



Alaska Ocean Observing System

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**Scoping the Approach and Priorities for Ocean Acidification (OA)
Monitoring Activities in Alaska**

January 29-30, 2016

Hosted by Alaska Ocean Observing System

1007 W. Third Ave., Suite 100, Anchorage AK 99501

Purpose of Workshop:

- There is currently no coordinated statewide, multi-agency plan/vision for monitoring OA in Alaska at the various temporal and spatial scales and meeting a variety of needs;
- AOOS is receiving requests to fund OA monitoring activities ranging from instrumenting ferries and shellfish hatcheries to conducting annual and monthly ship surveys to adding sensors to existing moorings, and absent an overall vision and plan, it is difficult to make funding decisions; and
- We expect advances in capabilities and technology to occur on rapid time scales over the next 3-5 years that should be taken into account when making funding decisions for long-term monitoring.

Topics for the workshop include:

- Identifying priorities for OA monitoring in Alaska;
- Identifying acceptable technologies with respective goals (e.g., short term vs long term trends, spatial coverage);
- Developing consensus on best practices; and
- Developing a common vision for OA activities in Alaskan coastal waters.

Outcomes will include a workshop report and a current project and future priorities map for OA Monitoring in Alaska.

NOTE: AOOS is hosting and facilitating this workshop, but we really want you to think of it as YOUR workshop. We know it is a packed agenda, so let's stay focused on the outcomes. Also, this is not organized as a stakeholder workshop, but rather as one focused on technology. We will be working with a number of folks in this room and others to host stakeholder-oriented workshops in the coming 1-2 years.

Meeting Format And Focus Questions for the Workshop

The meeting format is meant to be informal though directed towards discussions that will address the more technical aspects of planning for OA efforts in Alaskan waters. We encourage discussions, therefore time is allotted after each presentation as well as during the working sessions. Presenters are welcome to use up to 15 minutes to give their overviews, but can use less time if desired.

Feedback on the initial draft agenda from participants suggested some focus questions to consider throughout the workshop:

1. How can we identify the ocean acidification signal in the Alaska coastal waters?
2. What is the temporal and spatial variability of that signal?
3. What are the advantages and disadvantages of the various methods (i.e., accuracy and precision required for purpose of data, moored vs. fast or slow moving platforms, cost, location, ability to analyze samples and data, maintenance of equipment, skilled techs/staff to do all above)?
4. What are the physical, chemical and biological parameters that should be included in the Alaska OA Observing System?
 - a. What will it take to measure all these parameters?
5. Are there benefits of staying in a location where there is a long OA record vs. benefits of moving the long-term monitoring effort(s) to another locale? In other words, do we break a long time series to get coverage elsewhere?
6. How do we site moorings, stations for sampling, and at what water depths? What distance between stations, and what are length scales for deciding an effort?
7. What organisms can we monitor in the field that will be an early warning indicator of the biological impacts of OA?

We provided a separate **Participant Questionnaire** – please consider these questions prior to the workshop, and if willing, provide the workshop organizers a completed questionnaire during or after the workshop.

The agenda is detailed to help guide discussions. Timelines shown are an effort to accomplish the mission. If something is missing, we welcome additional considerations that should be discussed or raised. There will be a review opportunity when the draft workshop report is completed this spring.

We at AOOS welcome you to this workshop and thank you for your generosity in providing your time, support and input to this valuable effort.

Day 1

8:00 Sign in, meet and greet, coffee & breakfast provided

9:00 Molly McCammon (AOOS) – Welcome and Introduction to AOOS
Round-table with short introductions (Name, organization, area of interest with respect to OA)

9:20 Carol Janzen (AOOS) - Brief review of goals and objectives of workshop

- Identify priorities for OA monitoring locations or emphasis in Alaska: for example
 - Areas with glacier discharge influence
 - Areas where salinity is changing or expected to change
 - Areas where ice cover is changing
 - Areas where terrestrial amplifiers are changing, such as nutrient inputs
 - Areas experiencing seasonal algal blooms indicate change/increased activity
 - Areas with biological species and coastal communities most vulnerable to OA
- Identify appropriate technologies for respective goals (e.g., short term vs. long term trends, spatial coverage/surface mapping baseline, acceptable techniques, water sample techniques, other necessary parameters that are required to make sense of OA data, forecasting);
 - What technologies are still in the RnD phase and which ones are accepted as proved technologies?
 - Help clarify what works for specific locations based on methods (i.e., shipboard vs. glider) and data need (accuracy and precision and spatial coverage) and resource availability (manpower, cost to implement appropriate methods)
- Describe and document best practices for OA monitoring efforts;
 - Discussion topics may include maintenance, replicate sampling, auxiliary data, calibration protocols, lab and field QA/QC, minimum standards;
 - Integrated data management protocols will also be presented (Jan Newton will be presenting on this topic: IPA-COA and GOAON-Global Ocean Acidification Observing Network)
- Develop an inventory list and map detailing the OA activities by region (GOA and Arctic) in Alaskan coastal waters;
- Revisit recommendations from 2014 AOOS supported OA Workshop, which serve as a starting point for discussions (are these still relevant, and can more specifics be added?). The recommendations from 2014 were:
 - Expand coastal OA monitoring to include additional moorings in most vulnerable regions (i.e., Bering and Chukchi Seas were identified in 2014).
 - Question: Where, how long, possible methods that make most sense?)
 - Provide real-time or near real-time OA parameters
 - Question: Where specifically? For forecasting? Planning shellfish activities? Ambient monitoring?
 - Increase lab and field research on potential biological and “human use” impacts of OA
 - Question: Labs exist, but more money is needed for paying technical staff and researchers time. Is it something to try to coordinate from other agencies or through proposal collaborations? How can AOOS help here?
 - Identify breadth of species being studied for impacts by OA changes, with emphasis placed on lower trophic level prey sources for commercially important species first
 - Question: How can AOOS support these types of OA activities?

Kickoff Presentations: 20 minutes are provided per presentation topic, but please keep presentations no longer than 15 minutes to allow for questions and discussions.

- 9:30-09:50 Jeremy Mathis (NOAA ARP, CPO)
Overview of NOAA OAP, and NOAA's Alaska OA Research Plan (2015-17). Discuss status and strategies and goals for the OA research for Alaska, and how this will add to existing OA monitoring assets (leveraging other sources of support such as State of Alaska, AOOS, NPRB and others). Discuss differences between OA monitoring and research activities, if any, and how OA sampling efforts should be considered in order to contribute to clear and defensible OA analyses and documentation.
- 09:50-10:10 Richard Feely (NOAA PMEL and OAP)
The Ocean Acidification Signal in the Gulf of Alaska
- 10:10-10:30 Bob Foy (NOAA Fisheries, AFSC Kodiak Lab)
Overview on the OA Impacts on Biology
The 2014 OA Workshop Summary recommended OA monitoring efforts focus on Shellfish, including commercially sensitive varieties; plankton; corals in AK. Highlight the areas that are most likely to be impacted in terms of these effects, and where monitoring efforts will be most prudent for helping plan resource activities (like seeding). Have these priorities changed? What else do we know now?
- 10:30 -10:45 Break
- 10:45 – 11:05 Jessica Cross (NOAA CIFAR)
Making OA Measurements in Alaska (and elsewhere)
Summarize: What is required for effective long-term OA monitoring efforts (accuracy need, length of records, frequency of sampling, etc). Discuss (list) existing/known methods for OA monitoring being used in AK. If possible, note any up-and-coming methods or instruments that show promise, when they might be available, expense to purchase and O&M, difficulties? What are people doing elsewhere (i.e., Contros instruments being tested in New England at NERACOOS)? Discussions are expected to add to this topic.
- 11:05 - 11:25 Dave Murphy (Director of Science, Sea-Bird Electronics)
Review of pH Sensing Technologies, past and present
Summarize pH options being used in aquatic sciences (pH probes on CTDs and YSIs for example, vs. newer technologies such as SeaPHETs, SunBurst pH sensors, and spectrophotometric approaches). Advantages and disadvantages of various methods (calibration, accuracy, response time, maintenance, QA/QC required, durability, stability/drift). Discuss an autonomous OA tool for pH monitoring – progress on Argo profiling floats - potential for future OA monitoring in oceans and coasts and in Alaska. Continued discussion of other technologies not covered here.
- 11:25 – 12:00 Open discussion, keeping focus questions in mind - relisted here for reference:
1. How can we identify the ocean acidification signal in the Alaska coastal waters? What do we know about this, and what do we need to still figure out?

2. What is the temporal and spatial variability of that signal? How much do we know and what still needs to be learned?
3. What are the advantages and disadvantages of the various methods (i.e., accuracy and precision required for purpose of data, moored vs. fast or slow moving platforms, cost, location, ability to analyze samples and data, maintenance of equipment, skilled techs/staff to do all above)?
4. What are the physical, chemical and biological parameters that SHOULD be included in the Alaska OA Observing System?
 - b. What will it take to measure all these parameters?
5. Are there benefits of staying in a location where there is a long OA record vs. benefits of moving the long-term monitoring effort(s) to another locale? Do we break a long time series to get coverage elsewhere?
6. How do we site moorings, stations for sampling, and at what water depths? What are length scales for planning regional vs. a more localized sampling effort?
7. What organisms can we monitor in the field that will be an early warning indicator of the biological impacts of OA?

12:00 Lunch will be provided.

FYI: The AOOS office is only 2 blocks from the Captain Cook Hotel.

13:00-13:20 Jan Newton (NANOOS, UWAPL)

IPACOA (IOOS Pacific Region Ocean Acidification Portal) Data Management Protocols and using the GOA-ON Plan for possible guidance. How to discern the quality of data required for OA monitoring efforts, and how to differentiate the various levels of quality. Briefly discuss delineations for climate, weather, and other. How data quality is being handled by IPACOA and the West Coast Regions.

13:20 – 13:40 List the current methods and approximate where they fit on the data quality scales.

13:40 – 15:00 Priority OA areas in Alaska: Review of current activities by region and method

1. Gulf of Alaska:

A. Moorings: **Kris Holderied lead review**: example GAK1 mooring

- a. Status, historical/length of record
- b. Other moorings (historical/current/planned)
- c. Methods used, usefulness of results, accurate enough?
- d. Challenges and outcomes (is it working, do it elsewhere, what are costs?)
- e. Carol will denote on the map the locations of long-term assets (> 3 years, > 5 years, > 10 years).

B. Shipboard Routine Monitoring: **Jeremy Mathis lead review**: example, Seward line OA monitoring since 2008 (coming on 9 years).

- a. Status, historical/length of record
- b. Other monitoring from ships, water samples or instruments?
- c. Methods used to analyze samples. Are the data meaningful? Do we know yet?
- d. Other areas to consider for this type of monitoring (i.e., only possible a few times a year? Expense? Ships of Opportunity)

- e. Challenges and outcomes (is it working, do it elsewhere, costs?)
- C. Alutiiq Pride Shellfish: **Jeff Hettrick lead review** of sampling program
- a. Status, historical/length of record
 - b. Method(s) and SOP implemented (what all is required to make these viable, validation? Temp controlled rooms?)
 - c. If replicating in other areas, where would this methodology and this kind of work be most successful and where are there concerns about OA (i.e. another commercial shellfishery?)
 - d. Challenges and outcomes (is it working at this location; is it working at all; should similar efforts be done elsewhere; costs?)
- D. Underway Shipboard/Ferry Transects (i.e. historical work in GOA– Glacier tour boat 2014): **Wiley Evans and/or Allison Bidlack lead review**
- a. Status of historical and any shipboard underway ops
 - b. Method(s) currently considered viable for fast moving platform applications, (specified accuracy and stability, response time, sample frequency, Nyquist resolution requirements, etc.)
 - c. Challenges and outcomes (is it working, do it elsewhere?, cost effectiveness)
- E. Gliders and AUVs: **Wiley Evans and/or Jeremy Mathis lead review**
- a. Status of glider ops (historical/current/planned)
 - b. Limitations (i.e., can Slocum fly these sensors or just Wave Gliders? Other platforms coming online? Profiling floats?)
 - i. Methods currently considered viable for slow moving platforms like gliders
 - ii. Challenges and outcomes (is it working, do we do it elsewhere, costs)
- F. Other OA activities in GOA we should be aware of? Any plans people are willing to share? Purpose, funding, proposed expected outcomes.

15:00 – 15:15 Break

15:15 – 16:15 Priorities for OA monitoring in Alaska: Review of current Activities by Region

- 2. Arctic
 - A. Moorings: **Seth Danielson, Claudi Hauri or Andrew McDonnell lead review**: example Chukchi Ecosystem Mooring OA effort (status, historical, length of record)
 - a. Other moorings (historical/current/planned)
 - b. Methods/sensors used, methods currently considered viable for moored apps, specified accuracy and stability
 - c. Challenges and outcomes (is it working, do it elsewhere?, costs)
 - B. Shipboard routine measurements **Natalie Monacci lead review** (example: water samples; CTDs)
 - a. historical/current/planned
 - b. Methods/sensors used, specified accuracy and stability
 - c. Challenges and outcomes (is it working, do it elsewhere?, costs)
 - C. Underway shipboard/ferry transect measurements **Volunteer to lead this review**
 - a. historical/current/planned
 - b. Methods/sensors used, specified accuracy and stability

- c. Challenges and outcomes (is it working, do it elsewhere?, costs)

- D. Glider work (slow moving platforms) **Volunteer to lead this review**

- a. historical/current/planned

- b. Methods/sensors used, specified accuracy and stability

- c. Challenges and outcomes (is it working, do it elsewhere?, costs)

16:15 – 17:00 Discussions, review inventory of existing and planned assets, review map

17:00 pm adjourn for dinner – on our own

Priorities OA areas Alaska: Review of current Activities by Region

Day 2

8:00 – 9:00 Breakfast provided at AOOS

9:00 – 09:20 Shallin Busch (NOAA Fisheries), CAN (Coastal Acidification Network) Efforts in the NE and SE Regions of the USA, and what to think about for an Alaskan Coastal CAN effort (AKCAN?). First, define what a CAN is, discuss why NOAA OAP has been involved in helping set up and staff CAN efforts, and provide update on how these efforts are evolving in these regions. Challenges, benefits, successes, what is needed.

09:20-10:30 Complete any unfinished priorities discussion from previous day.

10:30-10:45 Break

10:45 – 12:00 Based on Day 1-2 discussions and updated map showing current activities

- Identify what regions need to be in focus (most bang for the buck order list)
- Do we put more resources in one region to better quantify it, or do we spread out the resources?
- How much R&D should we do? AOOS was involved in helping test sensors on gliders for example.
- How do we get to sustainable OA monitoring or do we still need to identify where we need to do the monitoring?
- Do we provide and approach for more baseline type data, rather than process oriented data?
- Do we stay where we currently are?

12:00 – 13:00 Lunch provided

13:00 – 14:00 Finalize the Workshop Inventories and Address Focus Questions

(Much of this will have been accomplished in Day 1 activities, but just in case, these are key goals for this workshop...so let's make sure we got it all)

- Make a list of techniques/technologies for OA work with respect to data quality need and project goals (e.g., short term vs long term trends, spatial coverage)
 - What should OA monitoring minimum standards be?
 - Does this vary for routine monitoring (long term or regular interval) vs. spatial mapping efforts (seasonal monitoring or ships of opportunity)?
 - List what methods are preferred for a given OA activity in question and why?
 - Identify if possible data quality and implementation requirements (other parameters, validation, maintenance) per accepted method.
- What are the best practices for OA work
 - What other parameters must be measured for the various OA parameters/methods to make these measurements meaningful? (i.e. temp, salinity, pressure with pH; Oxygen with PCO₂?)
 - Are there parameters that can be measured if OA technologies or capability are not available that will help with the OA effort (i.e. oxygen)
 - Documentation, QA/QC, data integration management protocols

14:00 – 15:00 Wrap up, Adjourn.