Making Ocean Acidification Data Accessible and Useable for Coastal Managers

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Effects of Climate Change on the World Oceans
June 5, 2018
OA Data Cycle

1. State of the environment (improve it)
2. Collect OA data
3. Conduct experiments
4. Use data products to make decisions
5. Translate and create data products
6. Curate data

Informed by Science

Stakeholder input
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
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).
Integrated Ocean Observing System

http://www.ipacoa.org/
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
Visualization Tools
OA Mooring Data Synthesis

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

Findings:
Open ocean sites (not shown) experience present day surface pH and $\Omega_{\text{arag}}$ 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.

Based on this work, interactive monthly surface seawater $\Omega_{\text{arag}}$ 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.

<table>
<thead>
<tr>
<th>Threshold</th>
<th>Larvae</th>
<th>Region</th>
<th>Spawning Season</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Omega_{arag} &lt; 2.0$</td>
<td>Pacific oyster</td>
<td>northern CCE</td>
<td>year round (hatchery)</td>
<td>Barton et al. 2012</td>
</tr>
<tr>
<td>$\Omega_{arag} &lt; 1.8$</td>
<td>California mussel</td>
<td>throughout CCE</td>
<td>year round</td>
<td>Gaylord et al., 2011</td>
</tr>
<tr>
<td>$\Omega_{arag} &lt; 1.4$</td>
<td>Olympia oyster</td>
<td>northern CCE</td>
<td>late spring through summer</td>
<td>Hettinger et al. 2013</td>
</tr>
</tbody>
</table>

Sutton et al. 2016, Biogeosciences: www.biogeosciences.net/13/5065/2016/
Infographics
• Eggs & zoa: delayed hatching, lower survival at higher acidity.
• Megalopae: carapace damage with lower availability of carbonate.
• Juveniles & adults: Research starting on acidification effects.
Forecasts
JISAO's Seasonal Coastal Ocean Prediction of the Ecosystem (J-SCOPE)

Check out our website:

Siedlecki et al, 2016
A lot of variability in corrosive water (Ω)

Ω time series from Newport, OR
Harris et al. 2013

Depth of Ω=1 along coast
Feely et al. 2008
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

Check out our website:
Seasonal forecasts

Data courtesy of NOAA-PMEL (Alin and Feely)
Seasonal forecasts

5 Month Forecast - Comparison with Data

Depth of the $\Omega$ Saturation Horizon

- Model
- WCOA 2016 cruise

$\Omega_{ARAG}$ Saturation Pressure

Data courtesy of NOAA-PMEL (Alin and Feely)
Forecasting Crab Megalopae Distribution using a GLM and J-SCOPE

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.
Report Cards
Coral Reef Status Reports
Informs Coral Reef Conservation & Restoration

Cultivating *Acropora cervicornis*

Photos: NOAA
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
QUESTIONS?