**2010 Alaska Marine Science Symposium**

**Ocean Acidification Adaptation, Research and Communication Workshop Report**

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**1. Overview**

Ocean Acidification is now recognized as one of the greatest threats to Alaska’s marine ecosystems Recent observations in the Gulf of Alaska, Chukchi and Bering Seas (Yamamoto-Kawai et al., 2009; Bates

et al., 2009; recent work of author Mathis and colleagues) suggest that acidification rates are higher than previously estimated.

Research into the effects of acidification in the North Pacific to date has been largely uncoordinated and marine fisheries and resource managers have little practical guidance on how to adapt to this threat and most educators do not have adequate communication tools to build public understanding of this issue.

This workshop was designed to engage marine scientists and educators as well as resource managers and community representatives in an assessment of (a) research priorities, (b) adaptation guidance for marine resource managers and (c) communications best practices for ocean educators. More than 85 participants from the research, academic, non-profit, management and general community joined the workshop.

The workshop was comprised two main sections – a series of presentations on the current state of ocean acidification globally and in Alaska and examples of climate change adaptation and communication practices – those presentations can be found at http://www.coseealaska.net/oceanacidification/. The following sections outline results of participant break out discussions in three areas:

1. Research priorities

2. Adaptation options

3. Communication “best practices”

As with many aspects of the subject of ocean acidification, this workshop was viewed as a beginning rather than an end point in the adaptation response process. Because of time limitations and the evident lack of widespread understanding of this threat to Alaska’s marine ecosystems, participants were able to address only limited aspects of the workshop focus. Results are therefore presented for reflection and to guide future research, education and management.

Based on the response provided by participants, the conveners believe that this topic ought to be a focus for future sessions at the Alaska Marine Science Symposia as well as a priority for immediate research and public education efforts.

**2. Key References and Recommended Further Sources of Information:**

Bates, N.R., J.T. Mathis, and L.W. Cooper. 2009. Ocean acidification and biologically induced seasonality of carbonate mineral saturation states in the western Arctic Ocean. Journal of Geophysical Research Oceans. 11/5/09. [Abstract](http://www.agu.org/pubs/crossref/2009/2008JC004862.shtml)

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Secretariat of the Convention on Biological Diversity. 2009. Scientific Synthesis of the Impacts of Ocean Acidification on Marine Biodiversity. Technical Series No. 46. Montreal. 61pp. [Article](http://www.coseealaska.net/oceanacidification/oceanacidificationsciencenewsandsciencejournalarticles/www.cbd.int/doc/publications/cbd-ts-46-en.pdf)

Tobey, James, Pamela Rubinoff, Donald Robadue Jr., Glen Ricci, Richard Volk,  John Furlow and Glen Anderson2010. Practicing Coastal Adaptation to Climate Change: Lessons from Integrated Coastal Management, Coastal Management, Volume 38, Issue 3 May 2010 , pages 317 – 335. [http://www.informaworld.com/smpp/content~db=all~content=a922680468](http://www.informaworld.com/smpp/content~db%3Dall~content%3Da922680468)

Wootton, Catherine A. Pfister, and James D. Forester. 2008. Dynamic patterns and ecological impacts of declining ocean pH in a high-resolution multi-year dataset. Proceedings of the National Academy of Sciences. 11/24/08. [Abstract](http://www.pnas.org/content/early/2008/11/24/0810079105.abstract)

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Yamamoto-Kawai, M., F. A. McLaughlin, E. C. Carmack, S. Nishino, K, Shimada. 2009. Aragonite undersaturation in the Arctic Ocean: Effects of Ocean Acidification and Sea Ice Melt. Science Vol. 326. no. 5956, pp. 1098 - 1100. [Abstract](http://www.sciencemag.org/cgi/content/abstract/326/5956/1098)

**WEBINARS**

Alaska Center for Climate Assessment and Policy.

* ***Ocean acidification: what it means to Alaska.* Jeremy Mathis, Professor, School of Fisheries and Ocean Sciences, University of Alaska, Fairbanks. Webinar. March 23, 2010.**

[**View the Video**](http://www.uaf.edu/accap/files/WebinarVideo/Mathis_OA.mp4)

[Listen to the Podcast](http://www.uaf.edu/accap/files/Teleconference%20Recording/3_2010_OceanAcidification_Mathis.mp3)

Read the Alaska Journal of Commerce story:
[*Research expands to "sister" issue of global warming*](http://www.alaskajournal.com/stories/040210/loc_img29_001.shtml)

* ***Climate Change in the Ocean: acidification by atmospheric carbon dioxide.* Jeff Short, Auke Bay Laboratory, National Marine Fisheries Service, Juneau. Webinar. September 23, 2008.**

[**View the Presentation/slides**](http://www.uaf.edu/accap/documents/2008_09_Jeff%20Short_%20Ocean%20Acidification.pdf)

[Listen to the Podcast](http://www.uaf.edu/accap/files/Teleconference%20Recording)

Listen to radio coverage [*Ocean acidity threatens Alaskan waters*](http://kcaw.org/modules/local_news/index.php?op=sideBlock&ID=264) Bonnie-Sue Hitchcock. KCAW Raven Radio, aired Sept 23, 2008.

**WEBSITES**

[NOAA Pacific Marine Environmental Laboratory](http://www.pmel.noaa.gov/co2/OA/) Links to recent scientific articles about ocean acidification research.

[Question & Answer about Ocean Acidification - Pacific Marine Environmental Laboratory](http://www.thereeftank.com/blog/ocean-acidification-qaa-with-pmel/)

[Ocean Acidification - Resources. World Ocean Observatory](http://www.thew2o.net/events/oceans/oa.php)

[The UNESCO Ocean Acidification Network](http://ioc3.unesco.org/oanet)

[European Project on Ocean Acidification](http://oceanacidification.wordpress.com/)

**3. Ocean Acidification (OA) Research Priorities Breakout Discussion**

**Discussion Leader:**

**Jeremy Mathis (University of Alaska Fairbanks) -** **jmathis@sfos.uaf.edu**

**Overview**

Around 40 participants joined this breakout discussion to brainstorm ideas on how to prioritize ocean acidification research in Alaska. Dr. Richard Feely from NOAA-PMEL was on hand and helped lead the discussion. The group determined that there were three areas where research should be focused concurrently:

Monitoring

* Initial focus should be placed on the Alaskan coastal environment, but some emphasis should remain in the deeper ocean to provide context.
* Areas should be identified where reoccupations could occur and survey data could be collected to develop algorithms that are capable of predicting aragonite saturation states with only basic hydrographic observations.
* Moorings should be placed in critical zones to fisheries (i.e. GAK 1 in GOA, Glacier Bay in SE Alaska, and M2/8 in the Bering Sea).
* Field observations of organisms should be made during critical life stages with regards to ocean acidification impacts (i.e. pteropod shell density)
* Monitor near shore/ on shore process observations that impact OA (i.e. river and glacial discharge chemistry).

Biological Impacts

* Tolerance ranges should be established for commercially important and/or key stone species.
* A best practices guide should be developed for species incubations for OA response experiments.

Modeling

* Ecosystem models should be developed for the GOA and Bering Sea that include the impacts of OA.
* Single-species models and ecosystem models should both be coupled to economic output models.

Along with these three priorities the group also discussed how efforts could be coordinated within Alaska to conduct this research. It was suggested that existing management infrastructure should be used (i.e. North Slope Science Initiative) especially in the early stages of concerted research.

**4. Ocean Acidification (OA) Adaptation Breakout Discussion**

**Discussion Leaders:**

**Ian Dutton (Alaska SeaLife Center) -** **ian\_dutton@alaskasealife.org**

**Jeff Short (Oceana) -** **jshort@oceana.org**

**Overview**

Around 23 participants joined this breakout discussion to brainstorm ideas on how we might begin to address ocean acidification adaptation.

**What Are we Currently Doing?**

National Park Service + Alaska Ocean Observing System – Inventory of current conditions

North Pacific Fisheries Management Council

* closures of bottom trawling/establishment of ‘refugia’
* Arctic Fisheries moratorium

Kasitsna Bay Lab (UAF) – larval crab project

Kachemak Bay National Estuarine Research Reserve – long term monitoring

Alaska SeaLife Center – marine mammal and seabird diet studies

Ocean Policy Task Force

* Arctic objectives
* Marine spatial planning

State of Alaska – Governors sub-cabinet on climate change

**What Might We Do?**

* Is monitoring enough – do we need a more urgent/structured response?
* Timing of larval release may affect crab survival in acid waters
* PMEL
	+ could provide better feedback to local communities
	+ current nearshore monitoring is inadequate to understand problem
* Biological assessment is key – what species should we monitor? Are pteropods enough?
* Need to fill knowledge gaps on current biological and chemical conditions in AK waters
* Unclear how Pacific Decadal Oscillation (PDO) is affecting/may affect phenomena such as Ocean Acidification
* One short term response might be geo-engineering
	+ Iron in Gulf of Alaska (by plane)?
	+ Lime introduction to estuaries/nearshore areas?
* Empirical focus needed – we need standard methods for experiment and modeling in GoA
* OA requires a proactive approach – e.g. moratorium on areas that might be affected or where we have little knowledge
* Adaptive and precautionary management needed – science informs management via monitoring
* Is there enough known already? We must act while we study!
* Need to reduce current threats to facilitate resilience of ecosystems
	+ Urge greater precaution in setting use limits
	+ Reduced multiple stressors – e.g. litter, pollution, overfishing
* Think beyond calcifying organisms – what about wider bio-geochemical impacts on ecosystem
* Pragmatic approach - what can we do immediately?
	+ Aquaculture is likely a key part of the solution
	+ Change in species production/fisheries
	+ Assisted migration? – e.g. helping salmon move to new rivers, enhancing beach bivalve stocks
* Link data collection directly to community decision-making
* Hard to use current data for decisions – gaps/patterns, etc.
* ***Lots of reasons to “not jump the gun’ – fear that may lead to inappropriate decision making[[1]](#footnote-1) -*** We need a good adaptation research design to frame this work
* Lack of knowledge of what is possible - what are other people doing?
* Lack of knowledge of system limits – what are other elements of resilient systems?
* How best to engage communities – is there a knowledge base we can/should build?
	+ People are more engaged if they are knowledgeable and involved
	+ Can we engage them in OA science and developing community resilience plans?
* Link adaptation strategies to non ocean systems – start with mitigation!
* Need better understanding of the pathways by which OA reaches AK
* Encourage a more sustainable approach to the economy
* Build flexibility into any strategy – our knowledge of OA will improve
* Important to work with government and industry (esp. oil and gas) on their impacts on OA
* Both adaptation and mitigation are critical on this issue – can’t do one without the other

**How Might Fishers Adapt to increasing OA?**

* Too early – we can’t advise them yet?
* Need more data
* Think carefully about investments in fisheries – gear, geographies and effort
* Educate – don’t panic!
* Keep talking with scientists
* Fishers should lobby for more political support for research
* More transparency in fisheries reporting
* Insist results from observing address OA
* Need to diversify economies more – more farming in AK?
* Help fishers to network/learn

**How Might Tourism Operators Adapt?**

* Use sailboats!
* Sailboat based OA surveys that include a major outreach component!
* Educate interior Alaska residents – add OA to our interpretation efforts and collect data o public understanding
* More citizen science such as Earthwatch
* Non-consumptive tourism
* Standardize tourism science with help from scientists
* Halibut operators should return large fish and end derbies as these types of over fishing reduce ecosystem resilience
* Add OA sensors to ships to get better data
* Carbon offsets should be offered more widely

**How Might Communities Adapt? (Many recommendations relate to outreach and education)**

* Asking politicians to think globally
* Reduce plastics use
* Consider election cycles in lobbying
* Promote science literacy – scientists need to do more outreach
* Form community committees focused on CC/OA outreach
* Data collection – work with regional science institutions
* Document local and traditional knowledge – how did past societies adapt to change?
* Offer solutions to communities – seek advice from scientists on steps that can be taken
* Funding needed for Statewide adaptation responses (e.g. research, monitoring and changes in resource use)
* Recognize that we are a major part of the problem – reduce, reuse recycle! Encourage basic energy conservation
* Support volunteer programs in schools to build literacy
* OA should be a part of high school curricula in Alaska
* Make sure communities raise OA issues to federal agencies planning expansion of offshore oil and gas production**5. Ocean Acidification (OA) Communication Breakout Discussion**

**Discussion Leader:**

Carin Stephens (UAF School of Fisheries and Ocean Sciences) - cbstephens@alaska.edu

**Overview**

In our breakout session on communicating ocean acidification, a group of about 15 communicators, educators, scientists and graduate students discussed how best to spread the word about ocean acidification. (The breakout discussion on adaptation also resulted in recommendations about outreach and education in their discussion of “How might communities adapt?”)

**Why do we want to communicate about ocean acidification?**

* Implications for communities, especially coastal communities
* Increase awareness
* Need money for research funding
* Understanding of exacerbation of natural cycle
* Avoid scare tactics, engage people instead of turning them off
* Note winners and losers
* Did not get much attention at Copenhagen
* Directly impacts entire nation due to fish market
* Need for community preparedness and adaptation
* Help reduce causes (we want people to take action)
* Be able to explain simple chemistry
* Major lifestyle changes/subsistence

 **Who do/should we communicate with? Who are our audiences?**

* Politicians—have capacity to make change, will have to face this issue eventually
* Community leaders, especially Alaska Natives
* Young adults
	+ Get scientists into classrooms
	+ Kids share information with families
	+ Will be future leaders
* Fishermen (have lobbying power, i.e. UFA) (many are already aware)
* Managers of fisheries (so they can manage the catch)
* K-12 teachers-- provide them with non-controversial science
* Media (online audience)
* Need to reach full U.S. including inland states, not just the coasts

**How do we reach coastal residents?**

* Go to villages, the “3-day rule”—stay for 3 days rather than just coming and going too quickly
* Find community leaders at other venues
* Hit key individuals who are networking
* Share research in local area—especially results
* Talk to young adults who are going to college outside but returning to villages for visits
* Create lesson plans
	+ Ease of use
	+ Glossy themes and good graphics
	+ Send scientists to schools
	+ Make sure they explain their background

**How do we address “non-believers”?**

* Be careful to articulate correct science
* Avoid “acid ocean” terminology
* Online science forum
* Q&As answered by scientists (this website already exists for PMEL: <http://www.thereeftank.com/blog/ocean-acidification-qaa-with-pmel/>)
* Letters to Editor by credible sources
* Change is inevitable (focus on change instead of cause for some audiences)
* Simple booklet explaining changes and providing resources
* One-on-one conversations
* Show where to access information (amount of information can be overwhelming)
* NPS has talking points—distills research on climate change
* Simple fact sheets for non-scientists
* Homer Science Conference February 3 climate change workshop
* Target key people to participate in outreach events (community leaders)

**How do we maintain outreach about ocean acidification?**

* Twitter (to reach reporters)
* Blogging
* Listserves
* Social media sites (i.e. Facebook)
	+ SeaNet (social networking, provides communication and archive)
	+ YouTube— the importance of visuals
	+ Keep in mind that government employees don’t have access to some of these sites
* “Coffee Table” type radio shows with scientist interview and Q & A
* Connect educators with researchers (e.g., PolarPalooza)

**Tools for reaching our audiences**

* Book: *The Tipping Point* has good strategies
* Be creative when networking in your local community (i.e., hair salon as an example)
* Graduate students are great communicators and networkers
* Need broad approach to communication
* Use credible sources and people (NOAA, university, USGS)
* 15 minute videos are powerful
* Maximize use of online tools
* *Sea Change* documentary
	+ Circulate this in schools
	+ Reaches broad audience

**Should we change term “ocean acidification”?**

* “higher CO2 world”
* “ocean changes”
* “ocean is becoming less basic”

**How do we want to influence people?**

* Awareness
* Change people’s behavior
* Get past the “hopelessness” feeling
* Identify winners and losers in ocean acidification

**How do we communicate with the media?**

* Use public information officers
* Make sure your facts are straight
* Constant communication with scientists
1. This point was highlighted during the discussion as several participants felt it important to flag the importance of a systematic approach c.f. an ad hoc approach [↑](#footnote-ref-1)