Making Ocean Acidification Data Accessible and Useable for Coastal Managers

Dr. Libby Jewett

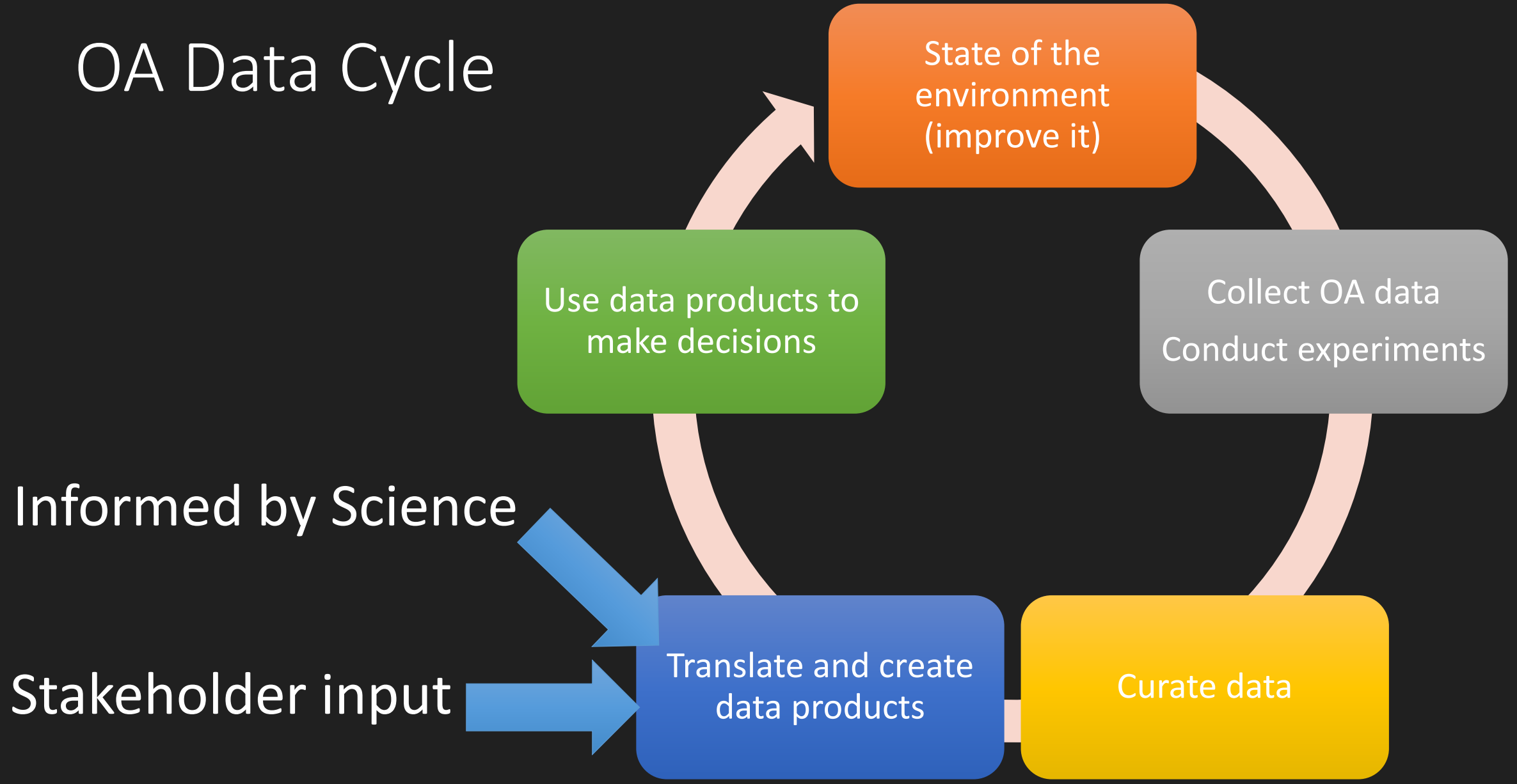
Director, NOAA Ocean Acidification Program

Co-authors: Simone Alin, Adrienne Sutton, Shallin Busch, Samantha Siedlecki, Dwight Gledhill

Effects of Climate Change on the World Oceans

June 5, 2018

OA Data Cycle



Making OA Data Accessible and Useable…

- regional and global OA data portals with built-in data visualization tools
- OA data to meet the needs of Sustainable Development Goal 14.3
- online tools that enable coastal managers to visualize how OA is manifesting in their region over time and how OA may affect important fisheries,
- infographics that summarize how OA may affect particular species or entire ecosystems,
- seasonal forecast models that predict how OA conditions might affect particular commercial fishery sectors,
- Report cards for coral reef managers,
- Amplify findings and share through the OA Information Exchange

Data Portals

NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

formerly the National Oceanographic Data Center (NODC)... more on NCEI

Home | Access Data | Submit Data | Public Outreach | About

NOAA Satellite and Information Service

This Site All of NOAA Search Go

You are here: Ocean Acidification Data Stewardship (OADS)

OADS Home Page
- Access data
- Submit data
- Downloads
- News
- Data partners
- Contact us

External OA Resources
- NOAA Ocean Acidification Program (OAP)
- Global OA Observing Network (GOA-ON)
- Surface Ocean CO2 Atlas (SOCAT)

Ocean Acidification Data Stewardship (OADS) Project

What we are:

Ocean Acidification Data Stewardship (OADS) is a data management project funded by NOAA/OAR/Ocean Acidification Program (OAP). We are located within NOAA's National Centers for Environmental Information (NCEI) at Silver Spring, Maryland. OADS builds on a collaborative approach with shared responsibilities among scientists, data managers, and data partners.

Near term goal:

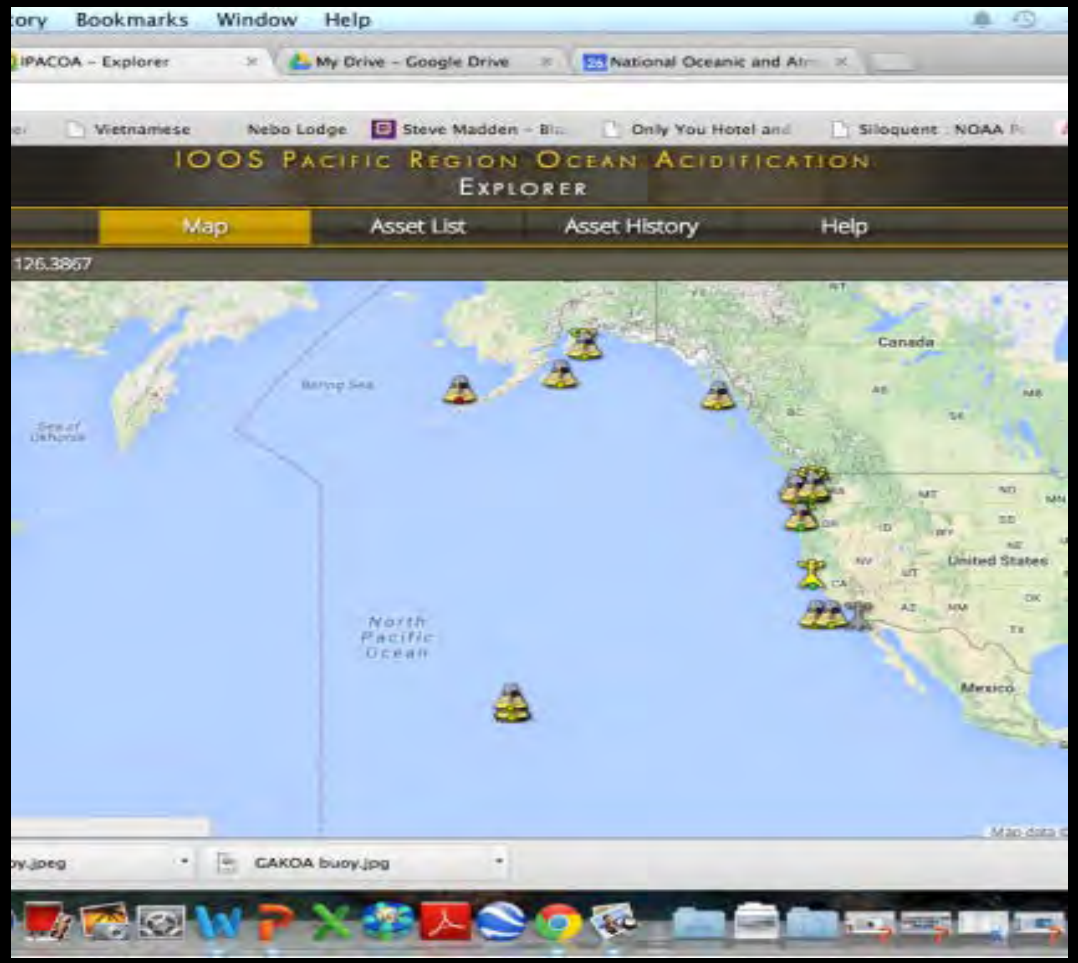
The near term goal of OADS is to ensure all data sets collected from OAP funded research projects are properly archived and made accessible towards improved OA analyses, forecasting capabilities, and better assessments of marine resource vulnerability.

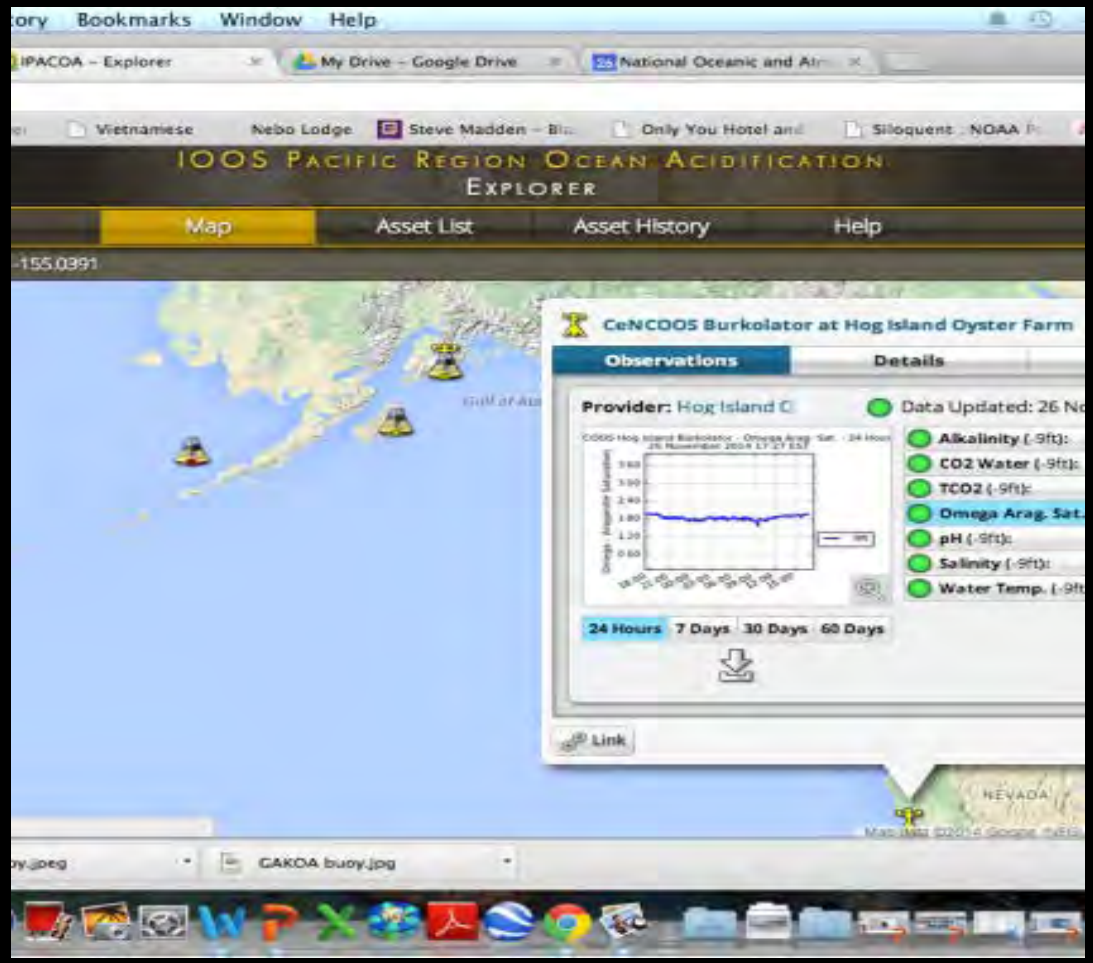
Long term goal:

The long term goal is to serve the broader OA community by providing dedicated long-term archival, online data discovery, access, and scientific stewardship for a diverse range of ocean acidification and other chemical, physical, and biological oceanographic data. OADS project is envisioned as a building block towards a U.S. national OA data management and integration service required by the Federal Ocean Acidification Research and Monitoring Act of 2009 (FOARAM Act).

Data portal

Integrated Ocean Observing System

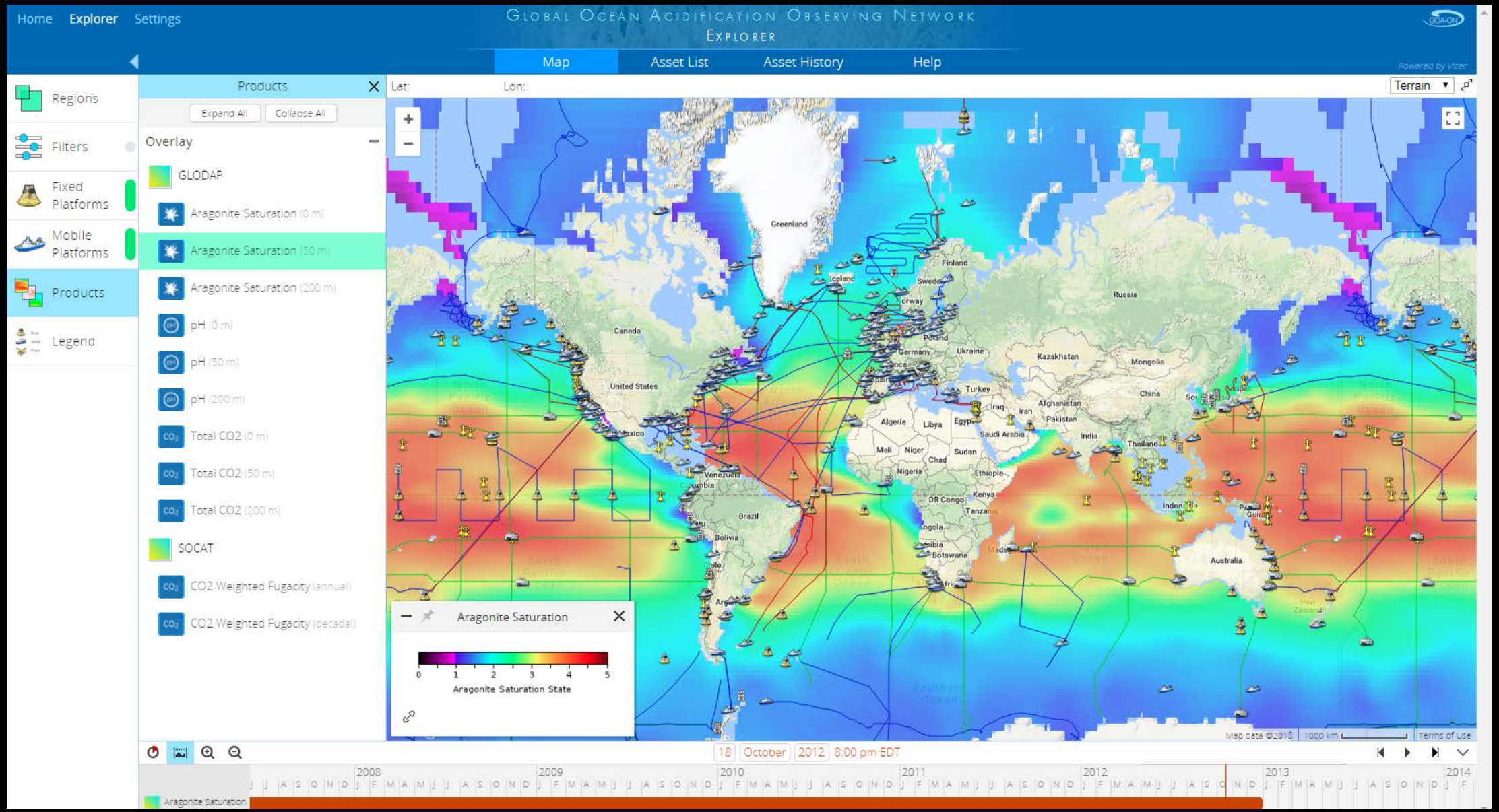




http://www.ipacoa.org/

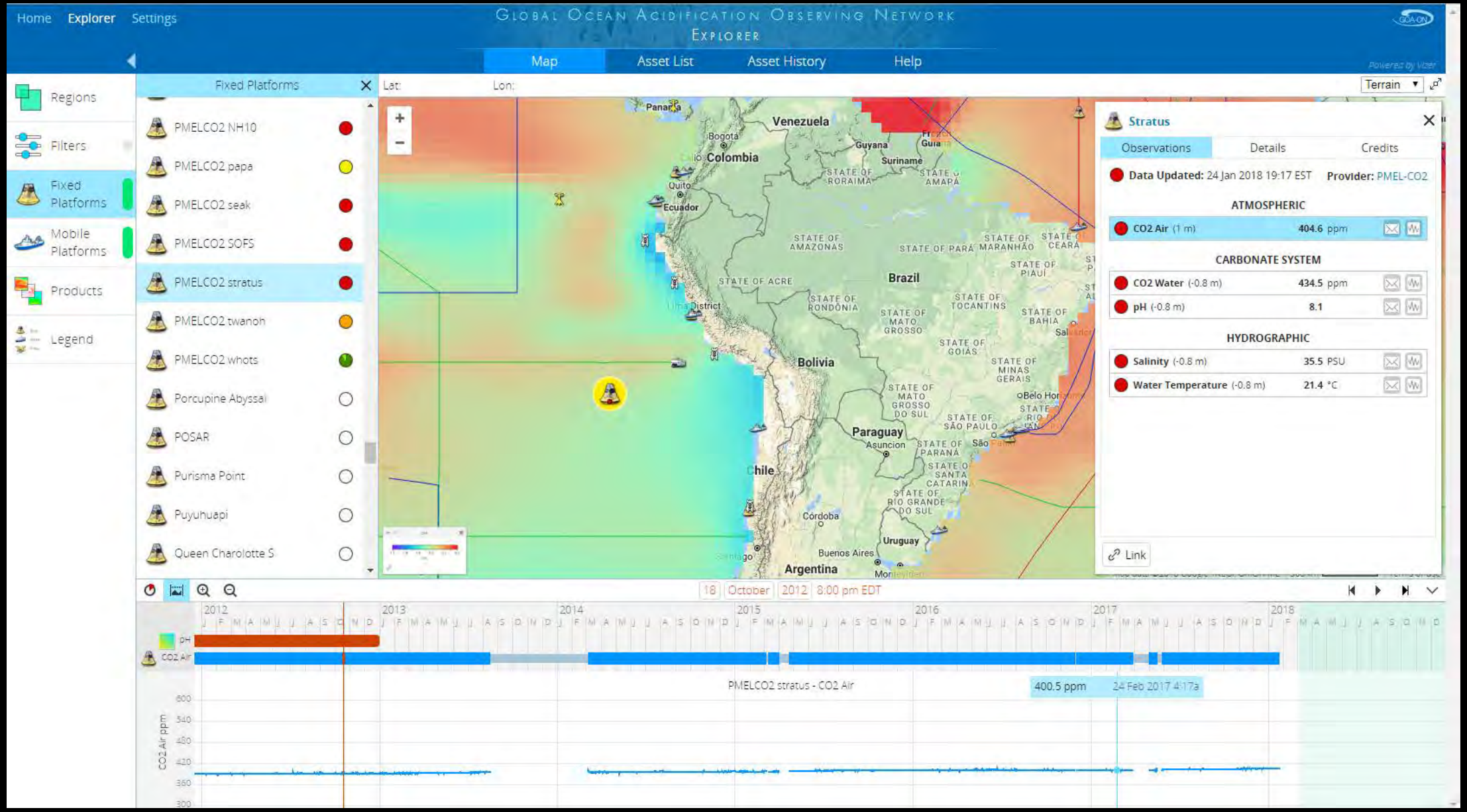
Data portal

Global OA Observing Network data portal



Data portal

www.GOA-ON.org



Sustainable Development Goals

Sustainable Development Goal 14.3

- IOC-UNESCO as custodian agency for developing method to track SDG14.3 progress
- *Indicator: 14.3.1 Average marine acidity (pH) measured at agreed suite of representative sampling stations*

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

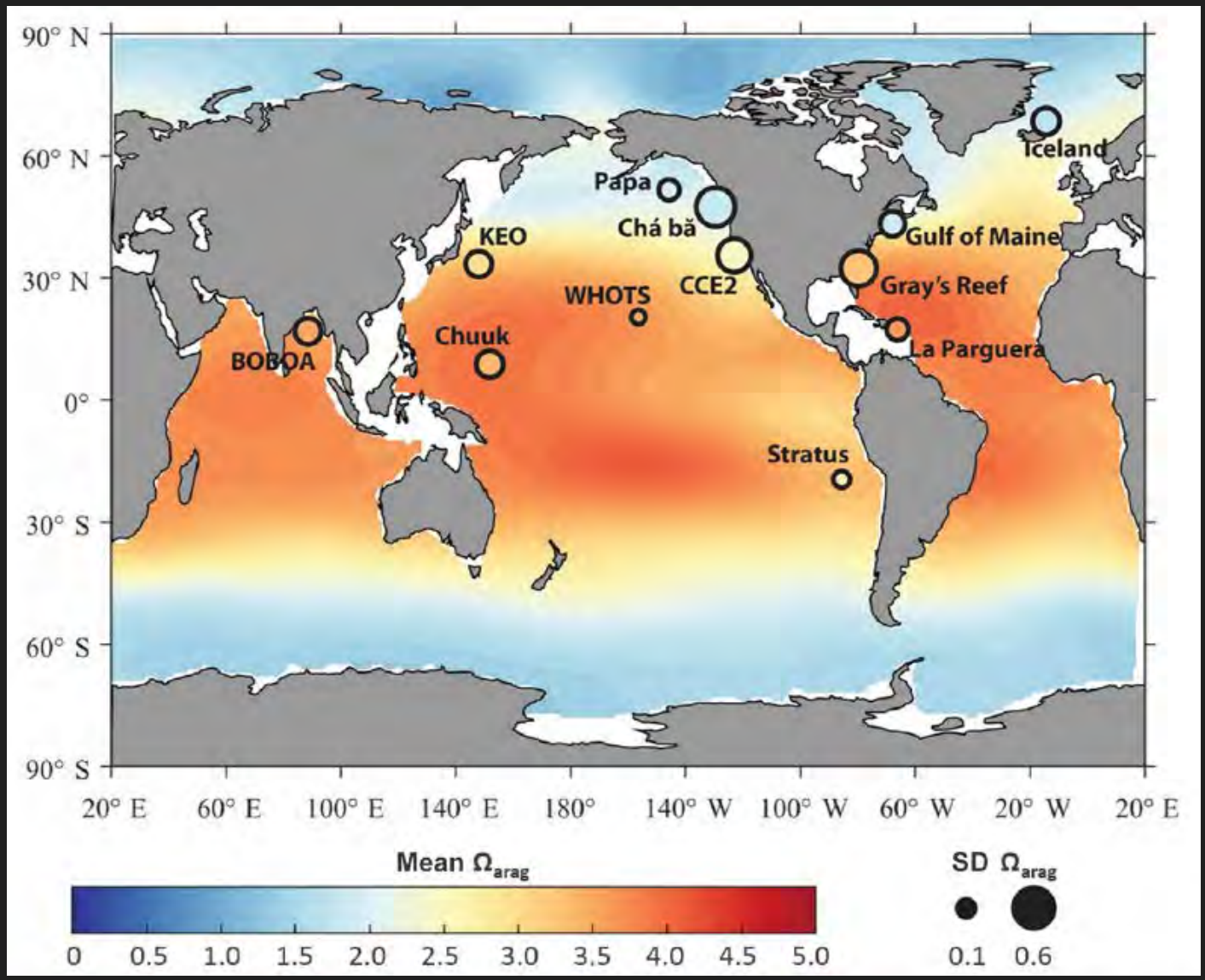
Visualization Tools

OA Mooring Data Synthesis

visualization

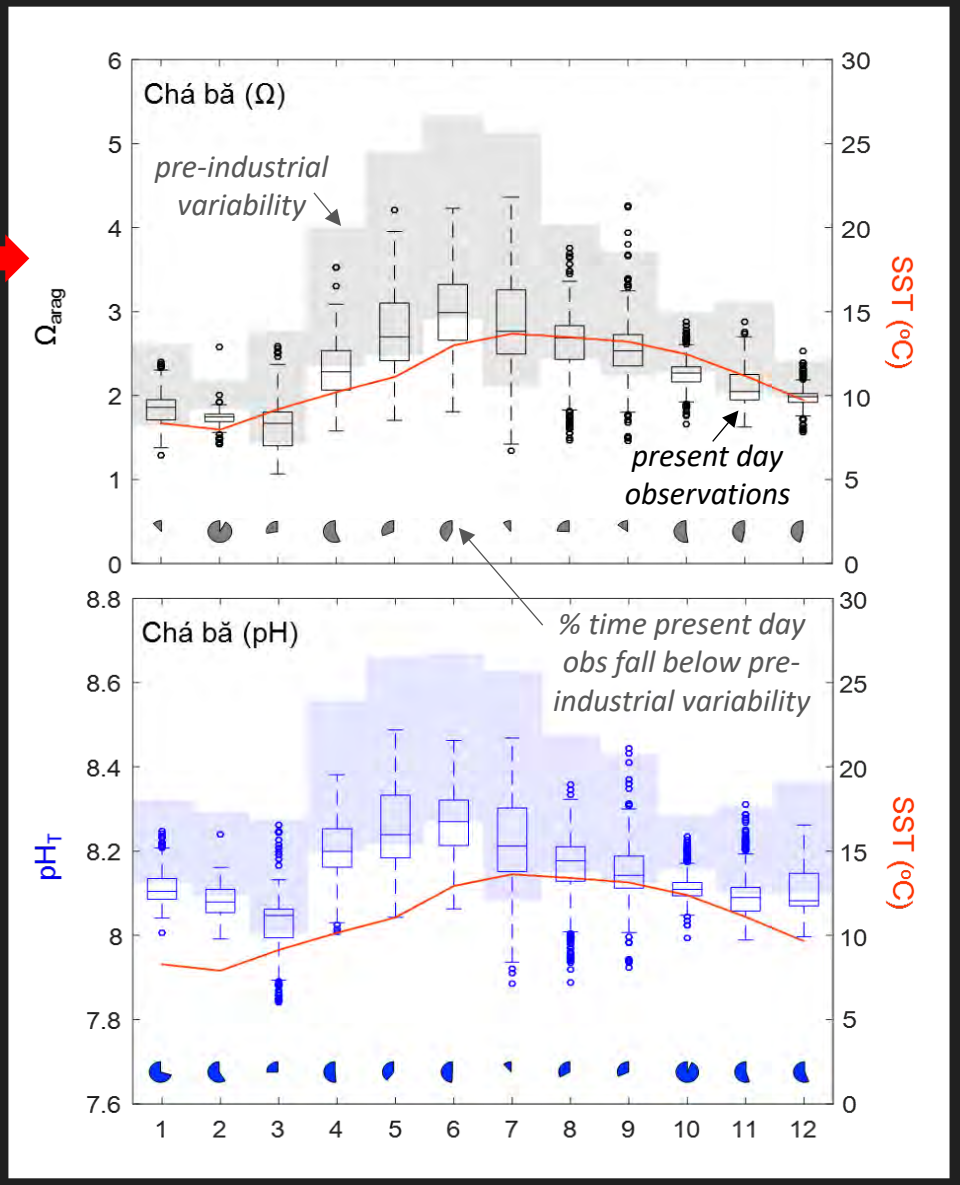
Goals of the network:

- track diurnal to decadal variability and change in CO_2 flux, the carbonate system, and the driving forces
- provide highly-resolved temporal data to inform biological impact studies and to parameterize/evaluate models



Sutton et al. 2016, *Biogeosciences*: www.biogeosciences.net/13/5065/2016/

Monthly Ω_{arag} and pH: present day and pre-industrial



Findings:

Open ocean sites (not shown) experience present day surface pH and Ωarag conditions outside the bounds of pre-industrial variability year round

Higher sub-seasonal variability at coastal sites (example shown on right) leads to more overlap with pre-industrial conditions

Sutton et al. 2016, *Biogeosciences*: www.biogeosciences.net/13/5065/2016/

New online tool for investigating thresholds

visualization

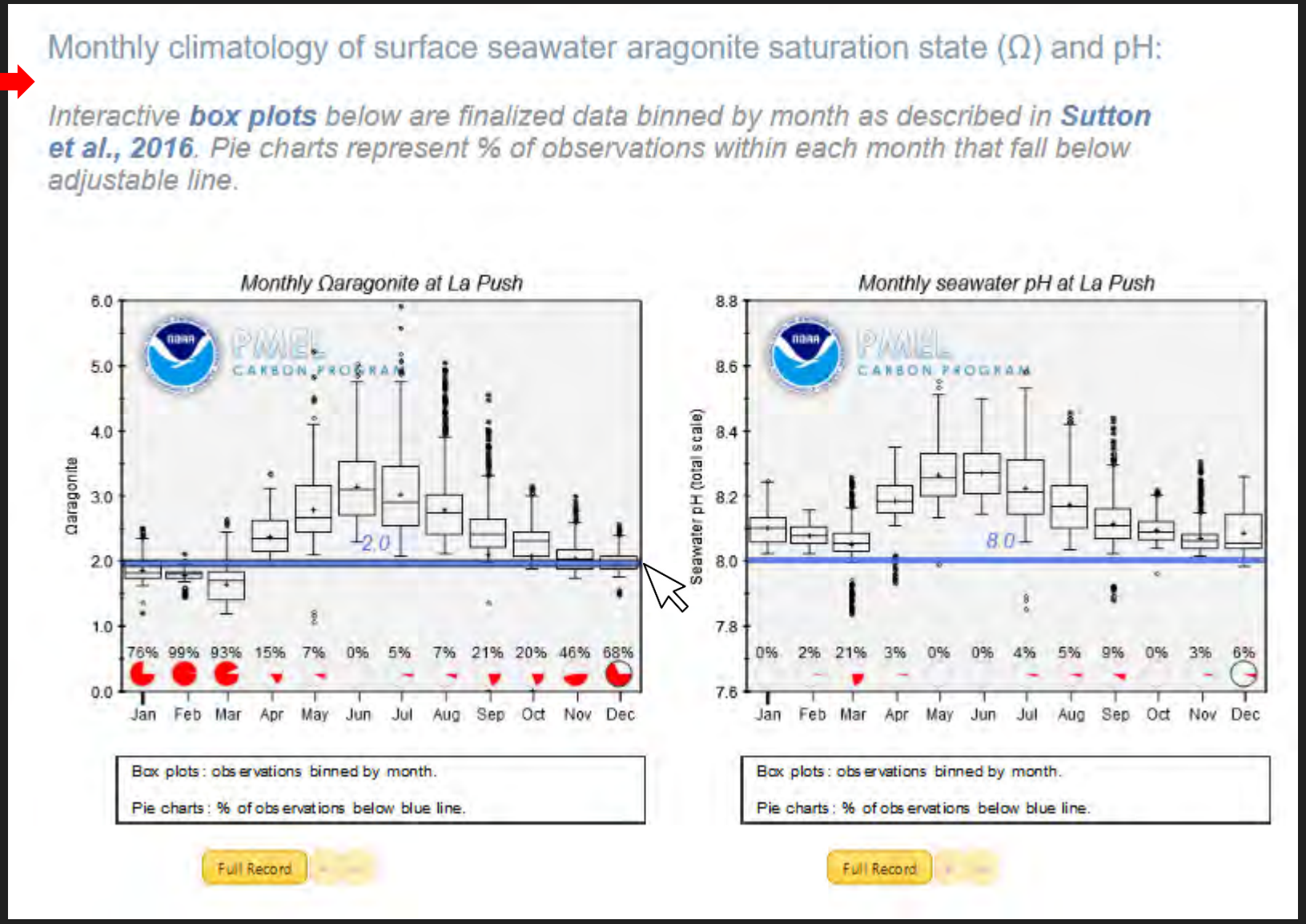
Based on this work, interactive monthly surface seawater Ωarag and pH plots now available at: www.pmel.noaa.gov/co2/story/La+Push

Features:

Adjustable threshold line

Ability to zoom in/out

Allows scientists and stakeholders to investigate exposure as new biological thresholds are discovered

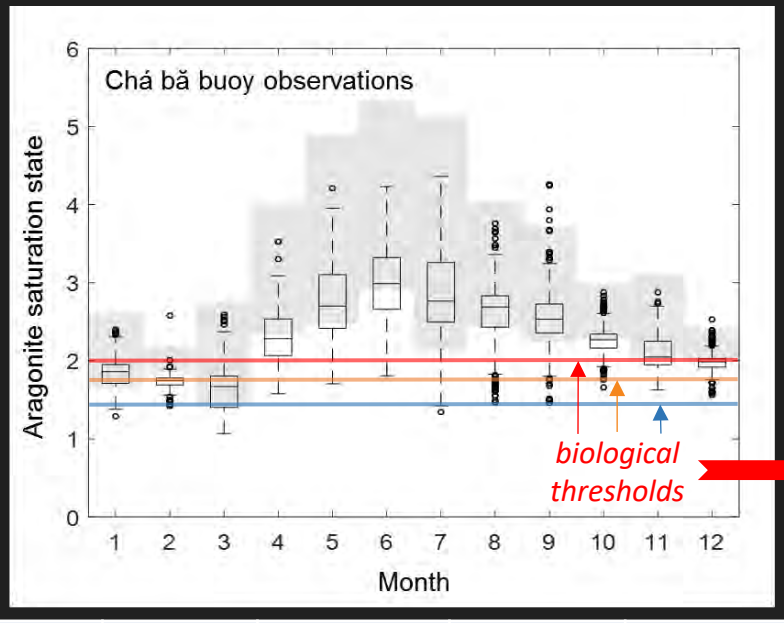


Shellfish exposure: seasonal variability + ocean acidification

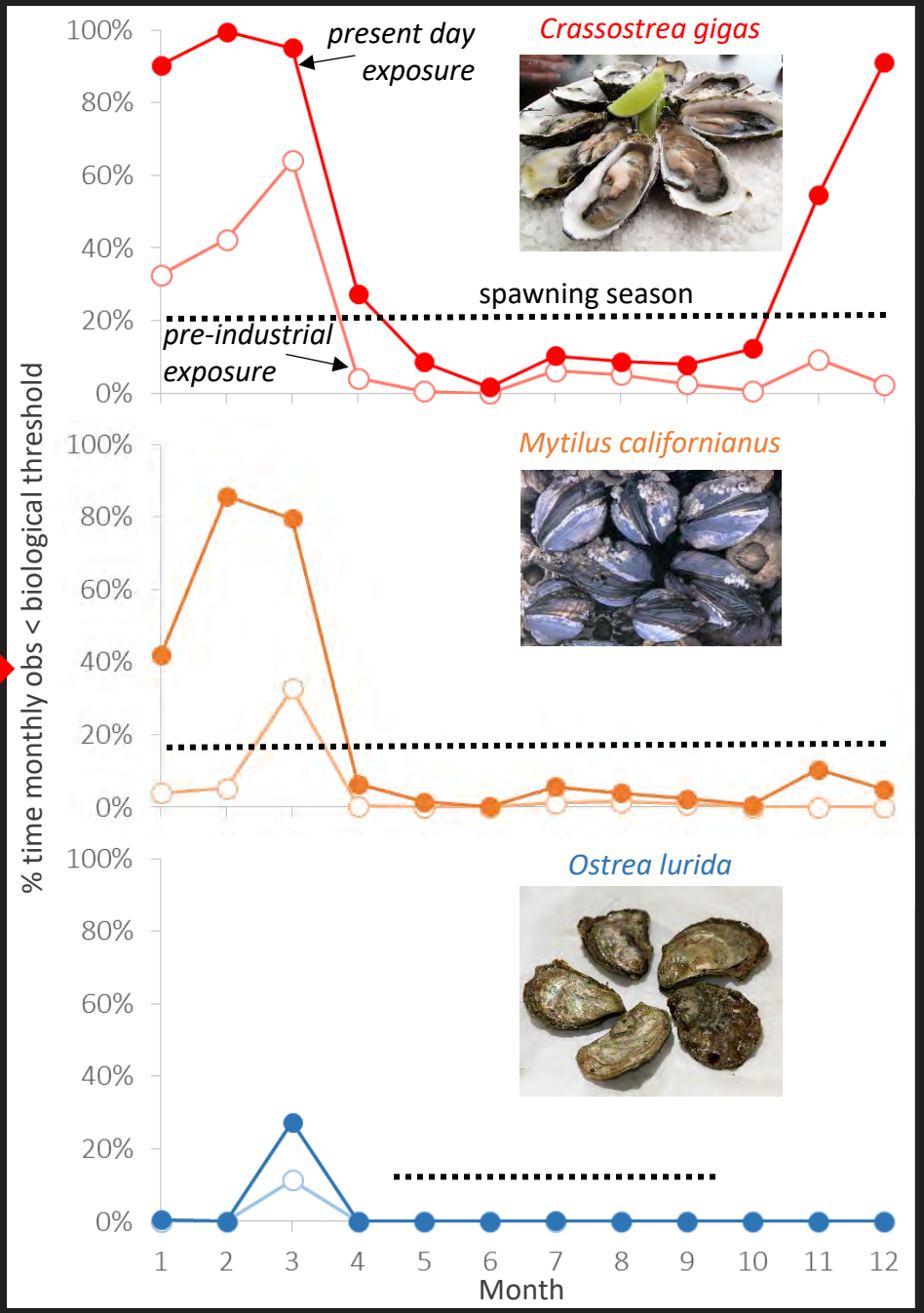
Findings:

Present day seasonal conditions in the California Current Ecosystem (example here) and Gulf of Maine exceed thresholds known to impact shellfish larvae

Unfavorable conditions existed prior to OA, however these conditions now occur more often



Threshold	Larvae	Region	Spawning season	Reference
Ωarag<2.0	Pacific oyster	northern CCE	year round (hatchery)	Barton et al. 2012
Ωarag<1.8	California mussel	throughout CCE	year round	Gaylord et al., 2011
Ωarag<1.4	Olympia oyster	northern CCE	late spring through summer	Hettinger et al. 2013



Sutton et al. 2016, *Biogeosciences*: www.biogeosciences.net/13/5065/2016/

Infographics

Dungeness crab: West Coast economic powerhouse

Infographics

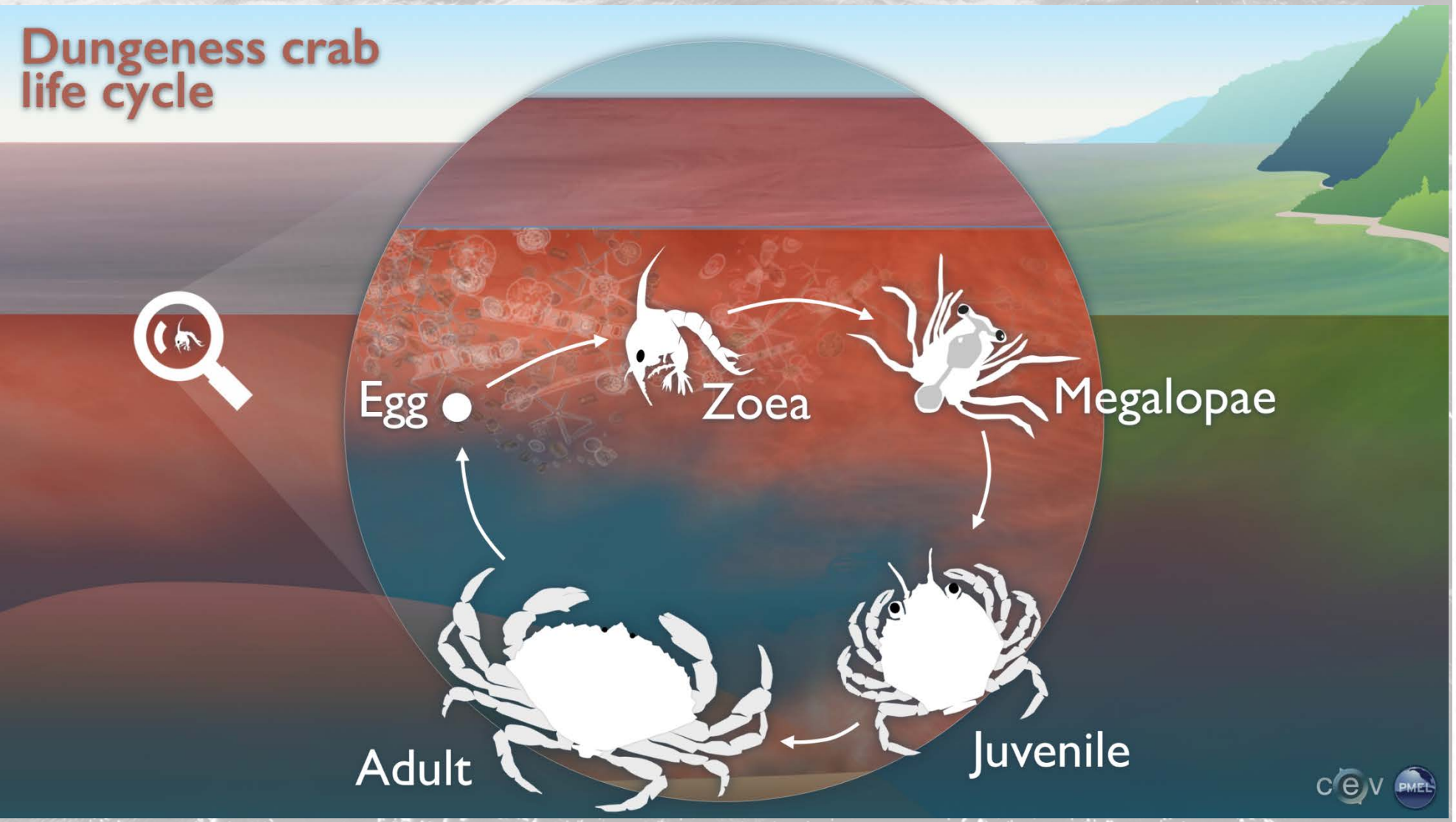


TABLE 5. Commercial landings[1] for most economically valuable fisheries on the US West Coast (California, Oregon, Washington) from 2003 to 2012.[2] Gray shaded entries represent invertebrates with some calcium carbonate hard parts.

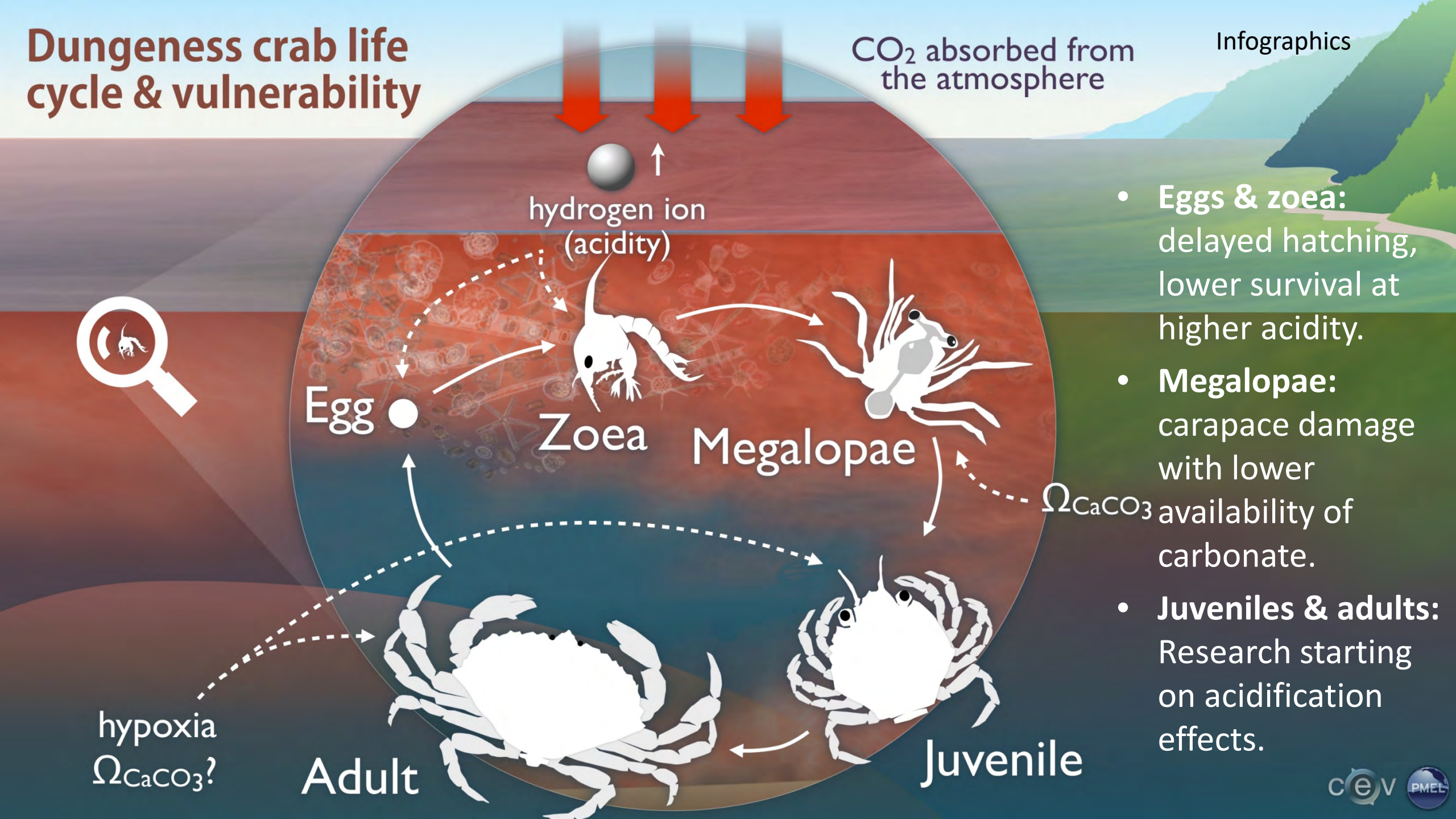
Species	Total value (2003–2012)
Dungeness crab	$1,312,233,926
California market squid	$417,528,455
Pacific oyster	$411,768,620
Pacific geoduck clam	$400,817,096
Pacific hake (whiting)	$334,971,917
Albacore tuna	$291,808,355
Sablefish	$271,104,039
Chinook salmon	$220,238,947
Manila clam	$199,346,707
Ocean shrimp	$152,899,359
Pacific sardine	$120,332,152
California spiny lobster	$86,553,611
Dover sole	$68,031,185
Sea urchin	$75,240,059

[1] Note: This database does not include the value of all aquaculture or of non-commercial tribal or recreational fisheries.
[2] Source: http://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/annual-landings/index.

Figure by Simone Alin and Hunter Hadaway (CEV)

Alin et al. Oceanography 2015

Dungeness crab life cycle & vulnerability



- **Eggs & zoea:** delayed hatching, lower survival at higher acidity.
- **Megalopae:** carapace damage with lower availability of carbonate.
- **Juveniles & adults:** Research starting on acidification effects.

Forecasts

Seasonal forecasts

JISAO's Seasonal Coastal Ocean Prediction of the Ecosystem (J-SCOPE)

Check out our website:
http://www.nanoos.org/products/j-scope/home.php

J-SCOPE

UNIVERSITY of WASHINGTON

JISAO

NOAA

CMG
UW Coastal Modeling Group

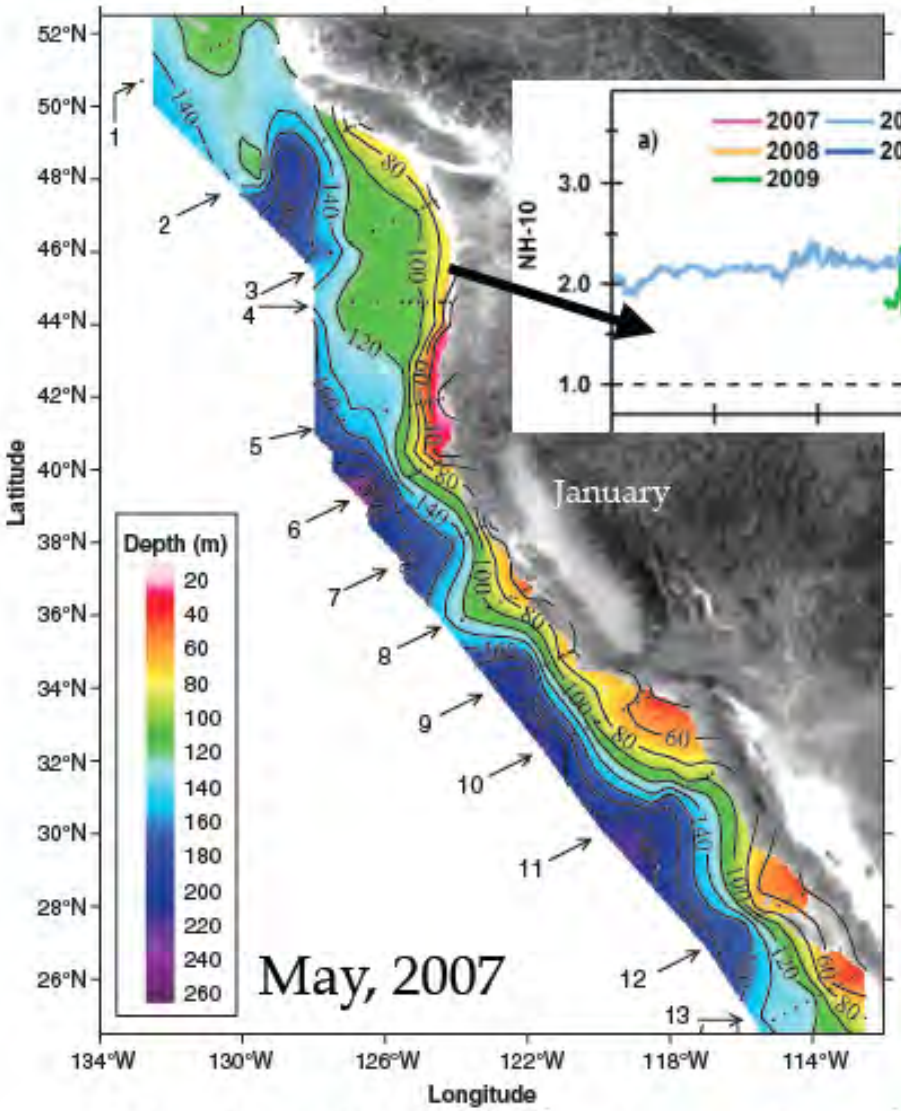
NWFSC
NORTHWEST FISHERIES SCIENCE CENTER

NANOOS

Siedlecki et al, 2016

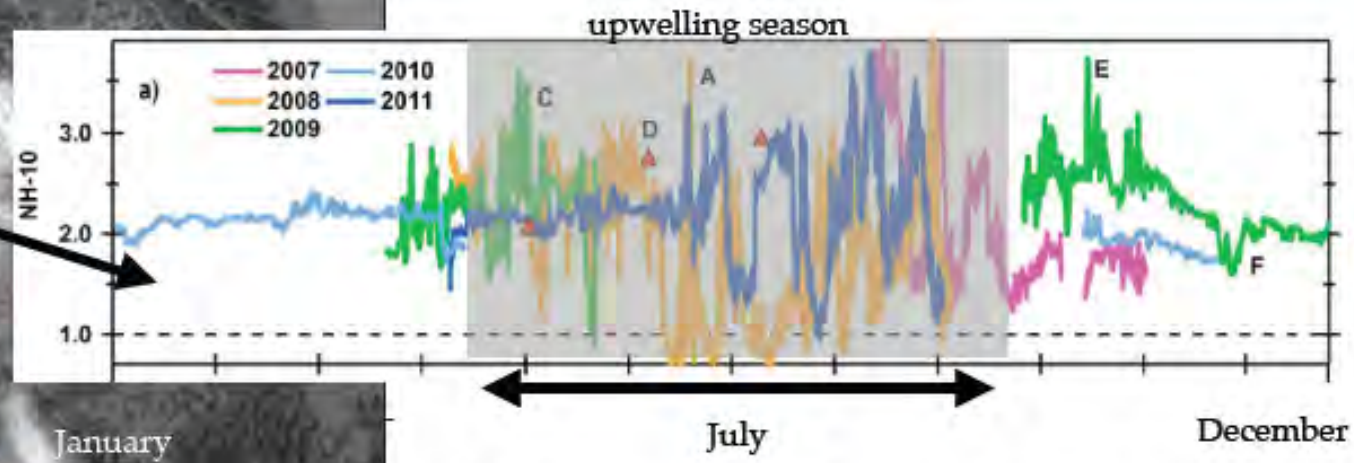
Seasonal forecasts

A lot of variability in corrosive water (Ω)



Depth of Ω=1 along coast

Feely et al. 2008

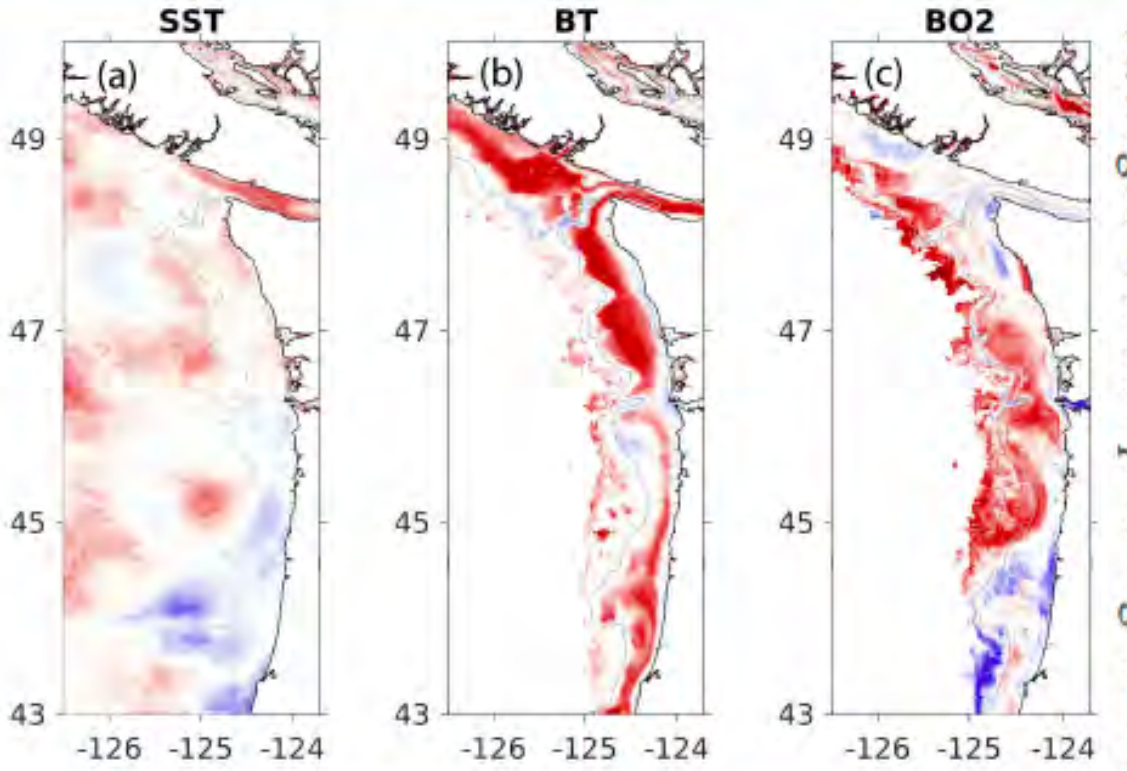


Ω time series from Newport, OR

Harris et al. 2013

Seasonal forecasts

J-SCOPE Forecasts show ocean conditions are predictable on Seasonal Timescales



JISAO's Seasonal Coastal Ocean Prediction of the Ecosystem (J-SCOPE)

We can forecast subsurface ocean conditions on seasonal timescales (2-4 months), for variables relevant to management decisions for fisheries, protected species and ecosystem health.

Currently forecasting:

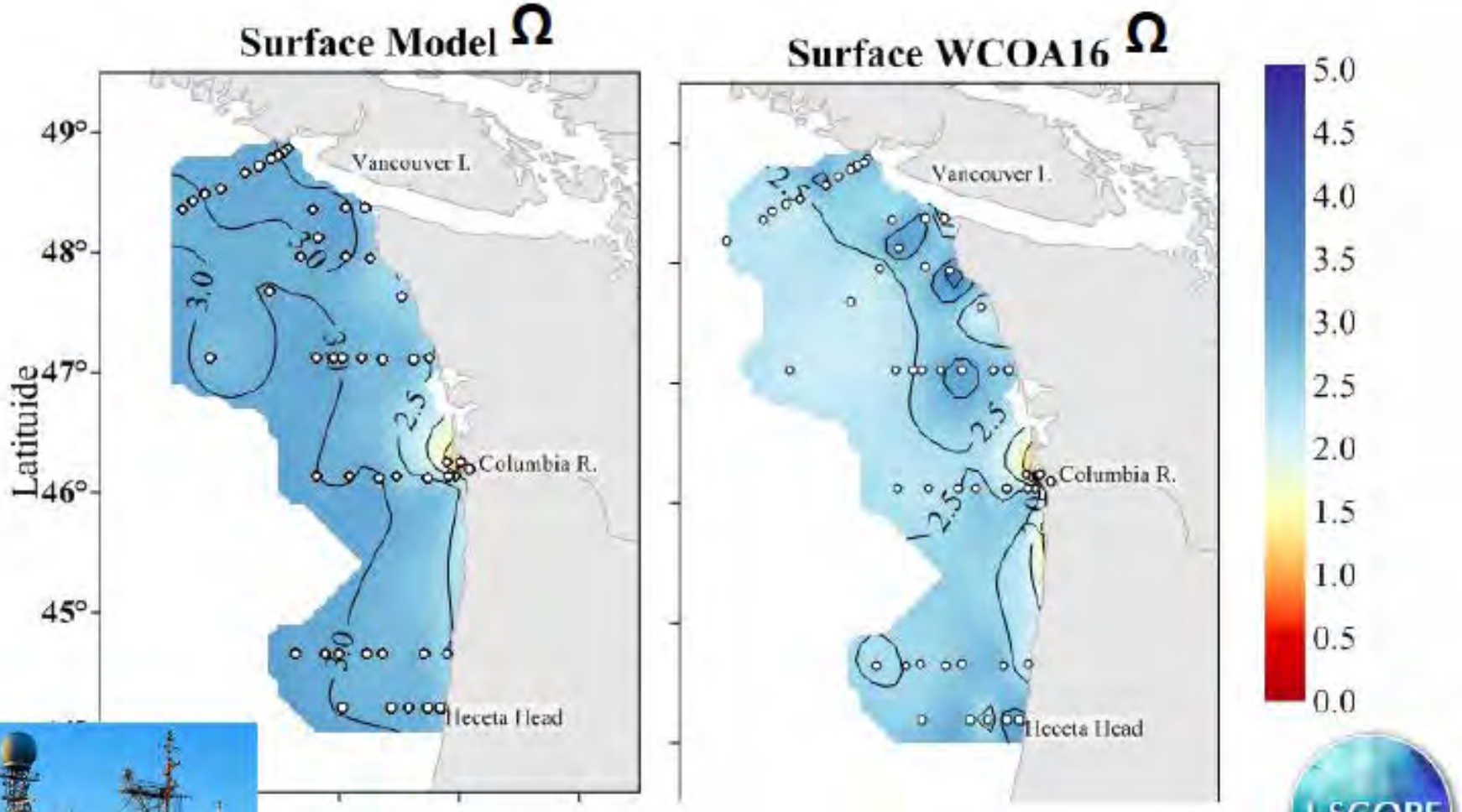
- Temperature, salinity, chlorophyll, nitrate, oxygen, pH, Ω
- Sardine Habitat (Kaplan et al. 2016)
- *in prep:* OA specific indices for crab megalopae (see talk by Siedlecki on Thursday 14:40, S2)
- *in prep*: Hake habitat (see talk by Malick on Thursday 17:00, S2)
- *in prep:* Adult Dungeness crab habitat

J-SCOPE

Check out our website:
http://www.nanoos.org/products/j-scope/home.php

Seasonal forecasts

5 Month Forecast -Comparison with Data

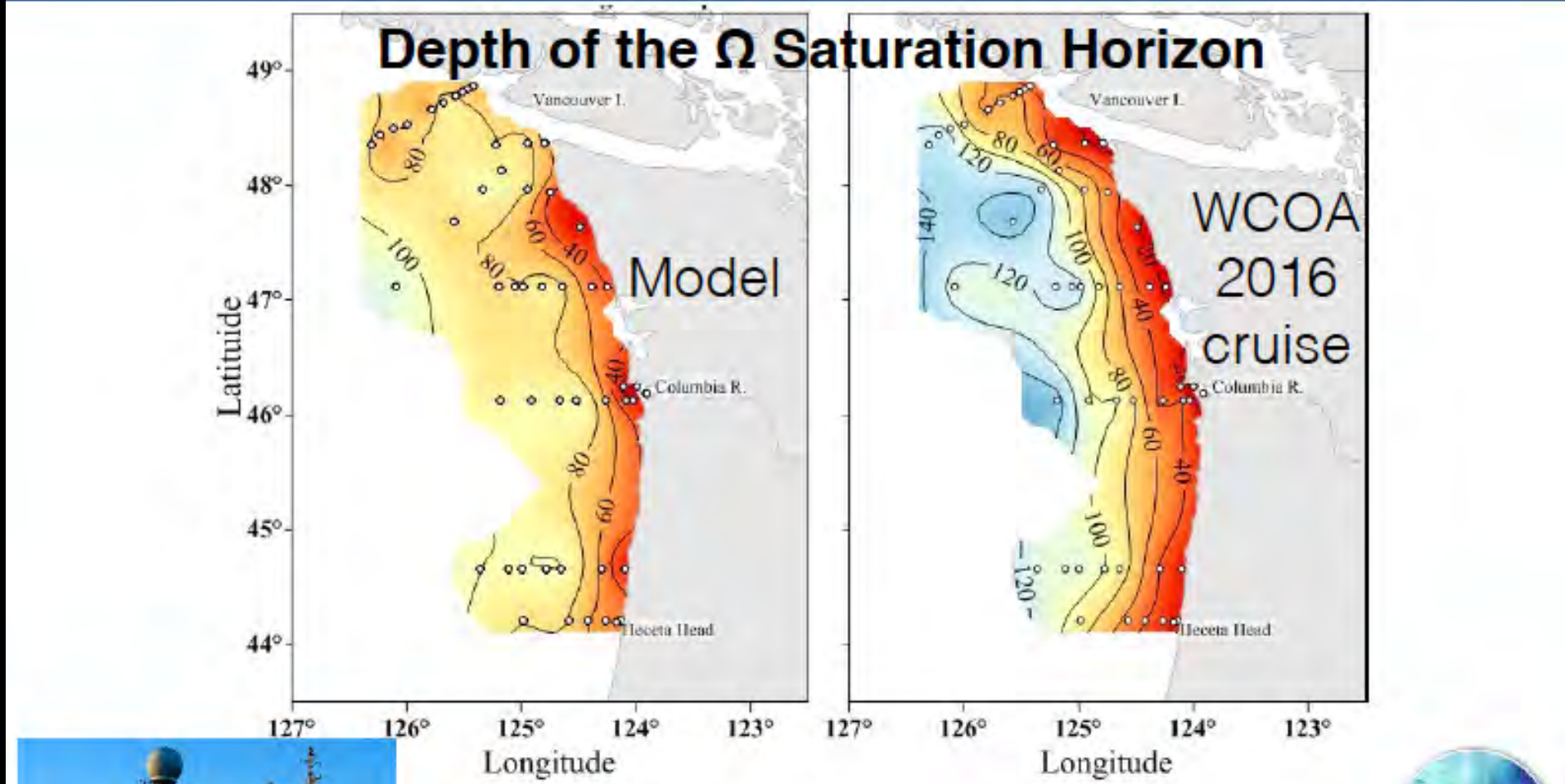


J-SCOPE

Data courtesy of NOAA-PMEL (Alin and Feely)

Seasonal forecasts

5 Month Forecast -Comparison with Data



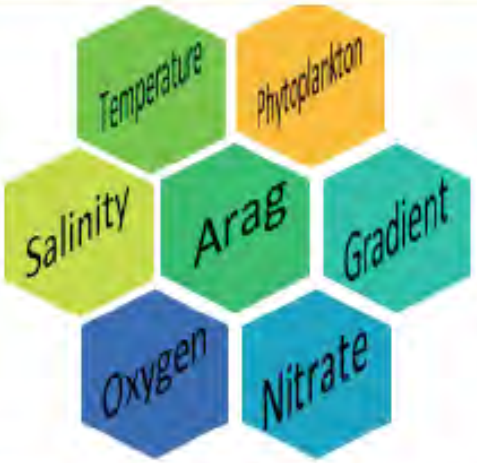
Data courtesy of NOAA-PMEL (Alin and Feely)

J-SCOPE

Seasonal forecasts

Forecasting Crab Megalopae Distribution using a GLM and J-SCOPE

4 years

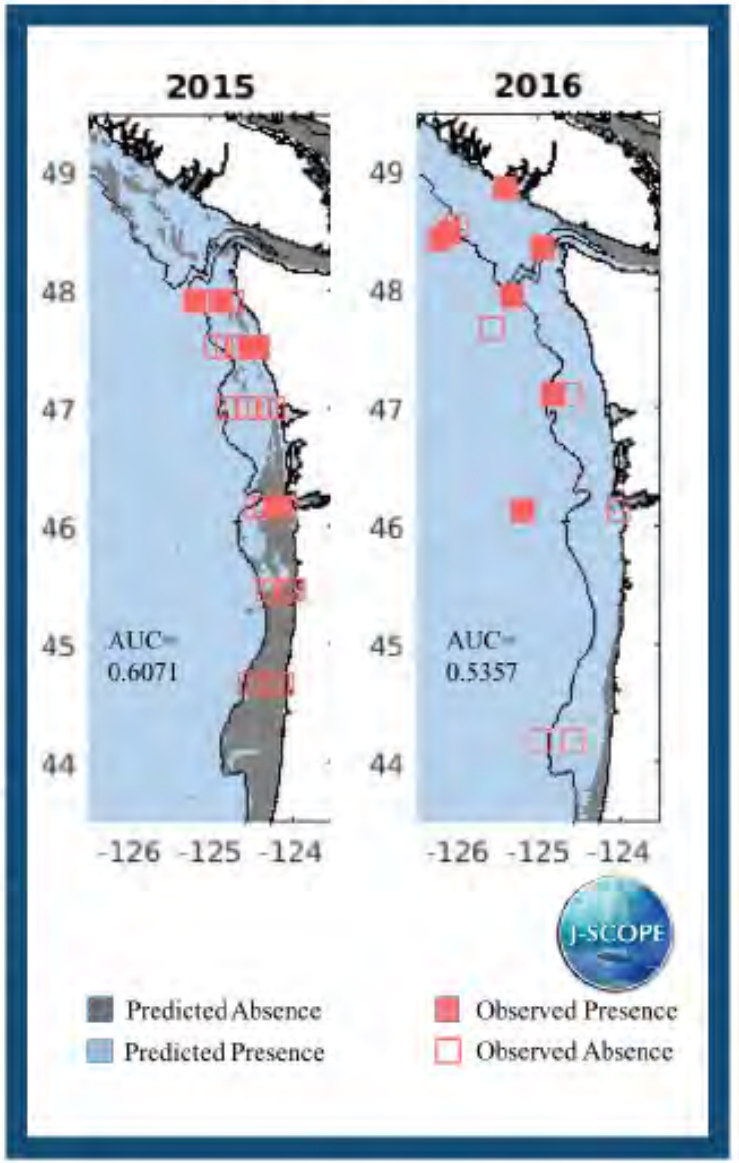


Best Fitting Variable Combination:

Lighter shades correlate to mo
positive variable coefficients

The historical data was provided by C. A. Morgan from surveys funded by NOAA Fisheries and the Bonneville Power Administration. Megalopae distribution data for 2016 was provided by NOAA Ocean Acidification Program West Coast Cruise.

Forecasts



Report Cards

Coral Reef Status Reports

Informs Coral Reef Conservation & Restoration

Cultivating *Acropora cervicornis*

Photos: NOAA

Information Exchange

Ocean Acidification Information Exchange

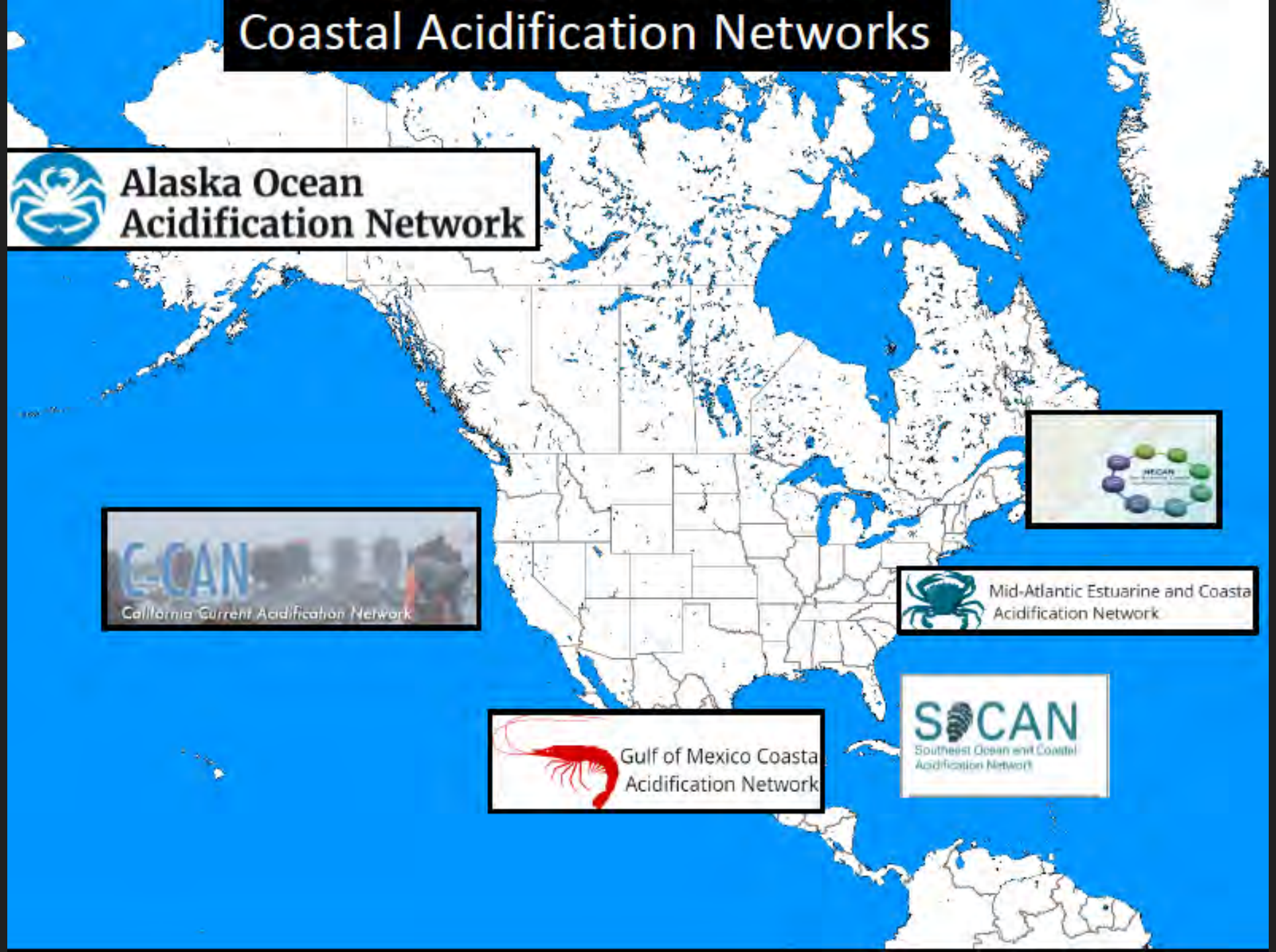
The Ocean Acidification Information Exchange and its members advance understanding of ocean acidification through collaboration and information sharing to better prepare communities to respond and adapt to acidification.

SIGN UP TODAY!!

www.OAInfoExchange.org




Information Exchange



QUESTIONS?