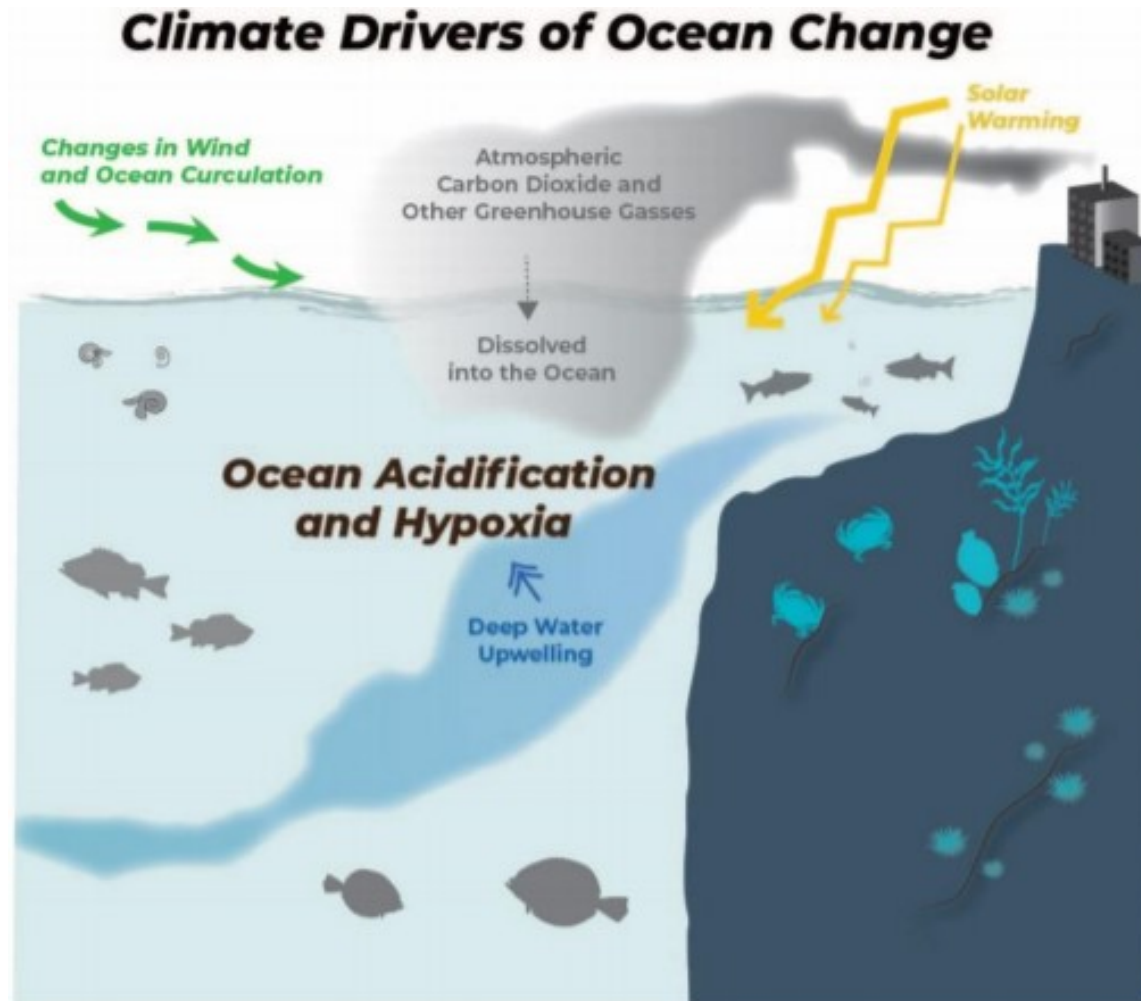
Nutrients: building blocks of phytoplankton



Adult krill: bigger in cold waters



Ocean acidification and hypoxia



- Less aragonite available for animals with calcified shells – *undersaturated waters*
 - Shell thinning
 - Increased mortality
- Hypoxia = little to no oxygen (< 2 mg/L)
 - Death for organisms that need oxygen (e.g., fish, crabs)

Tracking ocean acidification

Calculating aragonite saturation from commonly measured variables (T, S, DO)


[Estuaries and Coasts](#)

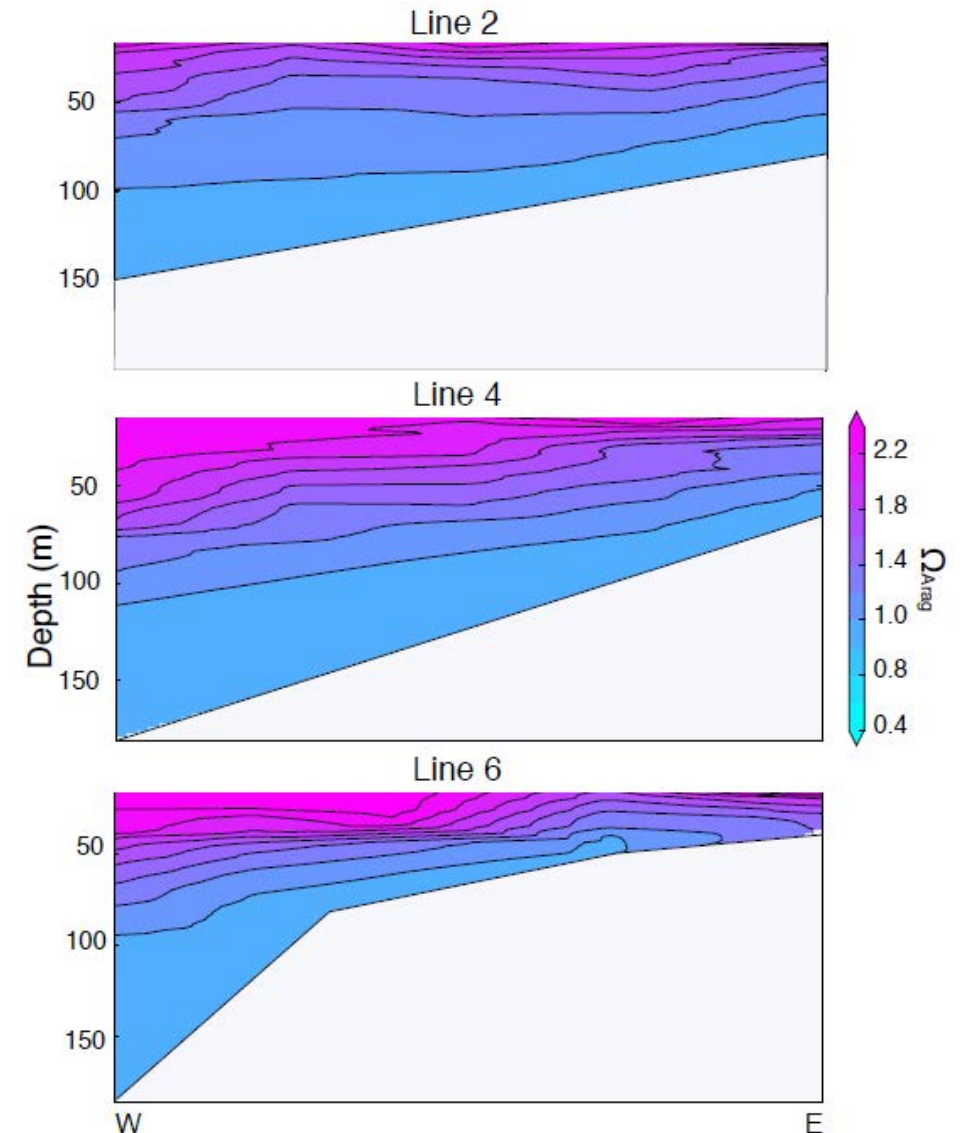
November 2018, Volume 41, [Issue 7](#), pp 2056–2069 | [Cite as](#)

Reconstructing Aragonite Saturation State Based on an Empirical Relationship for Northern California

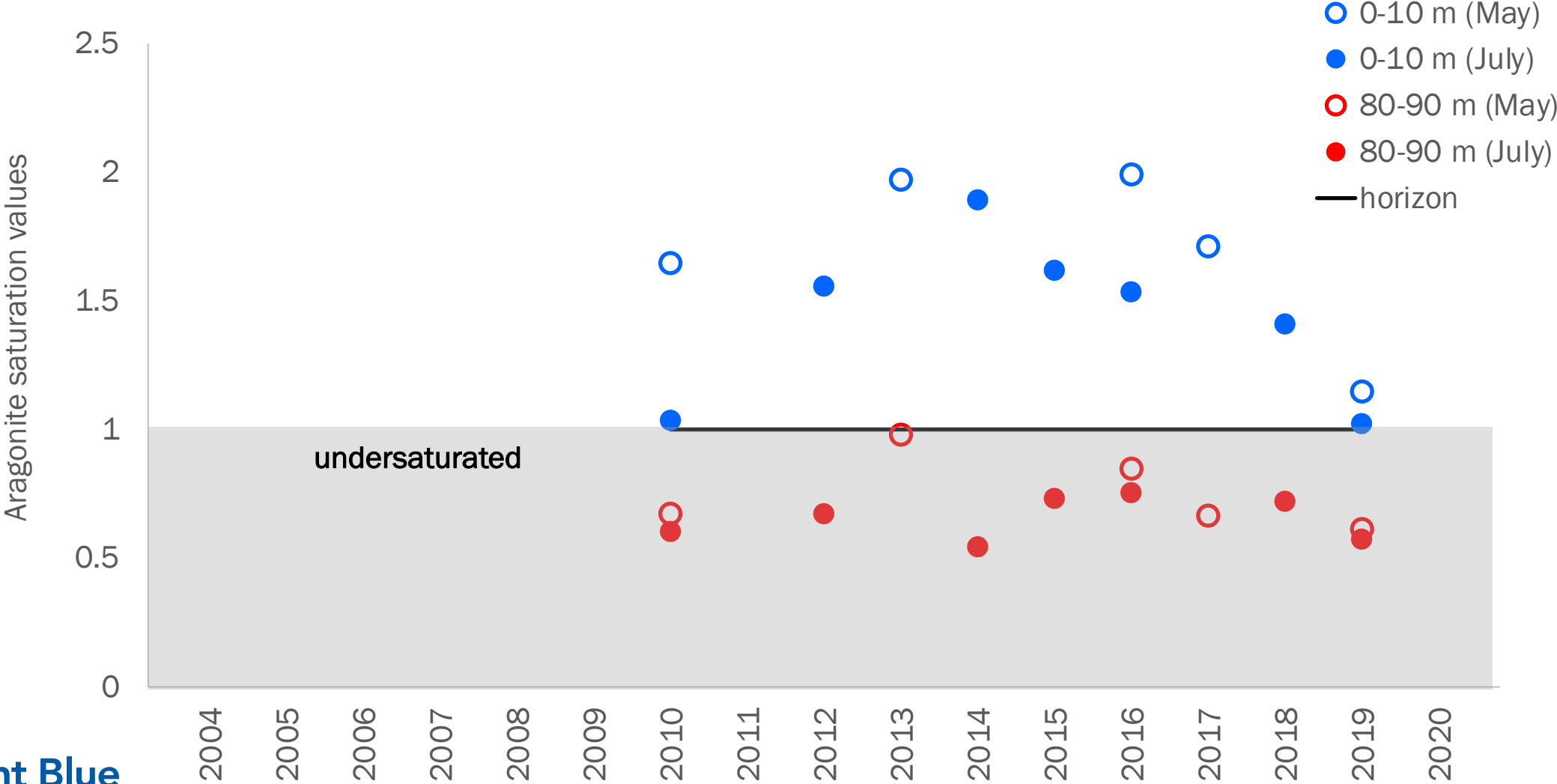
Authors

[Authors and affiliations](#)

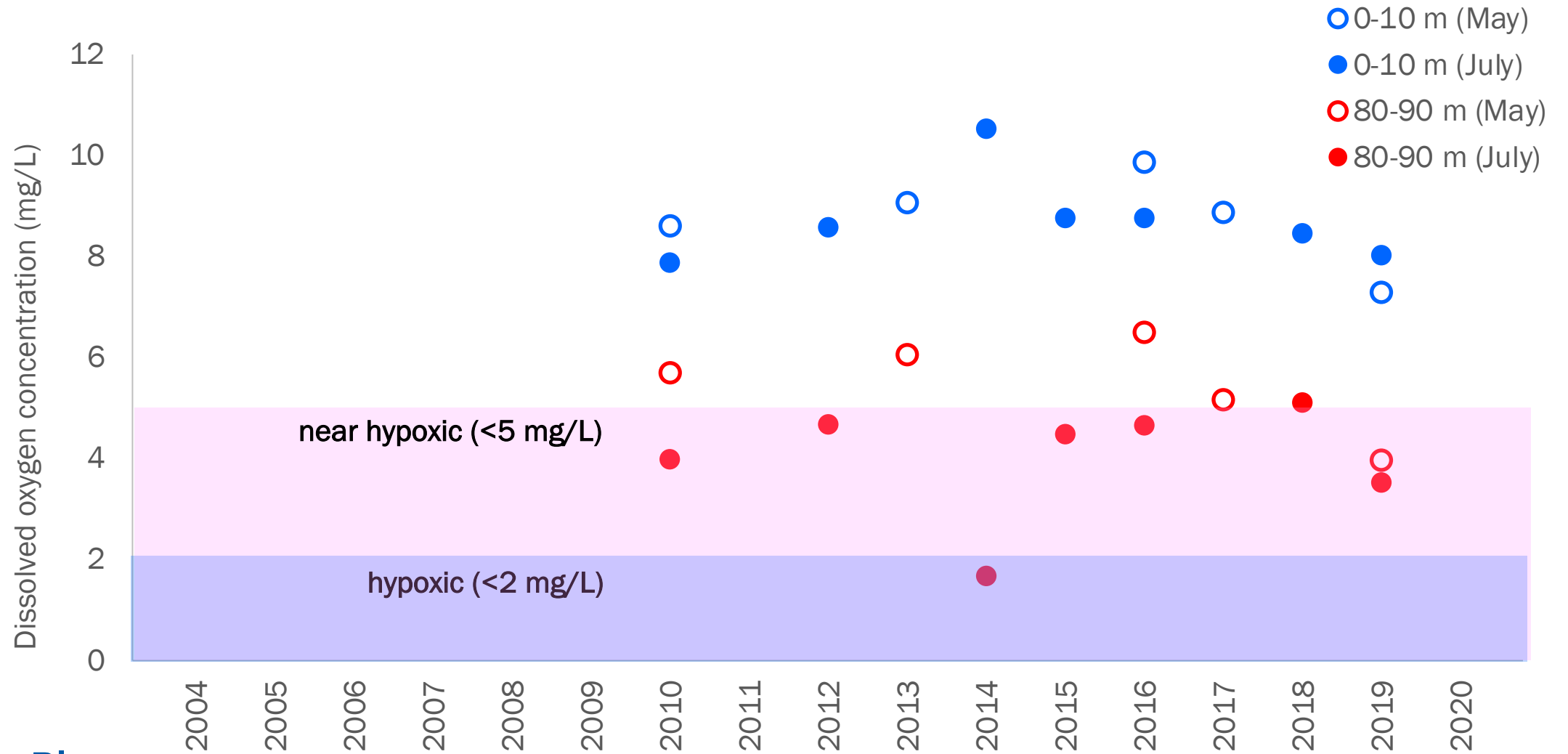
Catherine V. Davis , Kathryn Hewett, Tessa M. Hill, John L. Largier, Brian Gaylord, Jaime Jahncke



Ocean acidification (west of Cordell Bank)



Hypoxia (west of Cordell Bank)



And now on to Kate!