Regional Monitoring to Quantify Uncertainty In Predicted Biological Impacts

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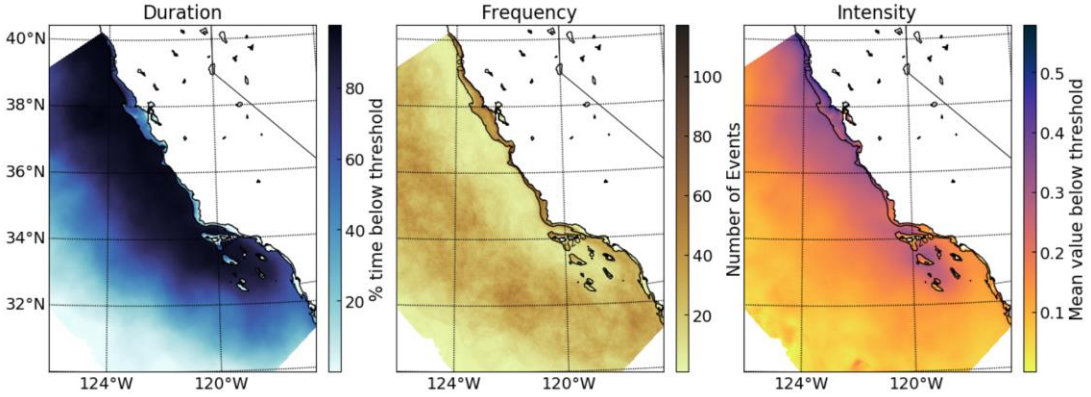
We Are Applying Tools to Characterize Biological Impacts To Model Output

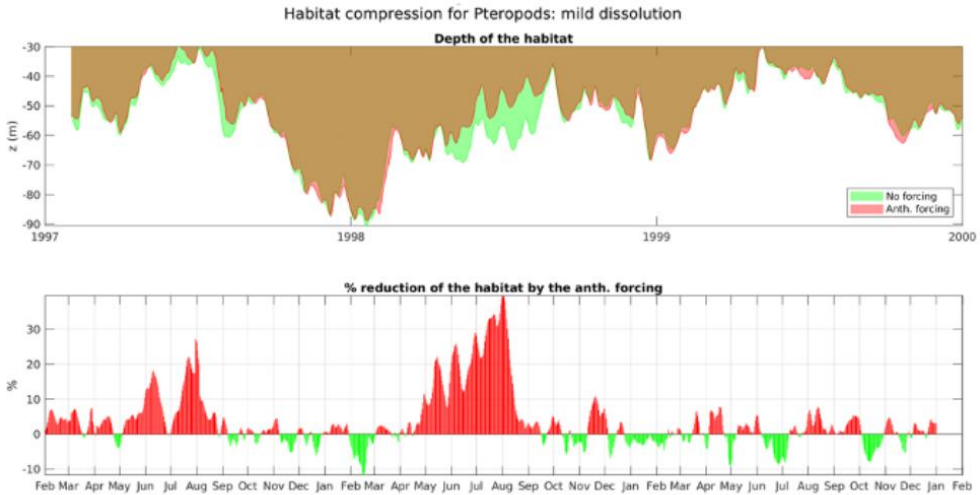
- Univariate metrics
  - OA thresholds for key taxa
- Multi-stressor Metrics
  - Laboratory experiments
  - Metabolic index for temperature dependent oxygen impacts on regionally relevant benthic and pelagic species

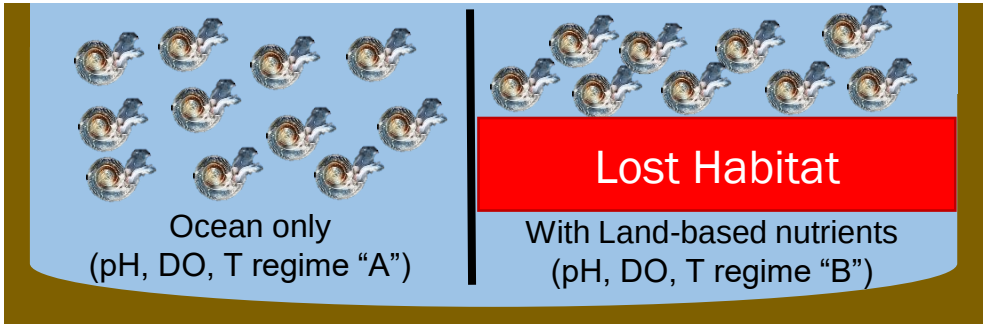


Pteropods juvenile mild dissolution thresholds assessed over 0-200 m

Are these the right indicators and metrics for the Bight?
What is the uncertainty in these biological assessments?

We Need to Validate How Well the Model Reproduces Predicted Biological Impacts





Does pteropod presence/absence and/or shell condition in the Bight under specific Temperature, Oxygen, and pH conditions match model predictions?

We Need Regional Data!

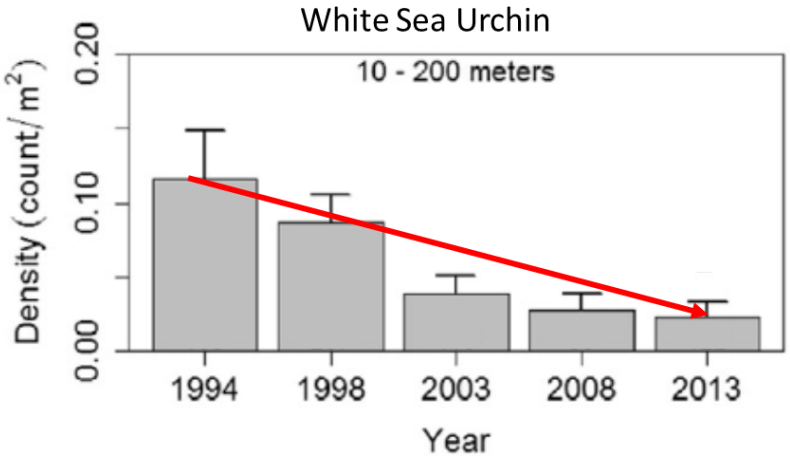
Bight Program Is Providing Biological Data to “Ground Truth” Biological Implications of Model Predictions

- Bight Historical data
  - Bight infauna and trawl datasets provide hindcast species distributions
  - Pull out key taxa to map out shifting patterns in presence/absence

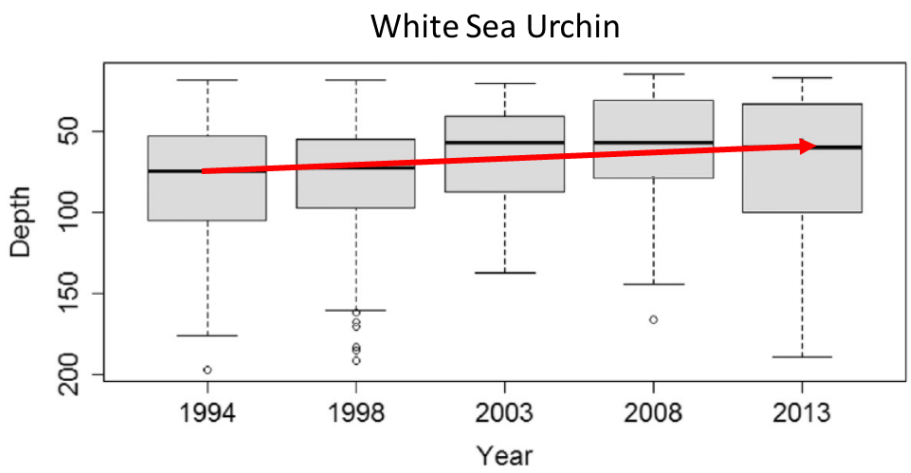
- Bight ’18: Pelagic biological dataset coupled with chemistry
  - Bight ‘18 pelagic zooplankton species distributions
  - Bight ‘18 pelagic zooplankton shell/carapace condition

Historical Data Shows Changing Species Assemblages

Lower Densities



Habitat Compression

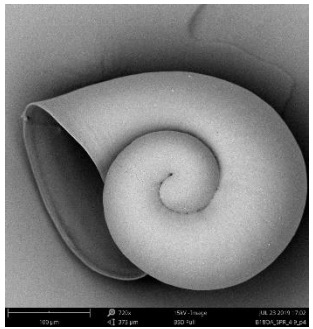


Do hindcast model simulations predict species shifts due to changes in temperature, dissolved oxygen and pH/carbonate saturation state?

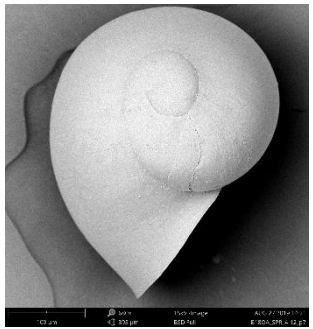
Sato et al. 2017

We Are Evaluating New OA-Specific Indicator Species and Biological Metrics

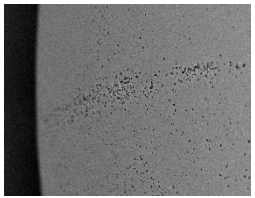
- The Bight Program routinely detected (1 or more seasons) three potential OA indicators with wide-spread distributions
  - Pteropods: Limacina and Heloconoides
  - Crab Larvae

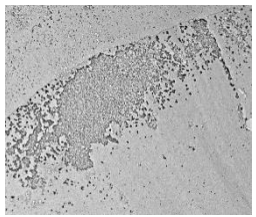


Heliconoidies

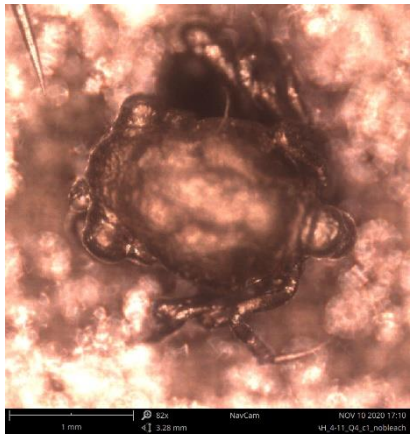


Limacina



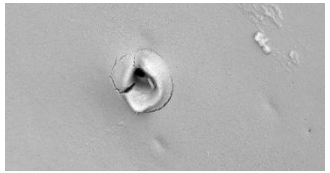


Intensity and Percent Cover of Dissolution

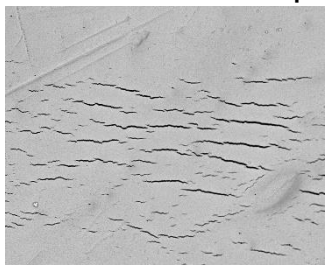


Crab Larvae

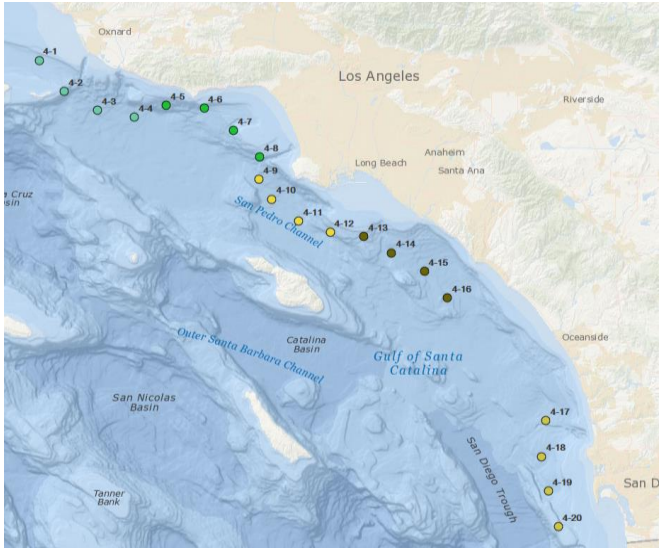
Dissolution of mechanoreceptors

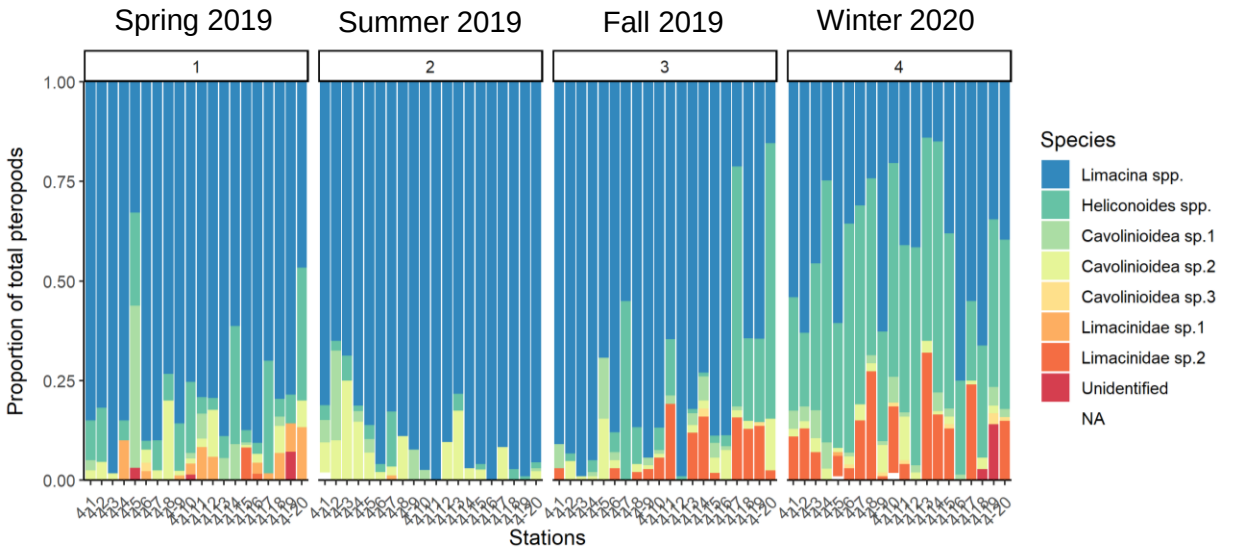


Dissolution of carapace



Pteropod Species Presence/Absence Under Different Environmental Conditions

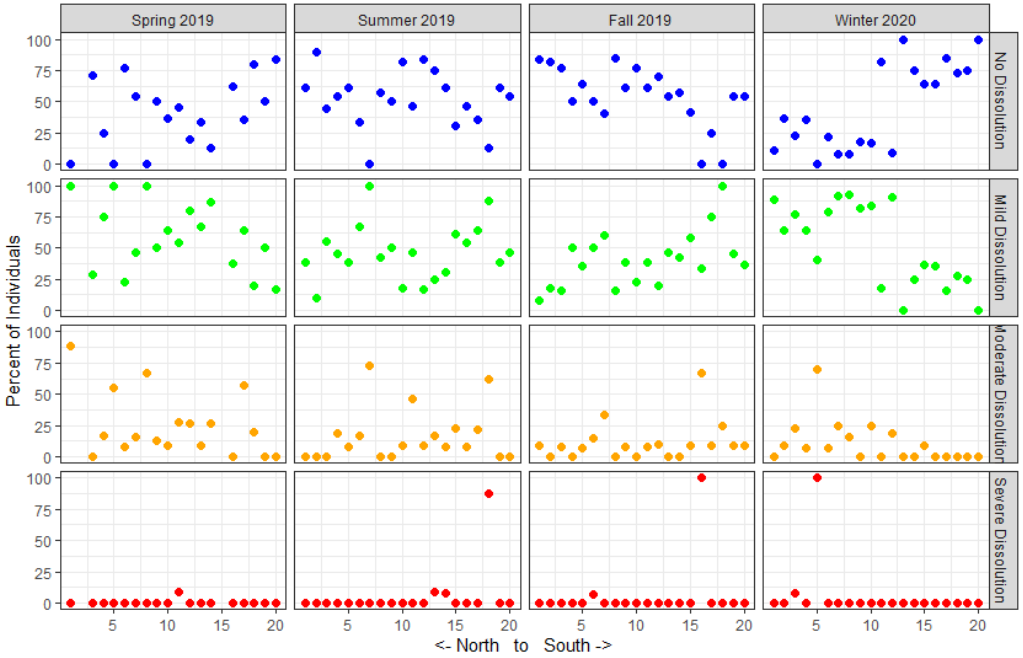


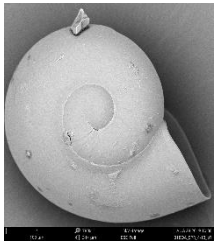


How do observed species distributions match model predictions based on temperature, dissolved oxygen and pH/carbonate saturation state?

Shell Condition Under Different Environmental Conditions

- SEM microscopy reveals shell condition and how it changes through time and space compared to chemical condition



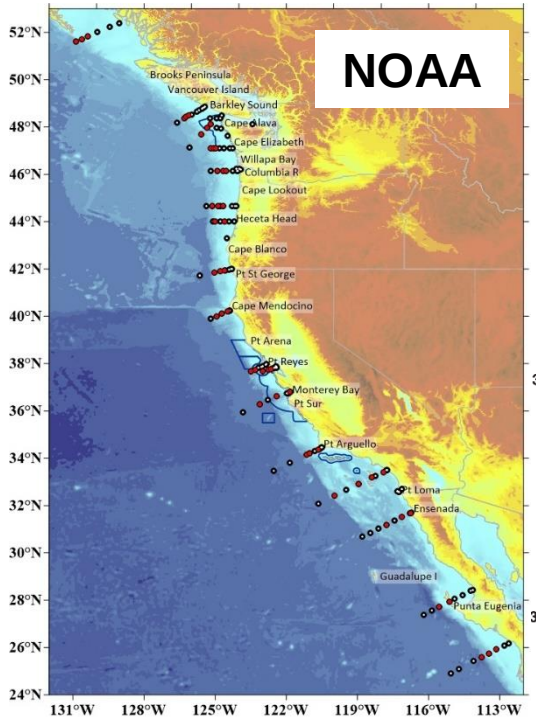


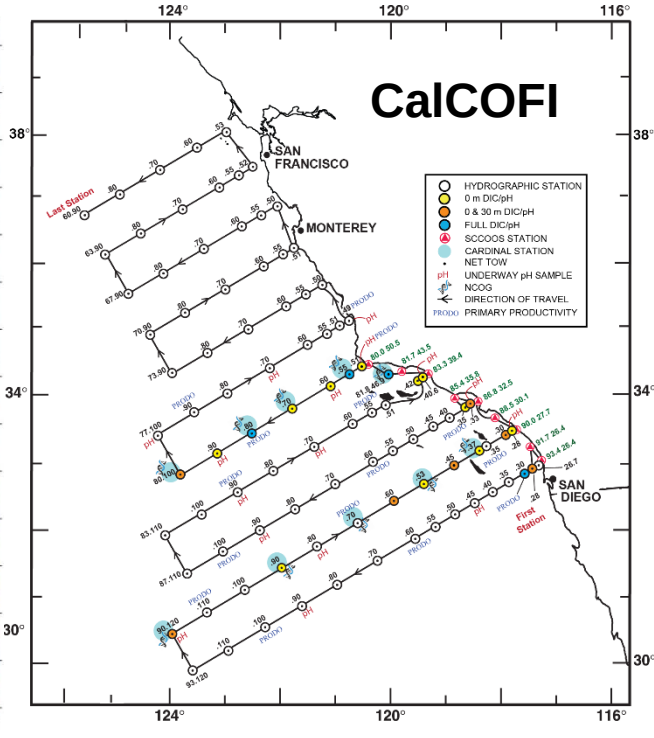
No dissolution

Moderate Dissolution

We Are Expanding Partnerships Increase Spatial Coverage and Leverage with Other Programs

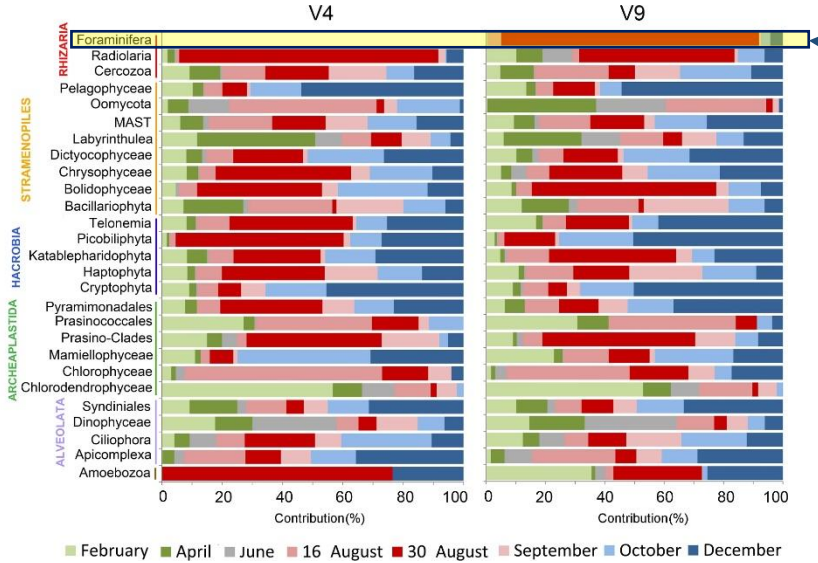
- NOAA PMEL
  - Summer 2021- partner with to repeat our Bight ‘18 metrics west coast wide
- CalCOFI
  - Collaborating to match up protocols for OA monitoring
  - Connects their offshore data to our nearshore data





New Measurement Methods Increase Our Understanding of Species Assemblages

- DNA metabarcoding can fill in the gaps in species assemblages
  - Cheaper, faster, more accurate
- Shows how species come and go seasonally and interannually



Carbonate Species

Percentage distribution of marine protist taxonomic groups across the year in the Gulf of Naples.

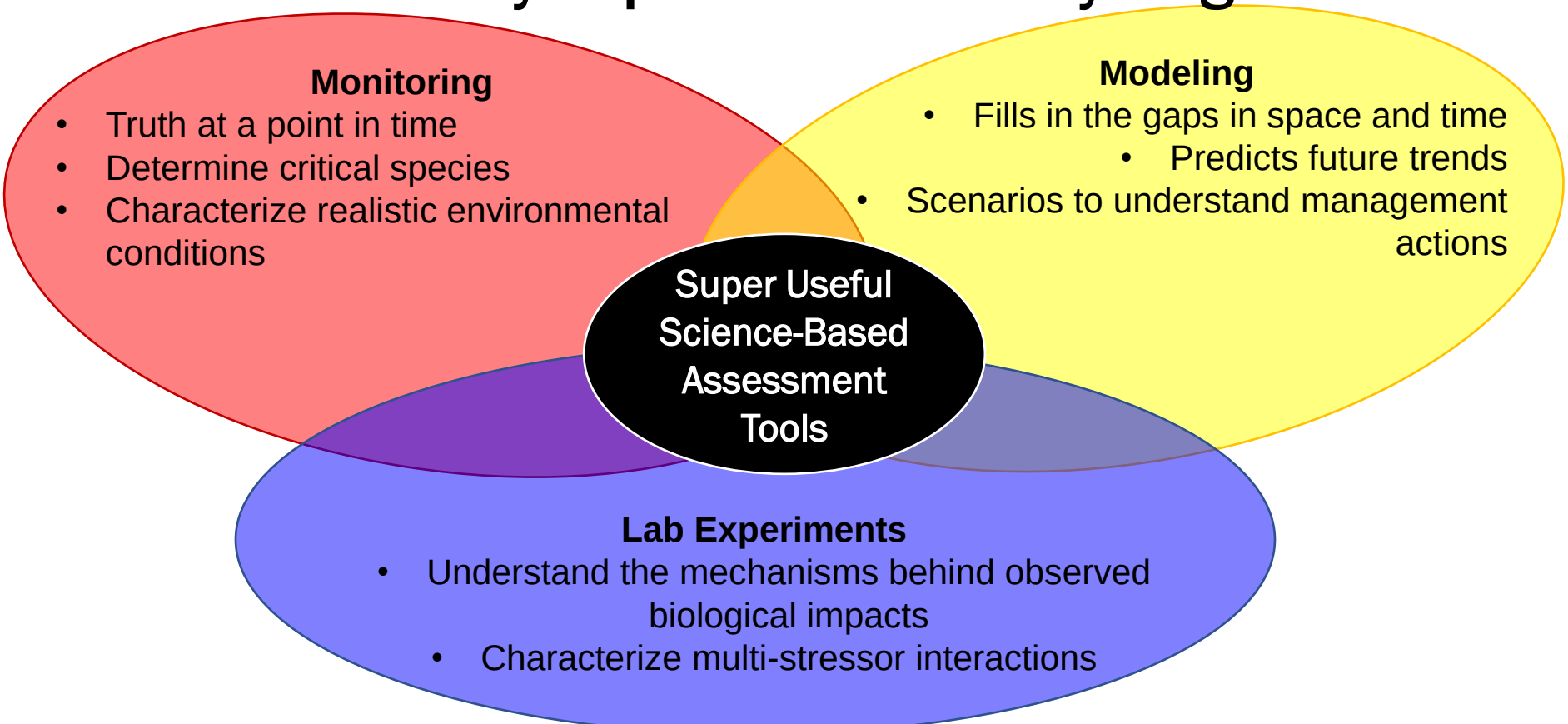
Piredda et al. 2016

Regional Monitoring Data Can Be Used as a “Ground Truth” for Model Predictions of Biological Impacts

- Check on whether indicator taxa are relevant for the Bight
- Check on whether the measured biological condition (shell dissolution) matches model predictions
- Check on whether species distributions match expectations of habitat compression

But it’s not just a one-way street!

Regional Monitoring and Regional Modeling and Laboratory Experiments are Synergistic



Questions?