

**California OAH Monitoring Stakeholder & Technical Workshop**  
**April 6-7, 2023, MBARI**

**Workshop summary:** On April 6-7, 2023, over 40 researchers, policy makers, and stakeholders gathered at the Monterey Bay Aquarium Research Institute in Moss Landing, CA for the California OAH Monitoring Symposium. The goal of the ‘Symposium’ was to convene California OAH monitoring project leads, stakeholders and data providers (managers of shore station and coastal moorings, NERRS and USGS water quality monitoring managers, and diver-deployed OAH sensor programs) to achieve the following:

- Share lessons learned and facilitate input from the greater stakeholder community on OAH Portal and associated data visualizations, presentations, and analyses
- Discuss data ingestion and visualization capability to understand optimal information delivery for stakeholders and data providers
- Convene OAH monitoring project leads to enhance community awareness and identify synergies / areas of opportunity
- Share challenges, best practices, and lessons learned (including github code)
- Create community for learning and data quality enhancement
- Improve metadata linkage to co-located biological data
- Work with data providers to produce representative data visualizations within the Cal OAH Portal

**Key findings:**

- Local communities, including tribes and fishermen, should be included in the collection of OAH information.
- California state resource managers are still gathering available data for specific requirements. How can the OOS streamline their efforts?
- Sanctuaries and MPAs make significant contributions to our understanding of OAH along the coast but data is not real-time.
- Habitat compression models provide key insight into the impacts of OAH on pteropod and other indicator species but communicating these results to fisheries managers/fishermen remains a challenge.
- Data quality and spatial resolution challenges persist throughout the region. Specifically, there is a lack of funding when it comes to sensor validation and implementation of other QC best practices.
- There are a wealth of information products available, however, making data digestible for different stakeholders remains difficult. Incorporating education and outreach in OAH projects is key to ensure our products are useful for the community.

**Next steps/action items:**

- Data quality working group case study.
- WCOFS NUMERO continuing stakeholder engagement.

- BGC sensors on fishing gear.
- Incorporating shore station operations into university-level curriculum, tribal communities, and early career UN programs

**JAMBOARD -**

<https://jamboard.google.com/d/1bvn5xEld2tPMOw-YsqpyMuZU4u2IRUih5wxeHRYcTzc/edit?usp=sharing>

**About:** In the state of California, there are numerous, related efforts to measure, understand, and report OAH status and trends along the coast. However, coordination and communication across projects remains a challenge. Moreover, data quality challenges, particularly in the nearshore, make documenting coastal acidification uncertain.

**Deliverables:**

- Shared understanding of ongoing OAH projects and how they can be leveraged
- Agreement about data QC best practice and implementation plan
- Socialization of Cal OAH Portal and understanding of how to contribute and next steps for data visualization

**Agenda**

<b>Welcome and Intro</b>	
8:30	Coffee and Breakfast (Panera fruit and bagels)
9am	<a href="#">Welcome, intro, overview</a> - Henry Ruhl (CeNCOOS / MBARI), Chris Scholin (MBARI)
9:10	<a href="#">State of California</a> - Justine Kimball (OPC)
9:20	<a href="#">California Sea Grant</a> - Shauna Oh (CASG)
9:30	<a href="#">California OAH Portal</a> - Alex Harper (CeNCOOS)
<b>Morning session: Evolving stakeholder perspectives - Jan Newton (Chair)</b>	
9:40	<a href="#">Water quality management</a> - Keara Tuso (SWRCB)
9:50	<a href="#">Shellfisheries</a> - Gary Fleener/Terry Sawyer (Hog Island Oyster Co.)

10:00	<a href="#">Commercial/recreational fisheries</a> - Bruce/Diane (CWPA)
10:10	mCDR industry - Jeanine Ash (Capture 6, Virtual)
10:20	<a href="#">National Marine Sanctuaries</a> - Ryan Freedman (CINMS)
<b>10:30</b>	<b>Break</b>
10:40	Indigenous perspectives - Chairman Lopez (Amah Mutsun, Virtual)
10:50	<a href="#">Indigenous perspectives</a> - Rosa Laucci (Tolowa Dee-Ni' Nation, Virtual)
11:00	Panel discussion - How do we better deliver OA information for specific applications?
11:30	Lunch - Coastal Roots Catering
<b>Afternoon session: Collaborative OAH Monitoring in California - Clarissa Anderson (Chair)</b>	
12:15	<a href="#">West Coast OA Surveys</a> - Richard Feely (NOAA PMEL) / Nina Bednarsek (OSU)
12:50	<a href="#">West Coast Data Synthesis Project</a> - Dr. Sara Hamilton (UC Davis Postdoctoral fellow)
1:10	<a href="#">Modeling OAH on the US West Coast</a> - Chris Edwards (UCSC)
1:30	<a href="#">Enhanced OAH Monitoring Project</a> - Karen McLaughlin (SCCWRP)
1:50	<a href="#">West Coast Ocean Data Portal Ocean Acidification Indicator Development</a> - Jan Newton / Roxanne Carini (NANOOS / UW)
2:10	<a href="#">Trinidad Head Ocean Observing Node</a> - Eric Bjorkstedt (NOAA SWFSC)

2:30	Breakout 1: How well do our existing monitoring programs address stakeholder requirements? What can be improved? How do we build a more integrated network?
3:30	Reconvene- discuss (Alex, all)
<b>Afternoon - Products / Visualization</b>	
4:00pm	Axiom Data Portal Demo, <a href="#">Data Challenge</a> , Discussion and Drinks
5:00pm	Adjourn

<b>Day 2 - Shore station OAH Data Quality workshop</b>	
8:30 am	Coffee and Breakfast
9:00 am	Welcome / overview - Alex
<b>Morning session: Data Quality Best Practices - Emily Bockmon and Todd Martz (Co-chairs)</b>	
9:10 am	Cal OOS Shore Station overview ( <a href="#">MLML</a> , <a href="#">UCSD</a> ) - Tom Connolly (MLML)/ Melissa Carter (UCSD)
9:30 am	U.S. IOOS QARTOD - <a href="#">Manual for Real-Time Quality Control of pH Observations</a> - Mark Bushnell (QARTOD National Coordinator, Remote)
9:45 am	<a href="#">OOI Biogeochemical Sensor Data Best Practices &amp; User Guide</a> - Hilary Palevsky (Boston College, Remote)
10:00 am	<a href="#">Measuring Coastal Acidification Using In Situ Sensors in the National Estuary Programs (epa.gov)</a> - Stephen R. Pacella (U.S. EPA, Remote)
10:15 am	<a href="#">Best Practice Data Standards for Discrete Chemical Oceanographic Observations</a> - Liqing Jiang (NOAA Ocean Carbon Acidification Data System, OCADS)

10:30 am	Seawater pH Sensor Data QC Protocols for <a href="#">NOAA's Ocean Acidification Observing Network of Buoys</a> - Roman Battisti (UW CICOES, NOAA PMEL)
10:45 am	Breakout 1: How do data QC requirements vary along the coast? For different stakeholder groups? How do we improve data quality across sites/institutions?
11:30 am	Discussion
12pm	Lunch
<b>Afternoon - Products / Visualization - Alex Harper and Marine Lebec (Co-chairs)</b>	
1pm	Breakout 2 (small groups?): How do we improve data products across the coastal observing network?
3:00pm	Adjourn

### Participants (in-person attendance)

Name	Affiliation
Jeff Abell	Cal Poly Humboldt
Clarissa Anderson	Southern California Coastal Ocean Observing System
Fred Bahr	Central and Northern California Ocean Observing System
Roman Battisti	NOAA Pacific Marine Environmental Laboratory
Eric Bjorkstedt	NOAA Southwest Fisheries Science Center
Emily Bockmon	Cal Poly San Luis Obispo
Tom Connolly	Moss Landing Marine Laboratories
Julia Cheresh	UC Santa Cruz
Chris Edwards	UC Santa Cruz
Richard Feely	NOAA Pacific Marine Environmental Laboratory
Gary Fleener	Hog Island Oyster Co.

Ryan Freedman	Channel Islands National Marine Sanctuary
Christina Frieder	Southern California Coastal Water Research Project
Matt Galaska	NOAA Pacific Marine Environmental Laboratory
Sara Hamilton	UC Davis
Alex Harper	Central and Northern California Ocean Observing System
Jaime Jahncke	Applied California Current Ecosystem Studies
Liqing Jiang	NOAA National Centers for Environmental Information
Kevin Johnson	Cal Poly SLO/ California Sea Grant
Justine Kimball	Ocean Protection Council
Kristy Kroeker	UC Santa Cruz
Matthias Lankhorst	UC San Diego
Marine Lebrech	Central and Northern California Ocean Observing System
Chairman Valentin Lopez	Amah Mutsun
Todd Martz	UC San Diego
Karen McLaughlin	Southern California Coastal Water Research Project
Megan Medina	Southern California Coastal Ocean Observing System
Jan Newton	Northwest Association of Networked Ocean Observing System
Richard Ogg	F/V Karen Jeanne
Shauna Oh	California Sea Grant
Diane Pleschner-Steele	California Wetfish Producers Association
Henry Ruhl	Central and Northern California Ocean Observing System
Erin Satterthwaite	UC San Diego / CalCOFI
Terry Sawyer	Hog Island Oyster Co.
Anya Stajner	UC San Diego / CalCOFI
Bruce Steele	California sea urchin diver
Keara Tuso	State Water Resources Control Board
Megan Williams	Ocean Protection Council

Data QC Reference:

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- Humphreys, M. P., Gregor, L., Pierrot, D., van Heuven, S. M. A. C., Lewis, E., and Wallace, D.W.R. (2020). PyCO2SYS: marine carbonate system calculations in Python. Zenodo. [doi:10.5281/zenodo.3744275](https://doi.org/10.5281/zenodo.3744275).
- Jiang, L.-Q., D. Pierrot, R. Wanninkhof, R. A. Feely, B. Tilbrook, S. Alin, L. Barbero, R. H. Byrne, B. R. Carter, A. G. Dickson, J.-P. Gattuso, D. Greeley, M. Hoppema, M. P. Humphreys, J. Karstensen, N. Lange, S. K. Lauvset, E. R. Lewis, A. Olsen, F. F. Perez, C. Sabine, J. D. Sharp, T. Tanhua, T. W. Trull, A. Velo, A. J. Allegra, P. Barker, E. Burger, W.-J. Cai, C.-T. A. Chen, J. Cross, H. Garcia, J. M. Hernandez-Ayon, X. Hu, A. Kozyr, C. Langdon, K. Lee, J. Salisbury, Z. A. Wang, and L. Xue (2022), Best Practice Data Standards for Discrete Chemical Oceanographic Observations. *Frontiers in Marine Science*. 8:705638, <https://doi.org/10.3389/fmars.2021.705638>.
- Pierrot, D., Epitalon, J.-M., Orr, J.C., Lewis, E., and Wallace, D. W. R., MS Excel program developed for CO2 system calculations – version 3.0, (2021). [https://github.com/dpierrot/co2sys\\_xl](https://github.com/dpierrot/co2sys_xl).
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- Sharp, J. D., Pierrot, D., Humphreys, M. P., Epitalon, J.-M., Orr, J. C., Lewis, E. R., Wallace, D. W. R. (2020). CO2SYSv3 for MATLAB. [doi: 10.5281/zenodo.3950562](https://doi.org/10.5281/zenodo.3950562)