



Bight '18 Ocean Acidification

Presentation to SCCWRP Commission

March 4, 2022

We Lack Tools for Measuring OA Impacts

- In Bight '13 we documented ocean chemistry is at suboptimal levels for sensitive marine species
- We cannot answer the "so what" question
 - Biological impacts are what motivate managers into action
- There are a variety of challenges to assessing biological impacts from OA
 - We don't have an agreed upon list of sentinel species
 - We don't have standardized methods to collect sentinel species
 - We don't have a common method for measuring impacts
 - We don't have an assessment framework to quantify "good" from "bad"

Bight '18 Ocean Acidification Questions

- What is extent, magnitude and duration of Ω_{arag} at biologically important thresholds on the SCB shelf?

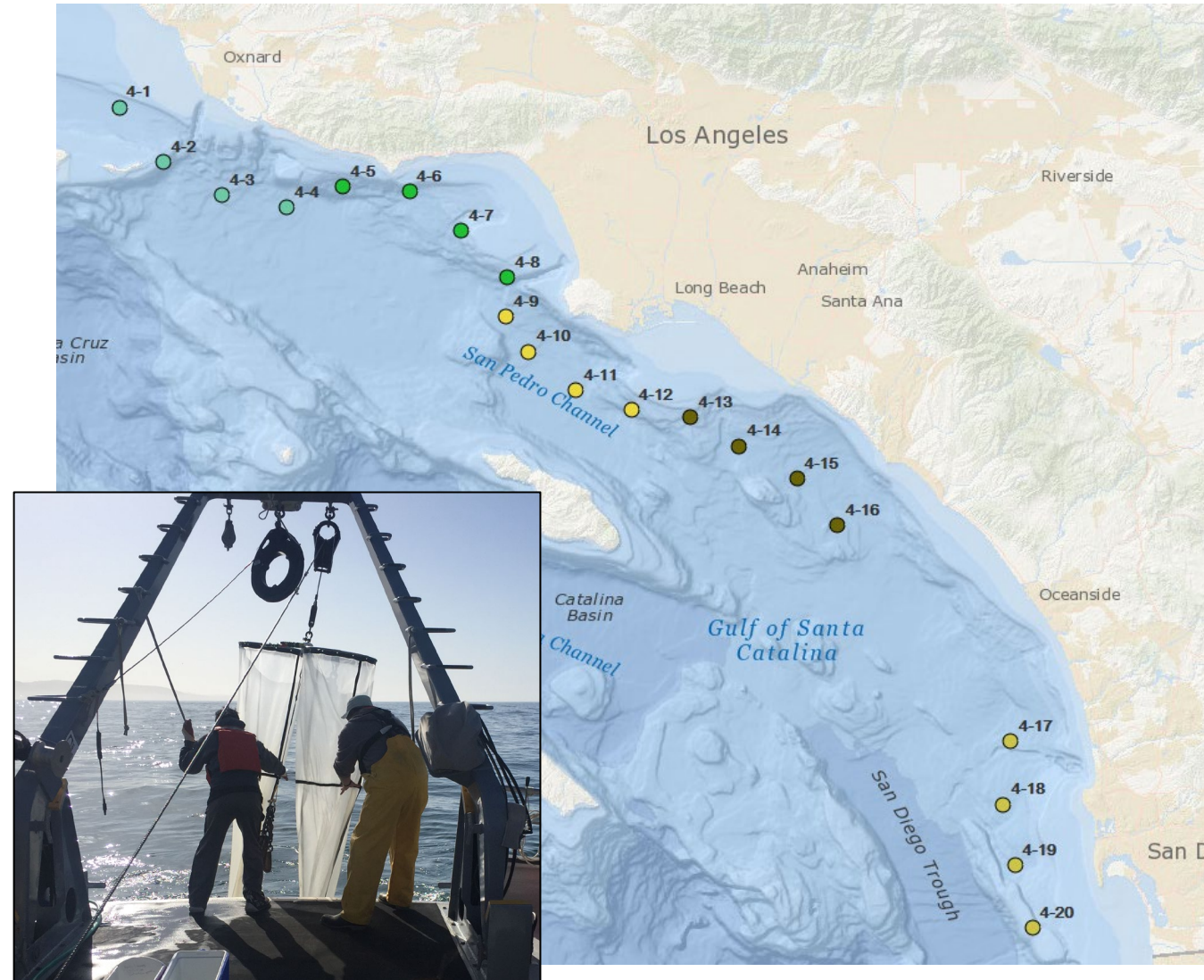
- What is the extent and magnitude of biological impacts related to acidification on SCB species?
 - Develop and pilot a biological monitoring program to assess impacts

Bight '18 OA Key Findings

- Regional aragonite saturation state was similar to 2013 study
 - Values at depth is suboptimal for sensitive calcifiers
- Pilot survey found 3 regional indicator species: two pteropods and one crab larvae
 - Pteropods, a sensitive indicator of OA is ubiquitous in the Southern California Bight
- Biological impacts of OA are pervasive, but mild

Bight '18 OA Biological Impacts Study Design

- Quarterly monitoring of 20 coastal stations
- Coupled chemistry and biological measurements
 - Pelagic zooplankton net tows
 - Chemistry at the surface and at the depth of the net tow + CTD cast



We identified three indicators with region-wide distribution in one or more seasons

2 Pteropods

Heliconoidies



Limacina

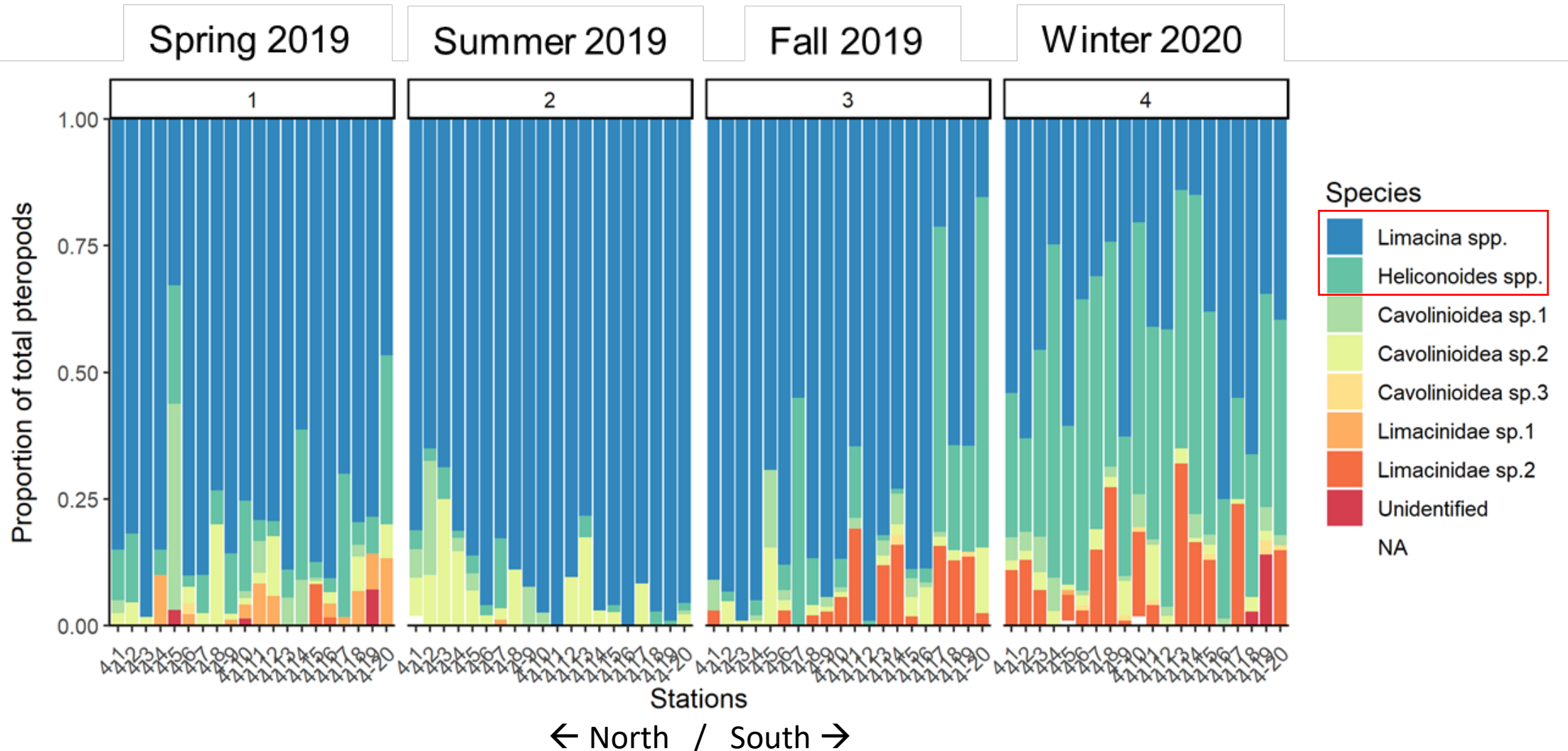


1 Crab Larvae:

Zoea life stage: *Emerita analoga*
Pacific Sand Crab

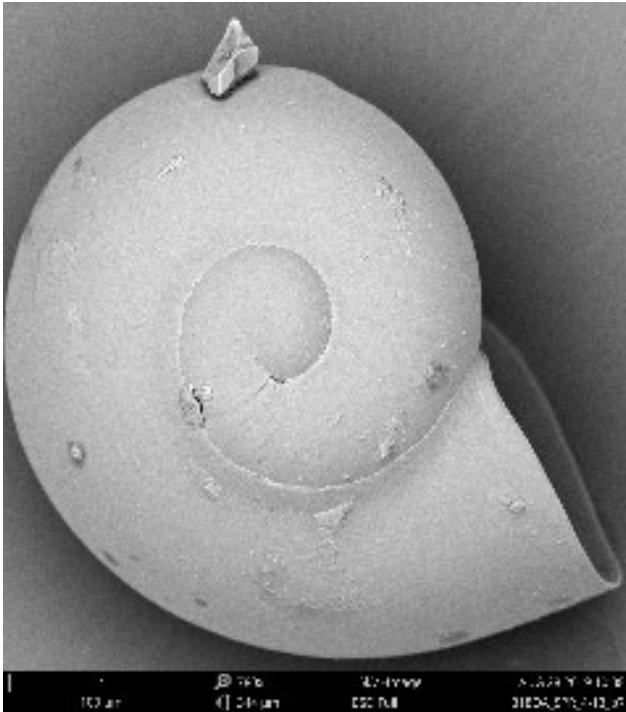


Pteropods are common throughout the Bight

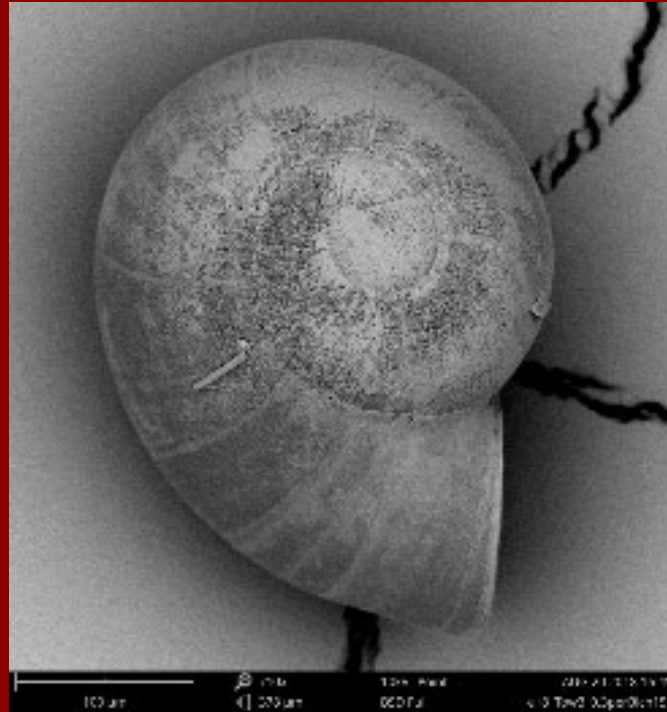


Pteropod shell condition is a good indicator of OA stress

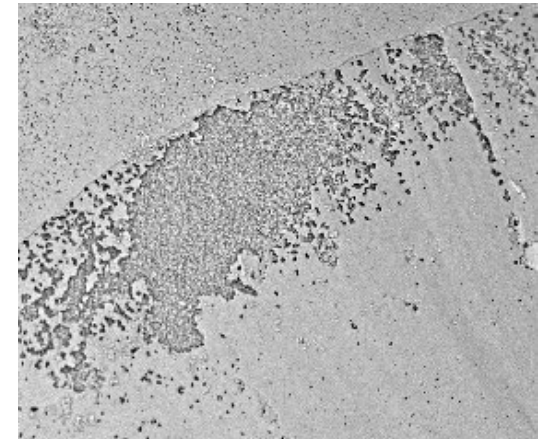
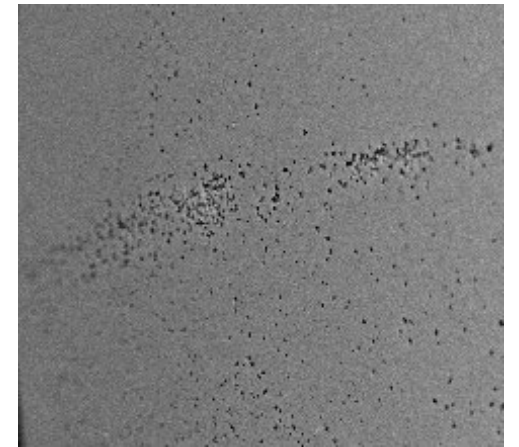
No dissolution



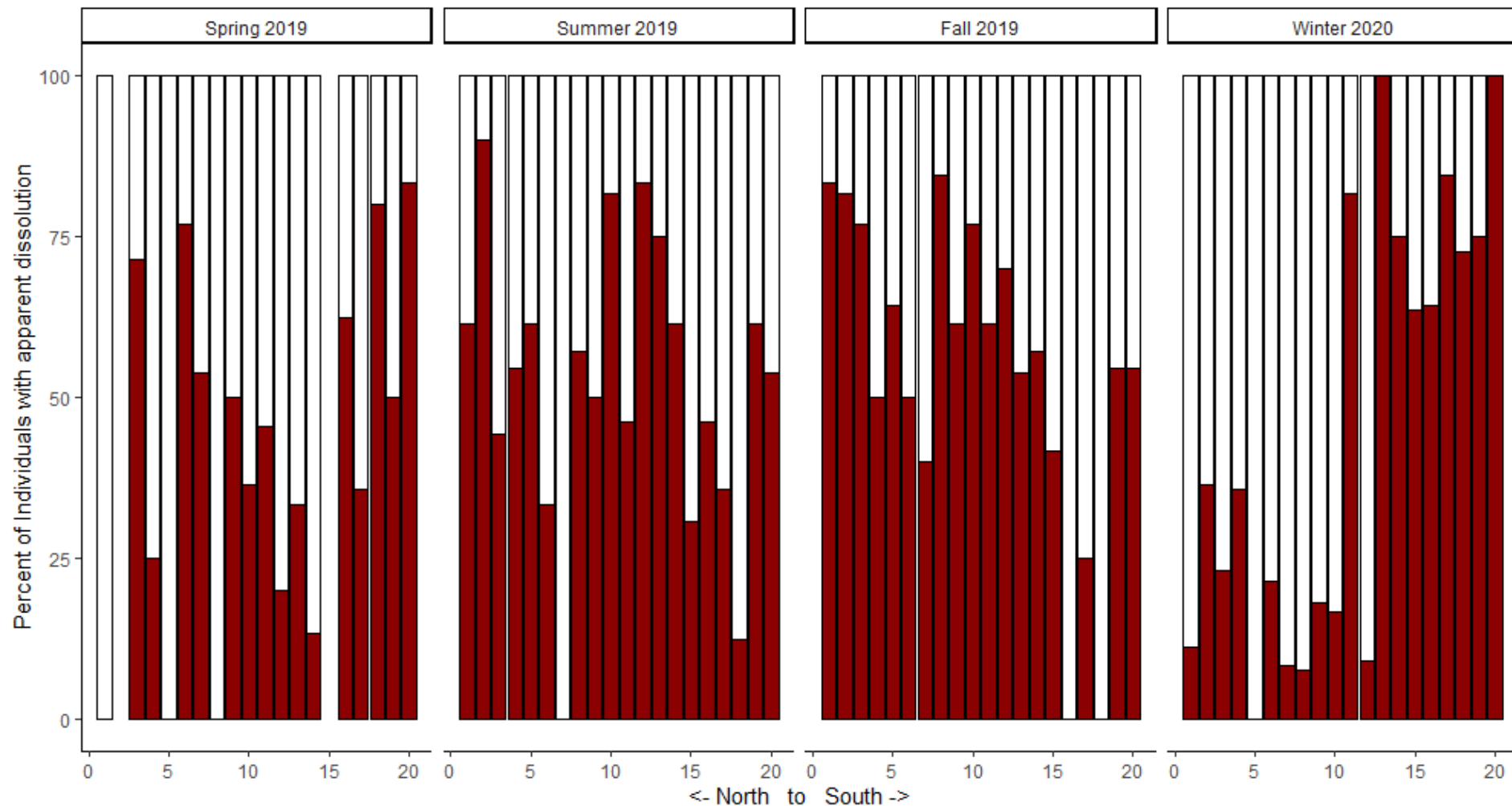
Moderate Dissolution



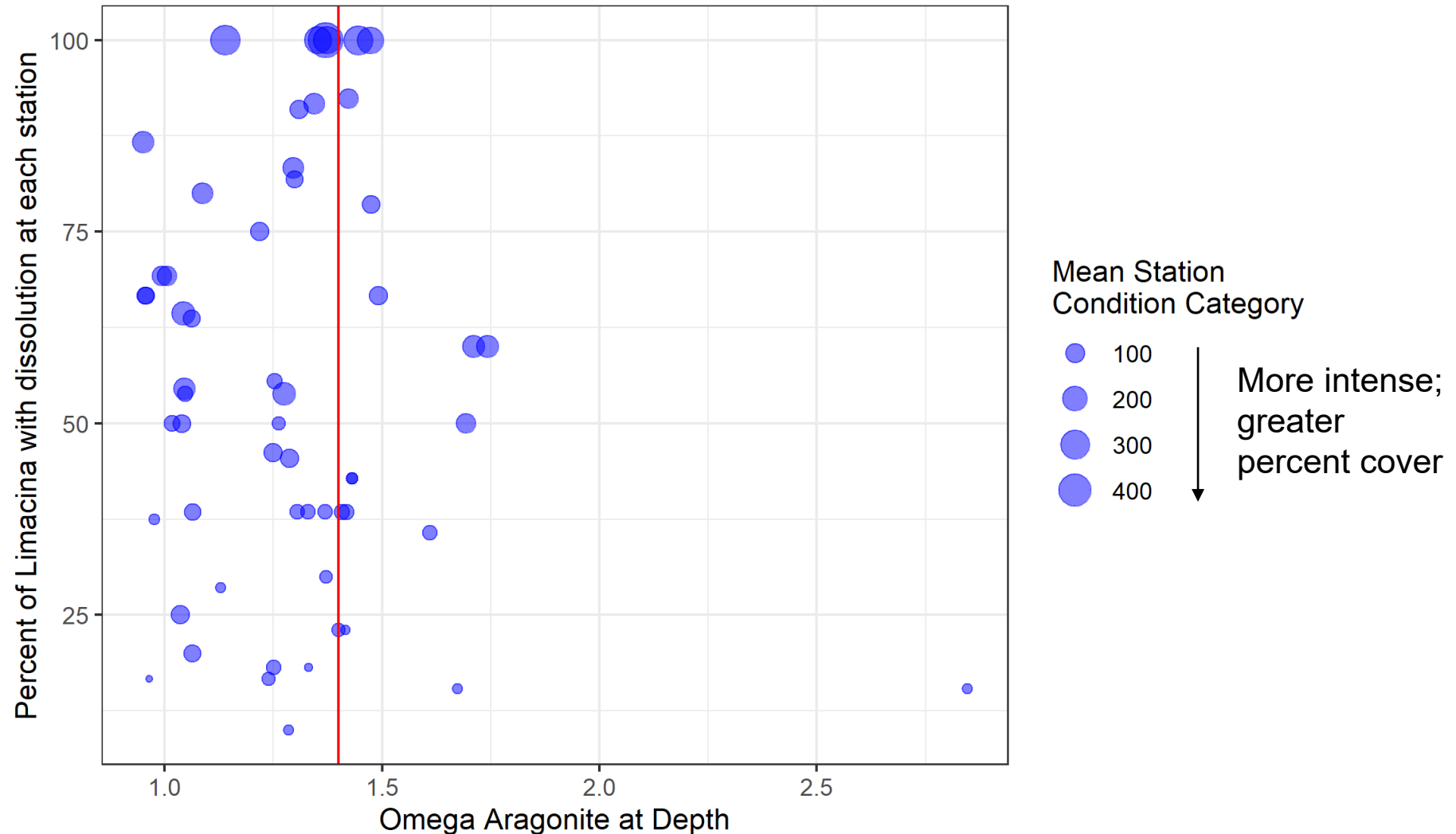
Intensity and Percent Cover of Dissolution



Dissolution was common in Bight pteropods

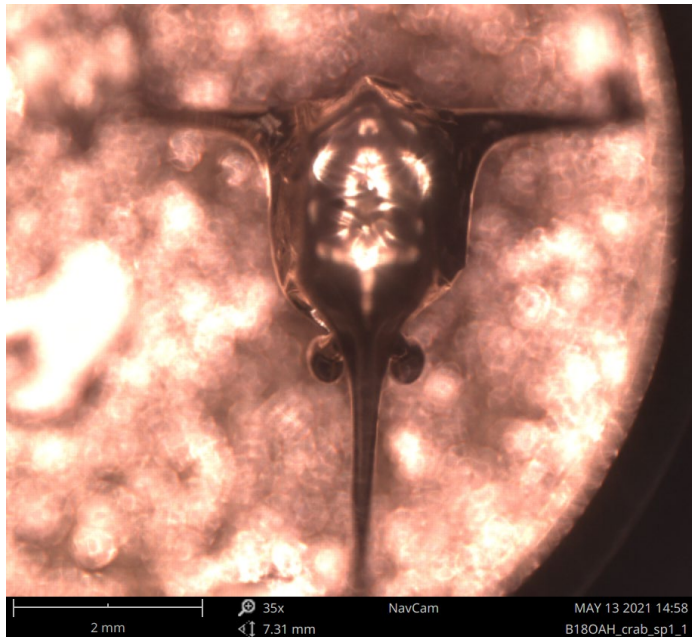


Pteropod dissolution increases at lower aragonite saturation states

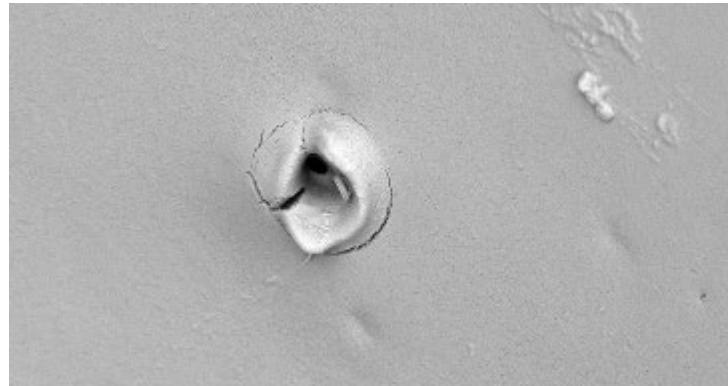


For crabs we look for dissolution around mechanoreceptors and crab carapace

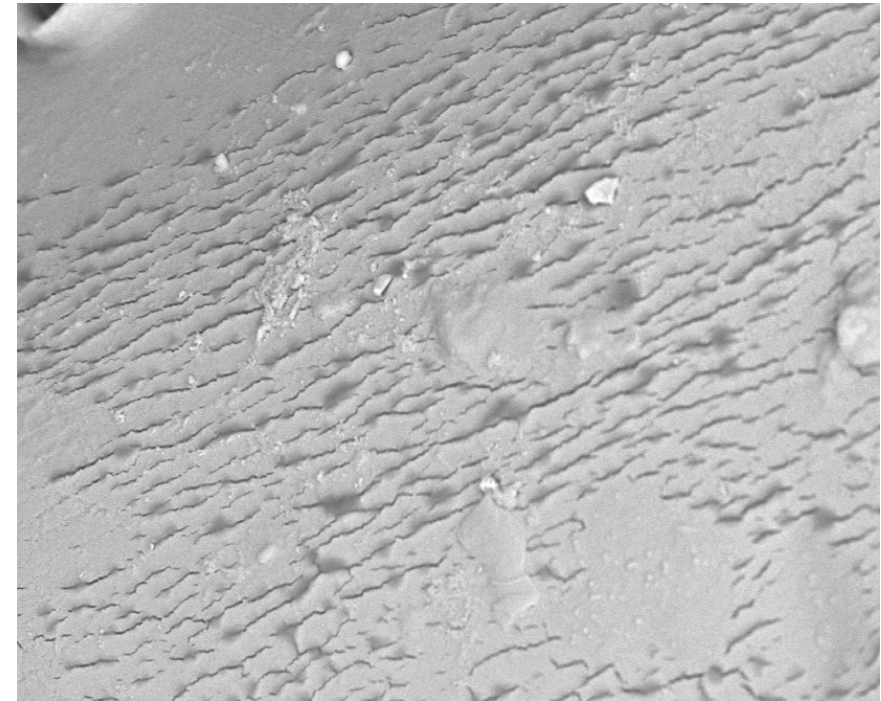
Emerita analoga
Pacific Sand Crab



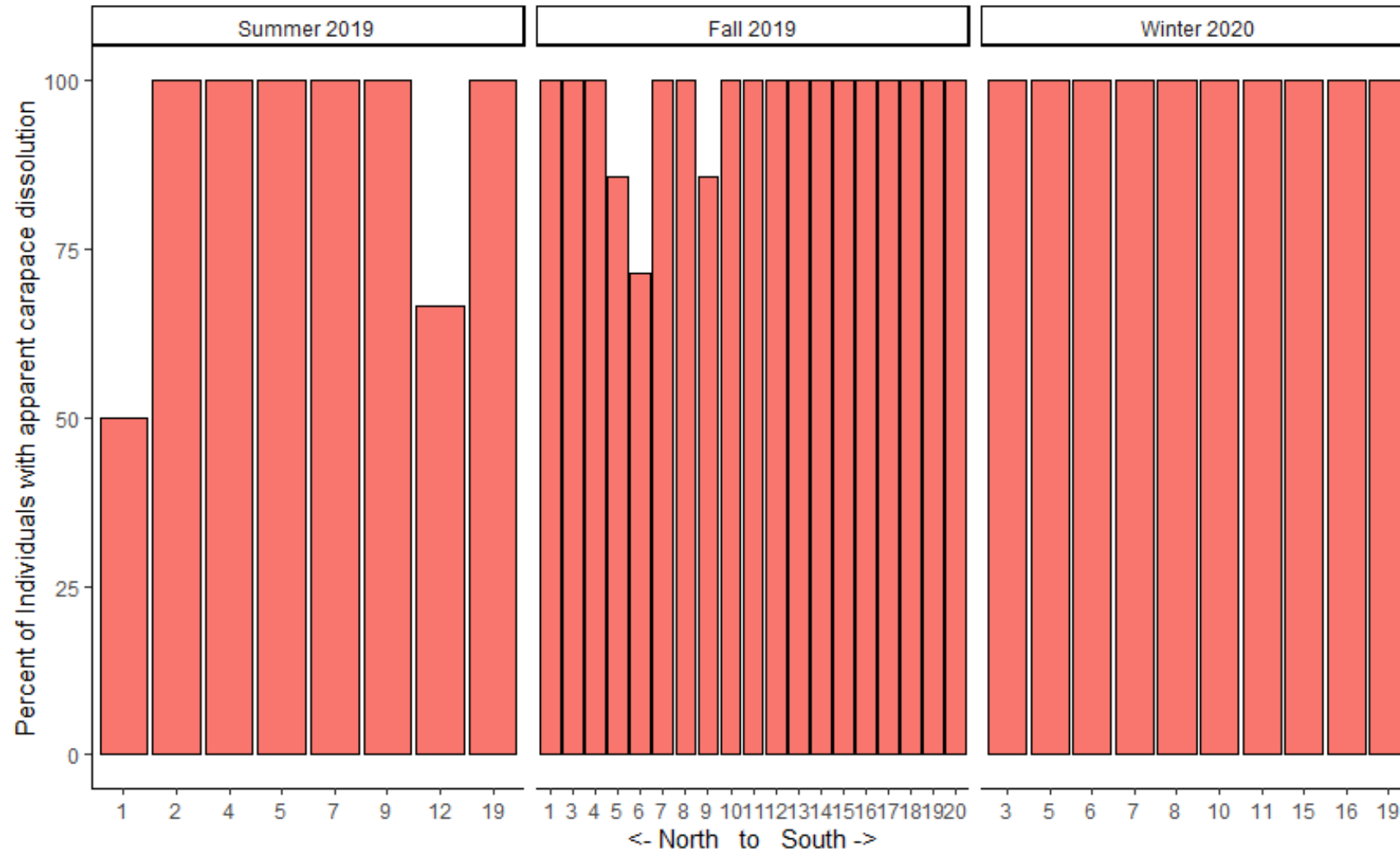
Dissolution of
mechanoreceptors



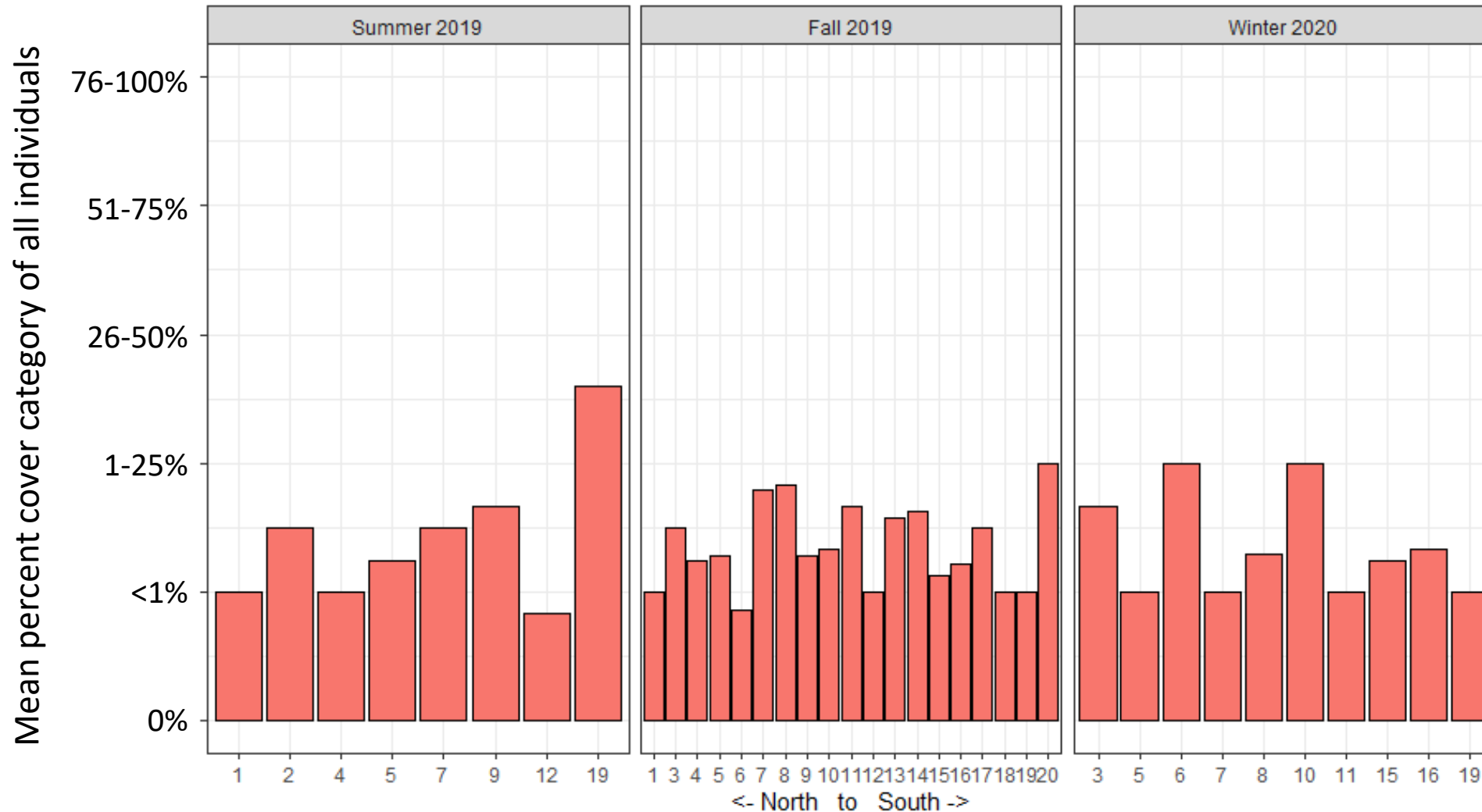
Dissolution of carapace



Dissolution on sand crab carapaces was pervasive



Percent of carapace affected was low



Bight '18 OA Take Home Messages

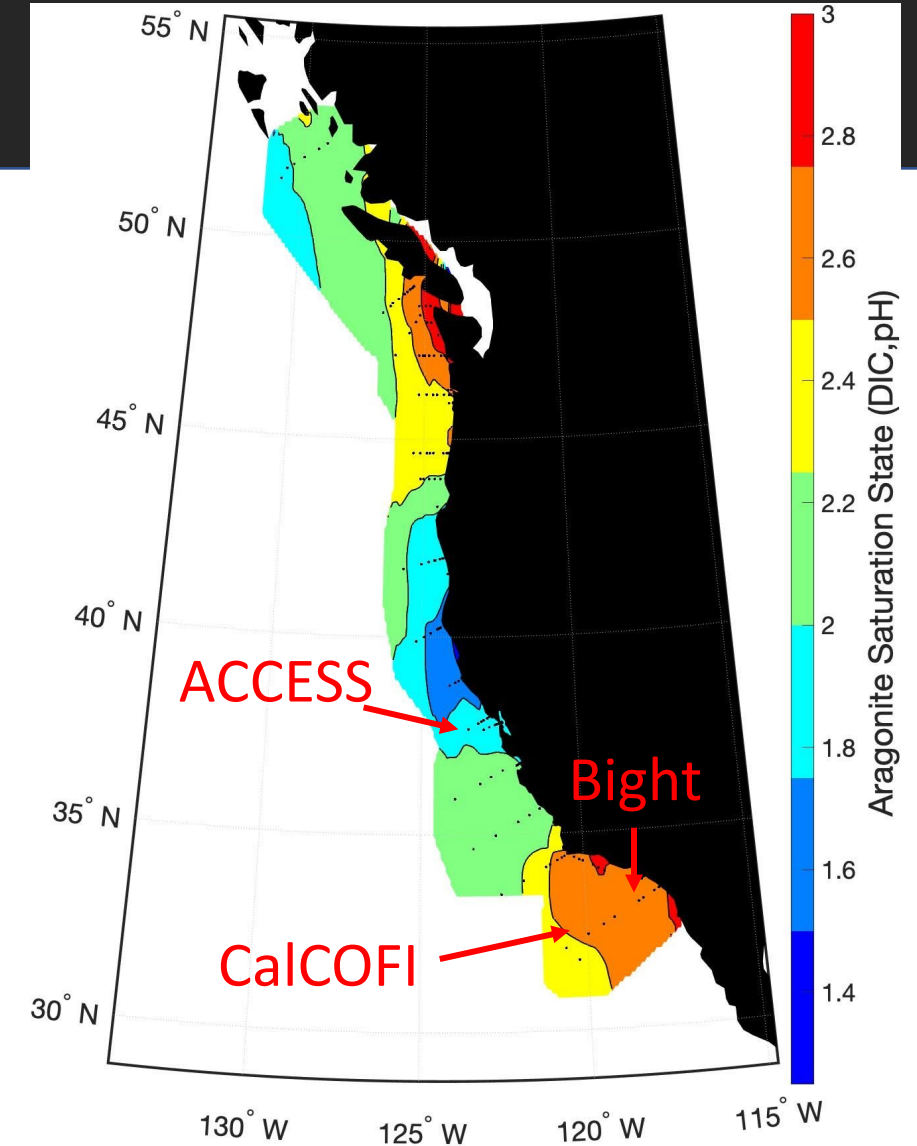
- Pilot survey found 3 regionally relevant indicator species
 - Pteropods: *Limacina* and *Heliconoides*; decapod: Sand crab
- Developed effective collection practices; trained member agencies to collect
- Dissolution of pteropod shells and crab carapaces are OA relevant biological metrics for the SCB
 - Dissolution of crab carapaces and pteropod shells was pervasive, but mild

Looking forward to 2023...

- How “bad” are these observations?
 - Need to develop an assessment framework for biological impacts
- Investigate how Bight species are affected by multiple, regional climate change stressors
 - Ocean acidification is not the only critical stressor for SCB species
 - We need to understand combined effects of low dissolved oxygen, temperature, and OA

We have a head start on needed monitoring!

- OPC initiated collaboration among CA regional monitoring programs
 - ACCESS, Bight and CALCOFI
- Each capture different spatial patterns in temperature, dissolved oxygen and aragonite saturation state
- Biological and chemical data to be collected in 2022 & 2023



WCOA 21 Aragonite Saturation State

Questions?

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