Ocean Acidification

Dr. Libby Jewett
Director, NOAA Ocean Acidification Program
Chair, OA Interagency Working Group
Co-Chair, Global OA Observing Network
Presentation to NAML, March 2 2013
MONITORING OCEANS
Observing Network for Monitoring Physics, Chemistry and Biology of Global Ocean Waters

Hydrographic Cruises
Documenting carbon distributions in the ocean interior

Volunteer Observing Ships
Documenting carbon distributions in the surface ocean

Buoys and Other Autonomous Systems
Documenting temporal changes in ocean carbon

Ecosystem surveys

Ocean Acidification
Aragonite Saturation State

Thermodynamic Threshold

Oceanic Buoy MS

GA Buoy

NH Buoy

5
4
3
2
1
0

A

B

C

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J

K

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M

N

O

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Q

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V

W

X

Y

Z
East Coast OA Cruise Summer 2016

Co-PIs
Joe Salisbury, UNH
Wei Jun Cai, Udel

Dates
June 17 – July 24, 2016

Ship
Gordon Gunther

http://www.aoml.noaa.gov/ocd/gcc/ECOA1/
Gulf of AK OA Cruise Summer 2016

Lead PI: Jeremy Mathis, PMEL
Dates: July 10 – 31, 2015

From Seattle

Kodiak

2015 GOA OA Cruise
Reef Monitoring Cross-disciplinary
ECOLOGICAL TO SOCIOECONOMIC IMPACTS
Calcifying shellfish potentially vulnerable to ocean acidification along US East Coast

Courtesy: C. Gobler
### Evaluating the Risks of OA In Alaska

#### Census Area/ Borough and Rank

<table>
<thead>
<tr>
<th>Census Area/ Borough</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake and Peninsula Borough</td>
<td>1</td>
</tr>
<tr>
<td>Wrangell City and Borough</td>
<td>2</td>
</tr>
<tr>
<td>Prince of Wales-Hyder Census Area</td>
<td>3</td>
</tr>
<tr>
<td>Aleutians East Borough</td>
<td>3</td>
</tr>
<tr>
<td>Petersburg Census Area</td>
<td>5</td>
</tr>
<tr>
<td>Sitka, City and Borough of</td>
<td>6</td>
</tr>
<tr>
<td>Yakutat City and Borough</td>
<td>7</td>
</tr>
<tr>
<td>Bristol Bay Borough</td>
<td>7</td>
</tr>
<tr>
<td>Dillingham Census Area</td>
<td>7</td>
</tr>
<tr>
<td>Valdez-Cordova Census Area</td>
<td>10</td>
</tr>
<tr>
<td>Hoonah-Angoon Census Area</td>
<td>11</td>
</tr>
<tr>
<td>Bethel Census Area</td>
<td>11</td>
</tr>
<tr>
<td>Juneau, City and Borough of</td>
<td>13</td>
</tr>
<tr>
<td>Kodiak Island Borough</td>
<td>14</td>
</tr>
<tr>
<td>Aleutians West Census Area</td>
<td>14</td>
</tr>
<tr>
<td>Wade Hampton Census Area</td>
<td>16</td>
</tr>
<tr>
<td>Municipality of Anchorage</td>
<td>17</td>
</tr>
<tr>
<td>Haines Borough</td>
<td>17</td>
</tr>
<tr>
<td>Skagway, Municipality of Nome Census</td>
<td>19</td>
</tr>
<tr>
<td>Nome Census Area</td>
<td>20</td>
</tr>
<tr>
<td>Yukon Koyukuk Census Area</td>
<td>21</td>
</tr>
<tr>
<td>Fairbanks North Star Borough</td>
<td>22</td>
</tr>
<tr>
<td>Matanuska-Susitna Borough</td>
<td>22</td>
</tr>
<tr>
<td>Northwest Arctic Borough</td>
<td>24</td>
</tr>
<tr>
<td>Ketchikan Gateway Borough</td>
<td>24</td>
</tr>
<tr>
<td>Kenai Peninsula Borough</td>
<td>26</td>
</tr>
<tr>
<td>Southeast Fairbanks Census Area</td>
<td>27</td>
</tr>
<tr>
<td>Denali Borough</td>
<td>28</td>
</tr>
<tr>
<td>North Slope Borough</td>
<td>29</td>
</tr>
</tbody>
</table>

#### Final Index Value

- 3.01 - 3.92 (High)
- 2.44 - 3.00 (Medium)
- 1.65 - 2.43 (Low)

#### Population

- 100,000 - 295,570
- 10,001 - 100,000
- 5,001 - 10,000
- 2,001 - 5,000
- 646 - 2,000

#### Commercial Harvest Value (M $)

- $101 - 314.8
- $21 - 100
- $2.9 - 20

#### Subsistence Fishing (lbs/capita)

- 201 - 377
- 101 - 200
- 51 - 100
- 26 - 50
- 11 - 25

Mathis et al., 2014
Progress in Oceanography
TECHNOLOGY DEVELOPMENT
New Technologies

Carbon Wave Glider
Adaptation Technologies

Beer bottle

Burkilator
MODELS AND FORECASTS
West Coast Modeling Efforts

What does the 2013 Forecast say about $\Omega$?

Seasonal increase in undersaturated waters’ presence on shelf, which varies regionally
Ecosystem Modeling


See also...

DATA MANAGEMENT AND SHARING
Sharing Regional Data in real time...

http://www.ipacoa.org/
Sharing quality controlled data...

Ocean Acidification Scientific Data Stewardship (OADS)

The U.S. NODC serves as the data management focal point for the NOAA Ocean Acidification Program (OAP) through its Ocean Acidification Data Stewardship (OADS) project. The main goal of the OADS project is to serve the broader OA community by providing dedicated online data discovery, access to NODC-hosted and distributed data sources, long-term archival, and scientific stewardship for a diverse range of ocean acidification and other chemical, physical, and biological oceanographic data. OADS builds on a collaborative approach with shared responsibilities among scientists, data managers, data partners, and NODC.

Access data
Submit data
Need Help?

For questions please contact NODC_Ocean_Acidification@noaa.gov

Web page last updated June 10, 2014 12:57 PM
Web page maintained by Herman Garcia
Upcoming Opportunities

• **Marine Sensor Innovation** RFP with IOOS
  – 2014. funded two projects. East and West coasts.

• **Biogeochemical to ecological modeling** with CSCOR/NOS

• **Northeast “high priority” species** RFP with Sea Grant - 2016

• **Data Synthesis**: Discussion at Woods Hole Mtg, June

• **Regional RFPs (stay tuned)**
  – Vulnerability Assessments
  – Observing Optimization

• **Adaptation strategies** RFP
States Taking Action

- Washington
- California
- Oregon
- Alaska
- Maine
- Maryland
- Massachusetts
- Rhode Island
Regional Networks

California Current Acidification Network (C-CAN)
http://c-can.msi.ucsb.edu/

Southeast Ocean and Coastal Acidification Network (SOCAN)
http://secoora.org/SOCAN

Northeast Coastal Acidification Network (NECAN)
www.neracoos.org/NECAN
GLOBAL APPROACH
How was GOA-ON made?

- Two international workshops have been convened to establish a coordinated approach to build an integrated global observing network for ocean acidification that addresses the requirements of nations affected by this emerging environmental problem.
- The first workshop held at the University of Washington in June 2012, was attended by 62 participants from 23 countries.
- The second workshop, held at St. Andrews, UK, in July 2013 was attended by 87 participants from 26 countries.
- These participants input have defined the goals, details, and focus of the global ocean acidification observing network.
GOA-ON will provide:

The Global Ocean Acidification Observing Network (GOA-ON) is a collaborative international approach to document the status and progress of ocean acidification in open-ocean, coastal, and estuarine environments, to understand the drivers and impacts of ocean acidification on marine ecosystems, and to provide spatially and temporally resolved biogeochemical data necessary to optimize modeling for ocean acidification.

**Approach and Goals**

Detailed information about the GOA-ON background, design, implementation, and data strategy can be found here:

*Global Ocean Acidification Observing Network: Requirements and Governance Plan (JA Newton, RA Feely, EB Jewett, P Williamson, J Mathis)*

**GOA-ON high-level goals:**

**Goal 1 - Improve our understanding of global OA conditions:**
- Determine status and spatial/temporal patterns in ocean acidity

**Goal 2 - An understanding of ecosystem response to OA:**
- Measure biological responses to physical/chemical changes
- Identify areas of vulnerability

**Goal 3 - Acquire and exchange data and knowledge necessary to optimize modeling of OA and its impacts:**
- Provide spatially and temporally resolved chemical and biological data to be used in developing models for societally relevant analyses and projections

*www.GOA-ON.org*
GOA-ON Plan now available

Global Ocean Acidification Observing Network: Requirements and Governance Plan

First Edition
September 2014

J.A. Newton, R.A. Feely,
E.B. Jewett, P. Williamson,
J. Mathis
**GOA-ON has a nested system design**

### Coral reefs

### Coasts & shelf seas

### Open ocean

<table>
<thead>
<tr>
<th>Goal 1</th>
<th>Goal 2</th>
<th>Goal 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>OA conditions</td>
<td>Ecosystem response</td>
<td>OA modeling</td>
</tr>
<tr>
<td><strong>L1:</strong> carbonate-system constraint, T, S, O, fluorescence, irradiance</td>
<td><strong>L1:</strong> biomass of functional groups (phytoplankton, zooplankton &amp; microbes)</td>
<td><strong>L2:</strong> species; processes incl. growth, grazing &amp; respiration</td>
</tr>
<tr>
<td><strong>L2:</strong> nutrients, bio-optics, transport, meteorology, trace metals...</td>
<td><strong>L3:</strong> capability-specific</td>
<td><strong>L3:</strong> capability-specific</td>
</tr>
</tbody>
</table>

**Inputs to models**
Global OA Observing Network

- IOCCP
  International Ocean Carbon Coordination Project
- SCOR
  Scientific Committee on Oceanic Research (of ICSU)
- IOC
  Intergovernmental Oceanographic Commission (of UNESCO)
- UNESCO
  UN Educational, Scientific and Cultural Organization
- OAI-RUG
  OA International Reference User Group
- OA-ICC
  International Coordination Centre (of IAEA)
- IGBP
  International Geosphere-Biosphere Programme
- ICSU & Future Earth
- IAEA
  International Atomic Energy Agency
- GEO
  Group on Earth Observations
- Blue Planet
  task of GEO/GEOSS
- GOA-ON
  outputs and outcomes
  common protocols, databases, synthesis products

Research funders: national and regional

Private sector and foundations
U.S. Federal OA Investment FY 13

Approx Total for FY 13: $22 M

NOAA: $6 M (now $8.5 M)
NSF: $12 million
Idea Under Construction:

OA Information Exchange

- NGOs
- Sea Grant NERRs
- IOOS RAs
- Federal Agencies
- Academic Scientists and Programs
- State Govts
- Industry: Technology, Fisheries
- Acidification Networks

OA INTERAGENCY WORKING GROUP

Advisory board

Oversees and funds
Come visit us at:
OceanAcidification.NOAA.gov

For the Global Ocean Acidification Observing Network:
www.GOA-ON.org