

Building a Baseline for Ocean Acidification Trends in Coastal Communities of Alaska

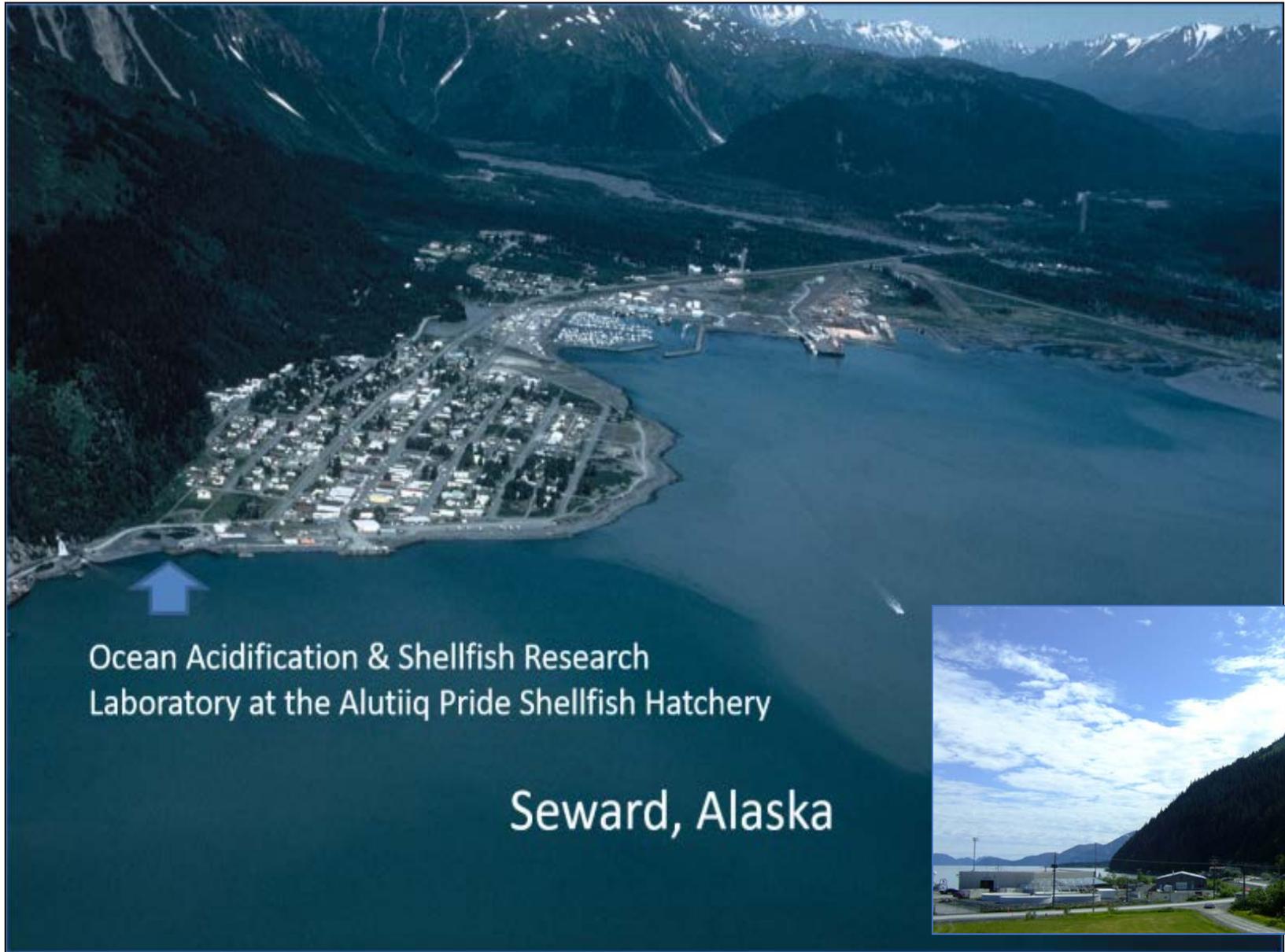
**Coastal Village IGAP Monitoring Program at
the
Alutiiq Pride Shellfish Hatchery
Seward, Alaska
Jeff Hetrick, Director**

APSH is a division of the Chugach Regional Resources Commission

This project offers the opportunity to document ocean acidification conditions and trends near-shore compared to data from traditional oceanographic work occurring offshore, as well as provide information that is specific and relevant to the local environment of Alaskan Native communities.

ALUTIIQ PRIDE
SHELLFISH HATCHERY
SEWARD, ALASKA





Ocean Acidification & Shellfish Research
Laboratory at the Alutiiq Pride Shellfish Hatchery

Seward, Alaska

APSH in relation to Resurrection Bay

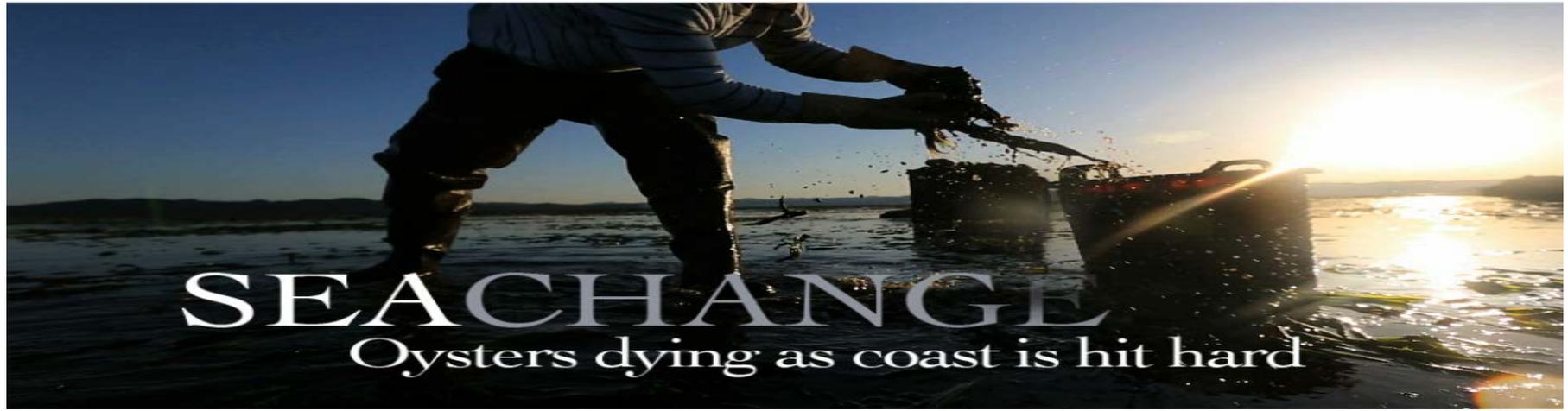
Animals grown at APSH:

- (1) Pacific oyster *Crassostrea gigas*
- (2) Geoduck clams *Panopea generosa*
- (3) Basket cockle *Clinocardium nuttallii*
- (4) Pacific Razor clam *Siliqua patula*
- (5) Littleneck clam *Protothaca staminea*
- (6) Purple hinge rock scallop *Crassodoma gigantea*
- (7) Blue King crab *Paralithodes platypus*
- (8) Red King crab *Paralithodes camtschaticus*
- (9) California sea cucumber *Parastichopus californicus*
- (10) Pinto Abalone *Haliotis kamtschatkana*

Ocean Acidification in the News

The Seattle Times

MENU



A Washington family opens a hatchery in Hawaii to escape lethal waters.

<http://apps.seattletimes.com/reports/sea-change/2013/sep/11/oysters-hit-hard/>

National Science Foundation
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News

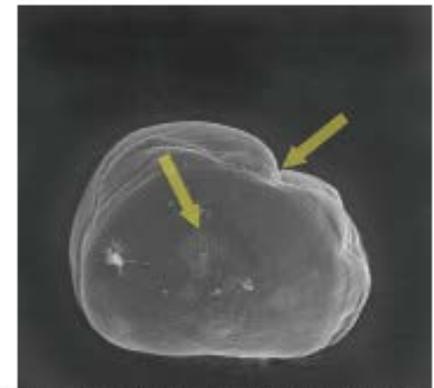
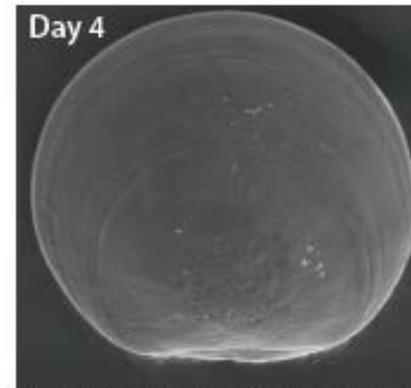
News From the Field
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Press Release 12-070
Ocean Acidification Linked With Larval Oyster Failure in Hatcheries

Increase in ocean acidification led to collapse of oyster seed production at Oregon hatchery

Ocean acidification comes to Netarts Bay, Oregon, visible in its hatchery oysters. [Credit and Larger Version](#)

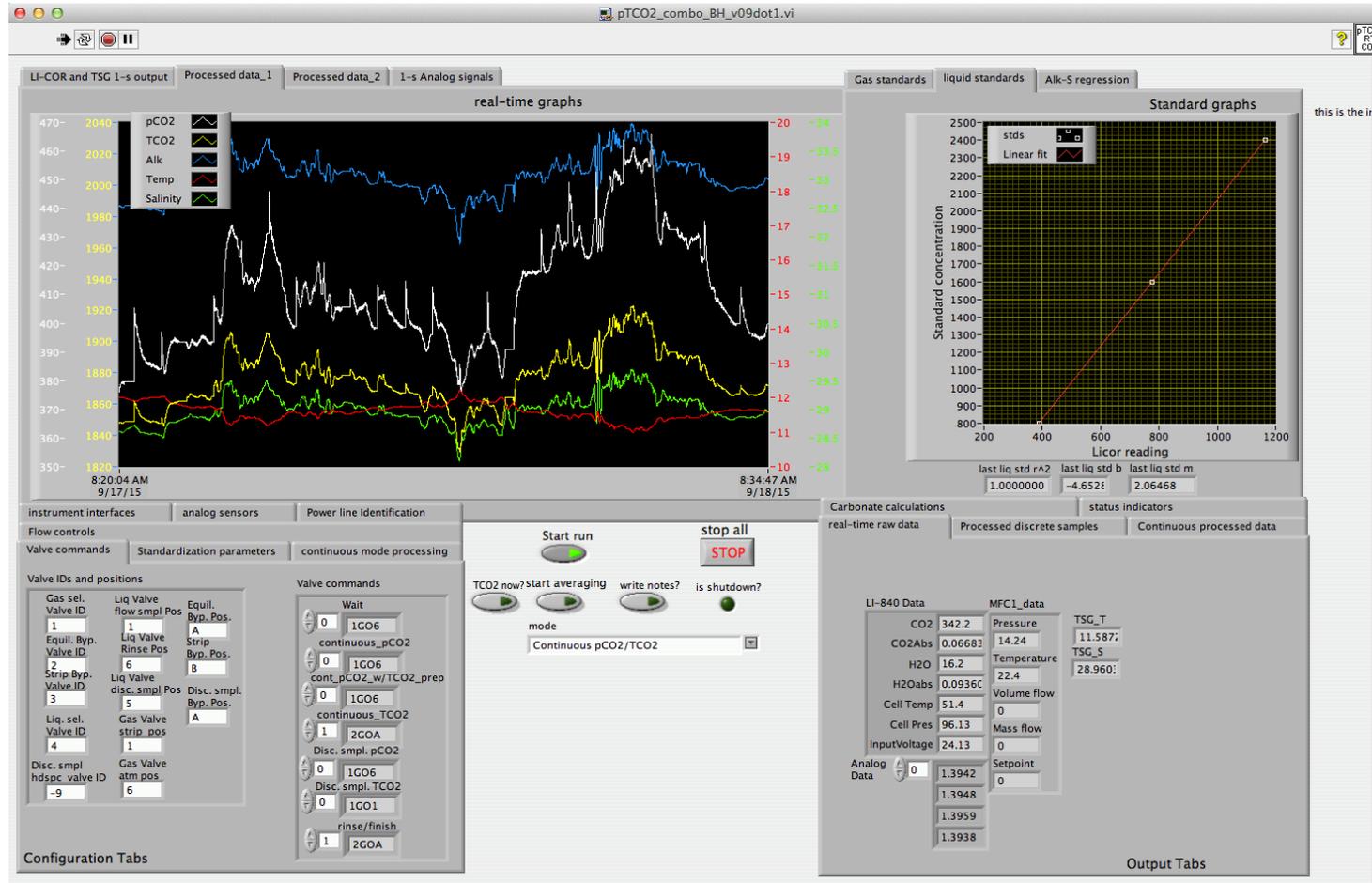
http://www.nsf.gov/news/news_summ.jsp?cntn_id=133619



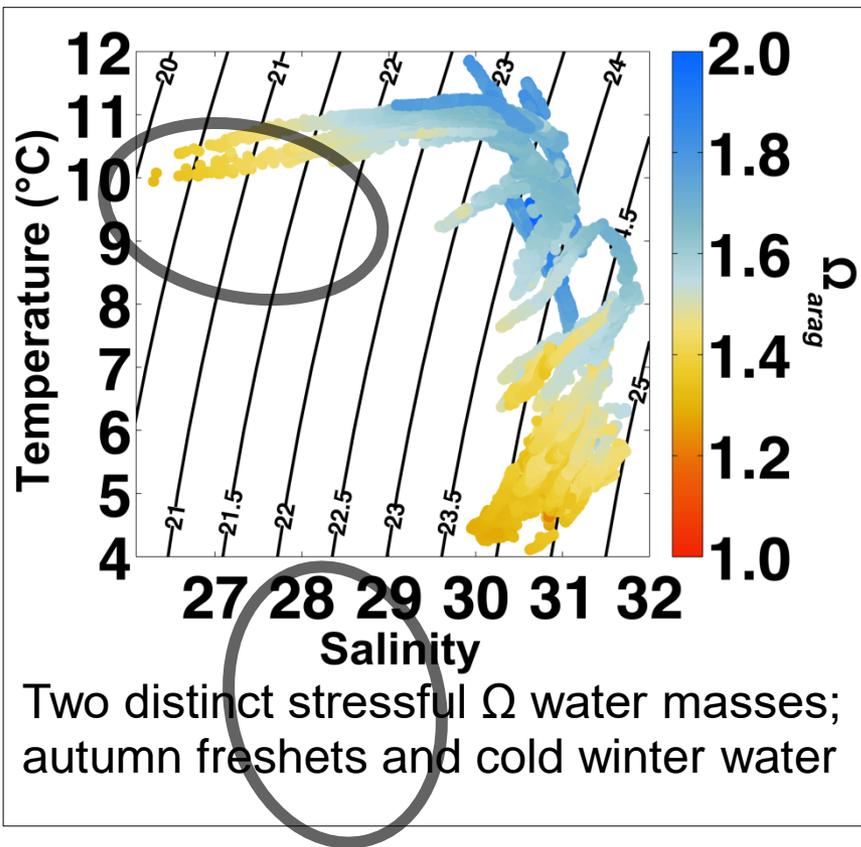
Oyster larvae in normal (L) and acidic, carbonate-poor ocean water. SEM image <100 microns. Courtesy Taylor Shellfish and OSU.

www.worldviewofglobalwarming.org

Continuous Monitoring



Early data: October 2013 to August 2014



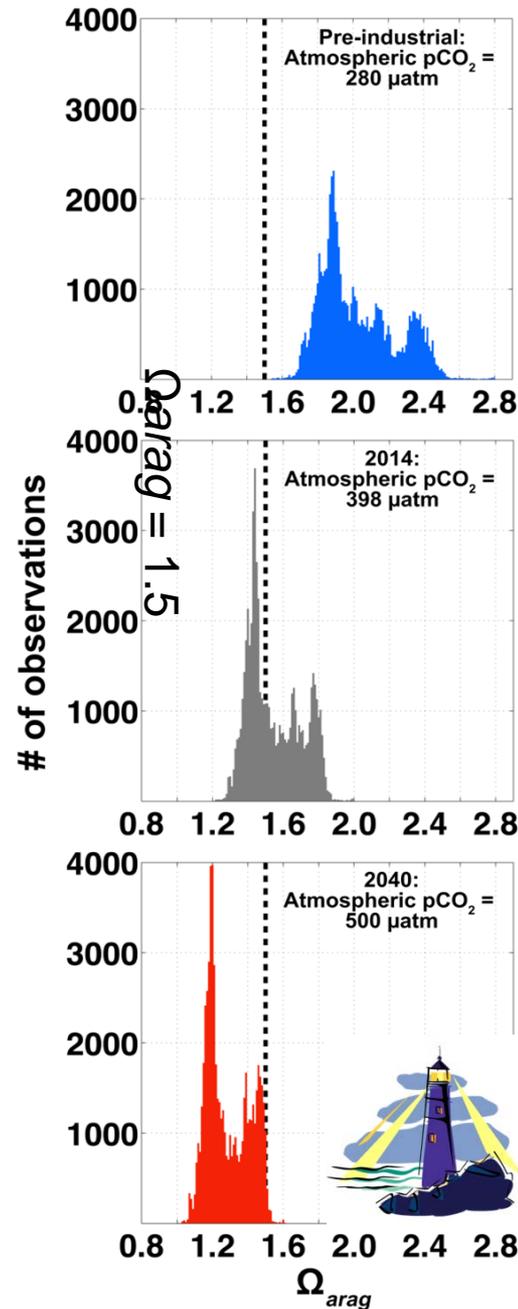
(-) anthroCO2
(Harris et al. 2013)

Average $\Omega_{arag} = 1.55 \pm 0.15$; 43%
< $\Omega_{arag} = 1.5$

Window of reprieve from stressful Ω_{arag} gone at
 $pCO_2(atm) = 500 \mu atm$

IPCC RCP 8.5 predicts this level by 2040

Significant implication for growing Alaskan industry



BIA Funding

In 2016, APSH received two years of funding from the Bureau of Indian Affairs (BIA) to conduct a sampling program in south-central Alaska titled “Monitoring for Ocean Acidification near coastal villages and communities in south-central Alaska: Building Capacity and Assessing Vulnerability”. APSH currently analyzes samples collected from seven native villages and four science partners ranging from Cordova to Homer, in southcentral Alaska.

BIA: 2015 Tribal Cooperative Landscape Conservation Program: Ocean and Coastal Management Program

Monitoring for Ocean Acidification near coastal villages and communities in south-central Alaska: Building Capacity and Assessing Vulnerability

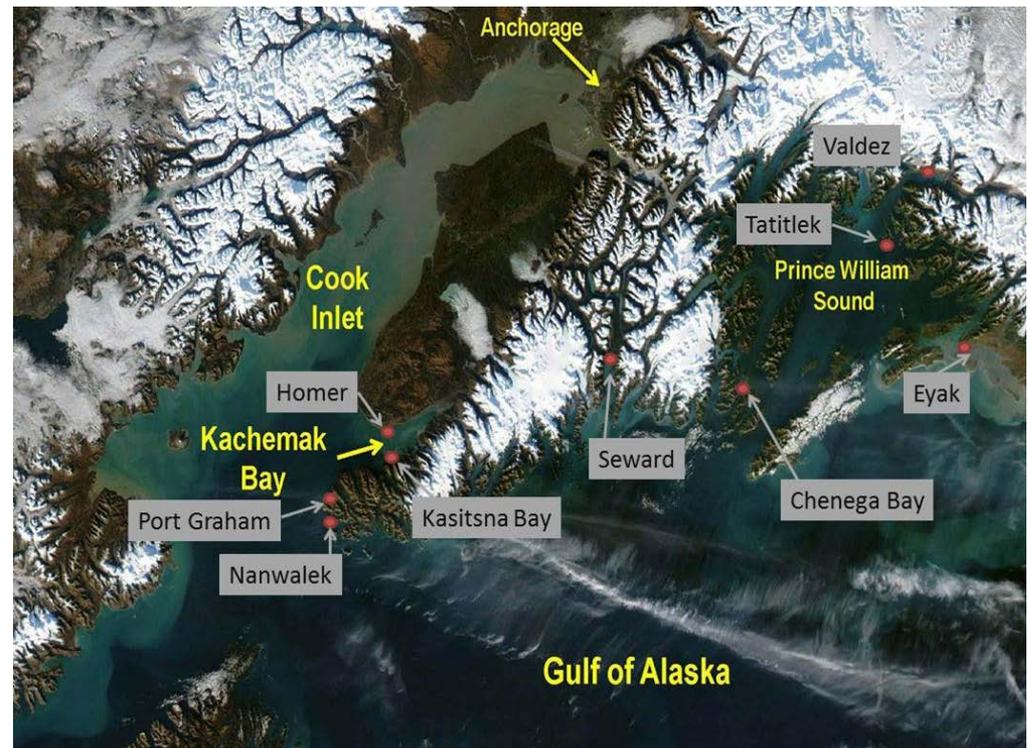
(a) Establishes near-shore seawater sampling program

- *Community involvement*

- *Integrates between sites and offshore*

- *Fills potentially important data gap*

(b) Novel large volume dosing system

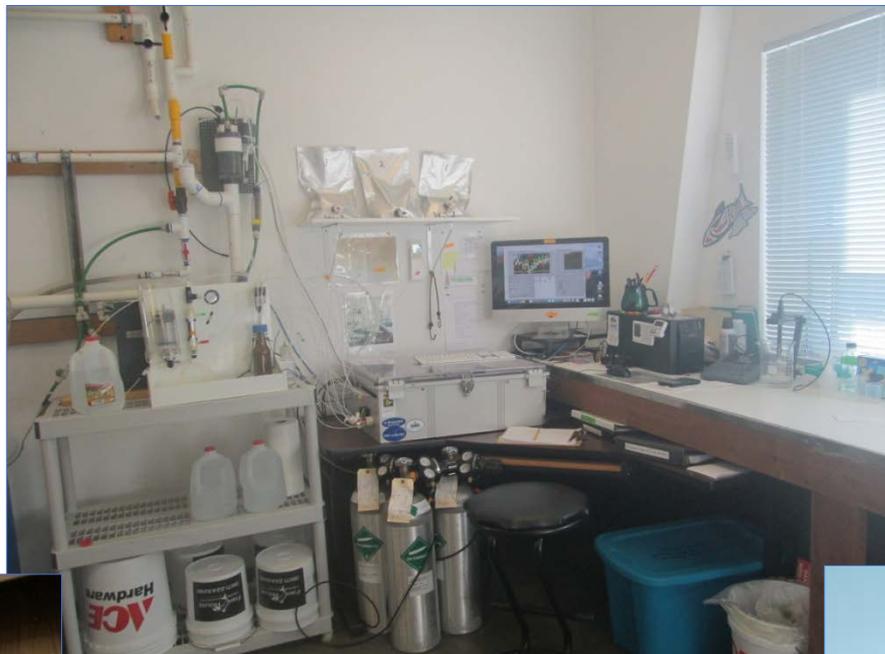


Discreet Sampling for Carbonate Saturation State of Sea Water



Building Capacity and Assessing Vulnerability

The system “Burk-O-Later”



Burke Hales Developer (OSU)
&
Wiley Evans (HAKAI)

Coastal Community Data Collection

Building Capacity to Expand Monitoring

- Long term OA data exist for open ocean sites but are limited in nearshore areas.
- Data is needed in proximity to coastal communities to determine OA trends compared to open ocean observations.
- Through collaborations with HAKAI, and CEOS, with funding through the BIA and support from AOOS, APSH has optimized a land-based monitoring platforms and developed the Ocean Acidification and Shellfish Research Laboratory, located in Seward, Alaska, using a Burke-o-Lator pCO₂/TCO₂ analyzer (developed by Burke Hales) show similar variability in aragonite saturation states.



Community Involvement



- APSH is now processing seawater samples collected on a weekly basis by citizen scientists from Alaska Native communities around South-central Alaska following established protocols for sampling dissolved inorganic carbon in water samples using APSH produced field kits.

The kits contain: Protocols, bottles, caps & cappers, paint pens, thermometers, sample logs, and fixative.

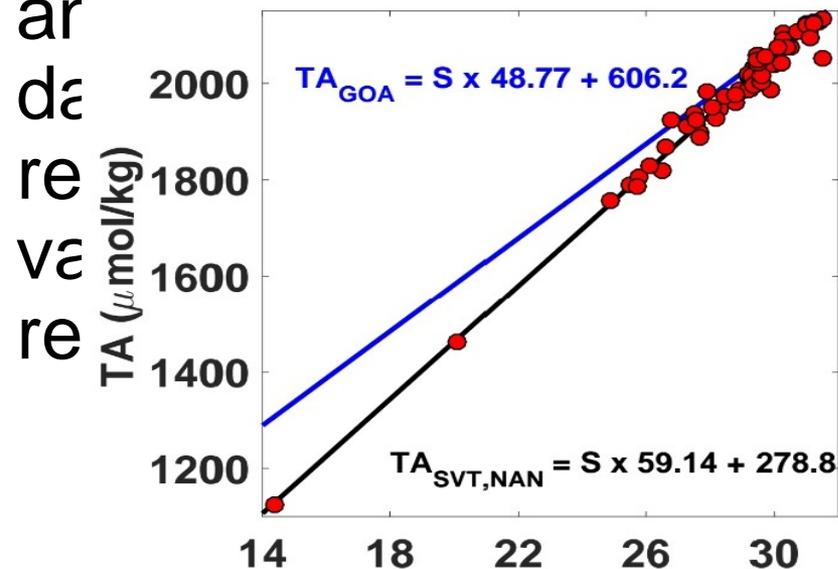
Preliminary Community Data Results

.Seldovia Village Tribe
Aragonite Saturation.

Samples taken weekly
over a year's interval
(December 2015
through November
2016) and analyzed at
APSH

.n=44 samples

.Linear relationship
between total alkalinity
and



Data Accuracy:

.**Inter-lab comparisons:** The lab at APSH is actively involved in establishing inter-lab comparisons with the PMEL Carbon Program laboratory.

.**Triplicate Sampling:** Samples are often taken in triplicate to ascertain the error of sample acquisition.

Dosing Research Lab Juvenile Butter Clams

- .Ambient pH: 7.95, $\Omega > 1$
- .Treatment pH: 7.65, $\Omega < 1$
- .2 weeks duration





How to measure impacts of OA: SEM-Shell dissolution

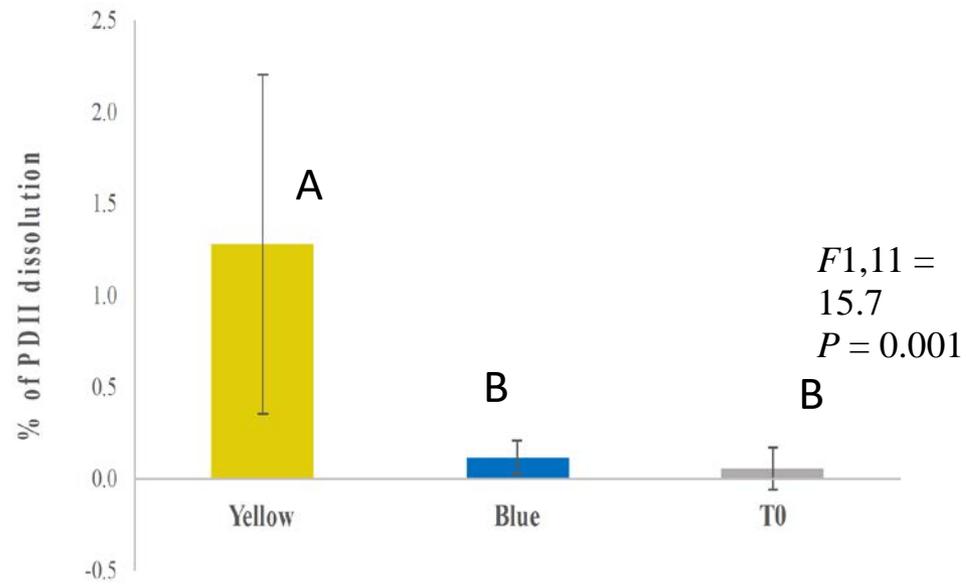
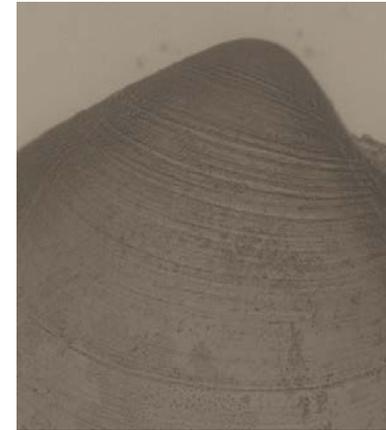
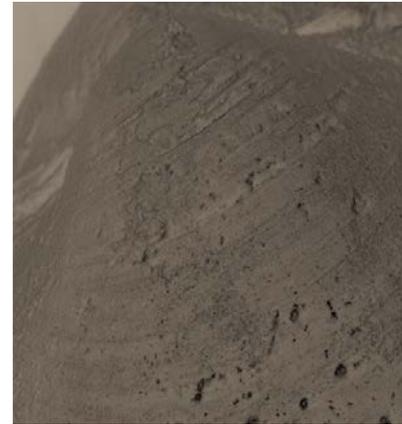
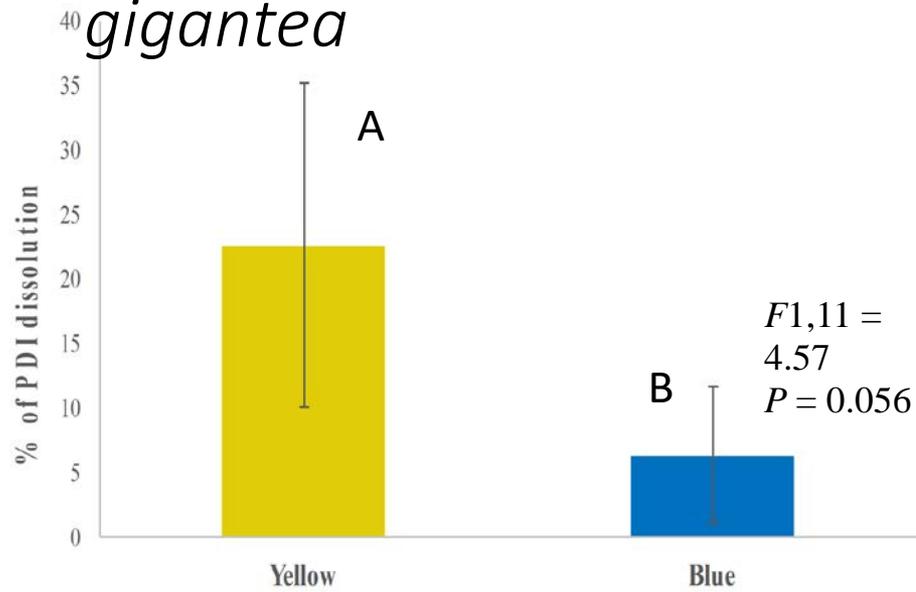
Ambient- pH 7.95

Acidified pH 7.65



Juvenile butter clams- *Saxidomus*

gigantea



Pore sampling

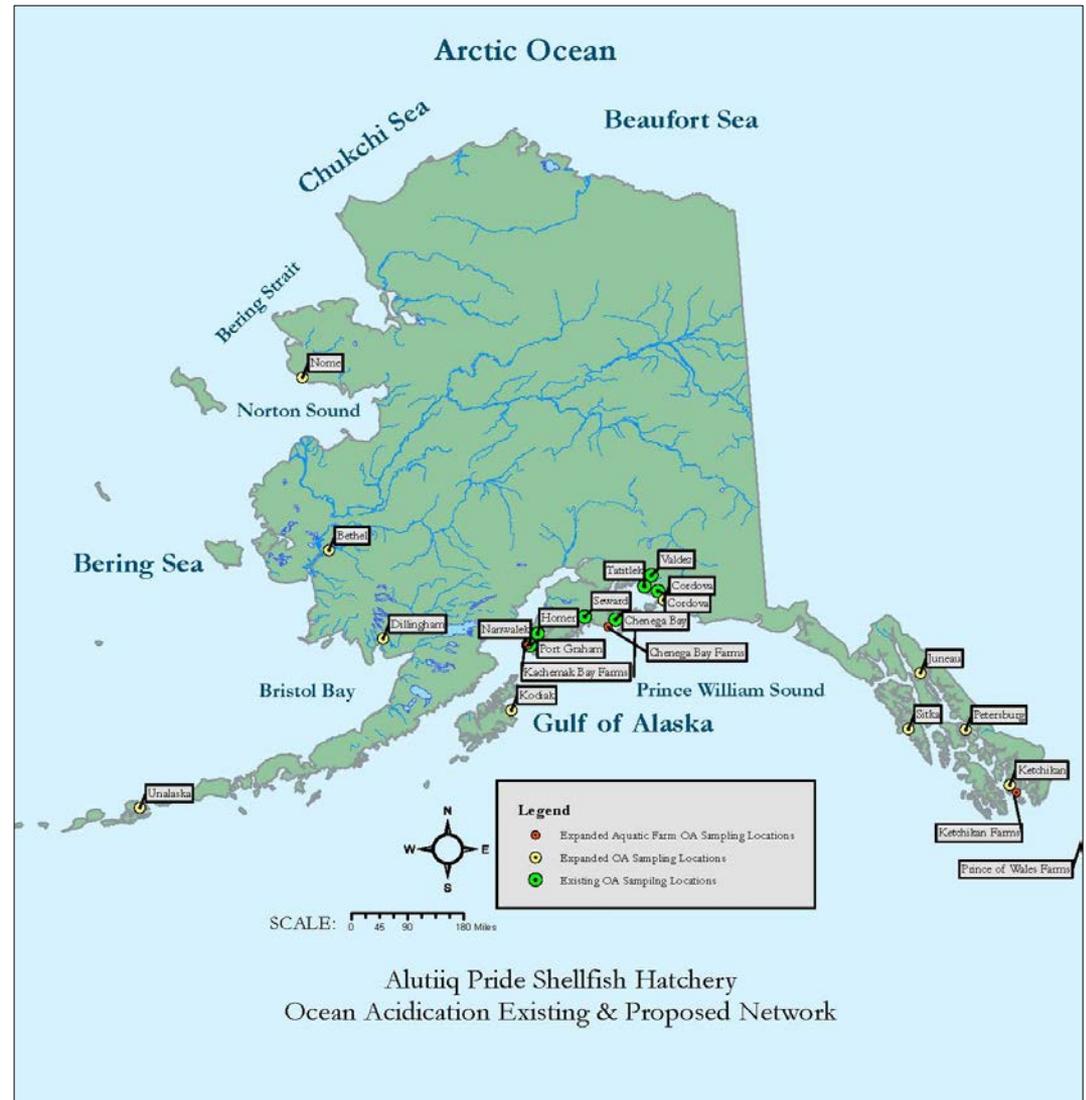


Pore Sampling



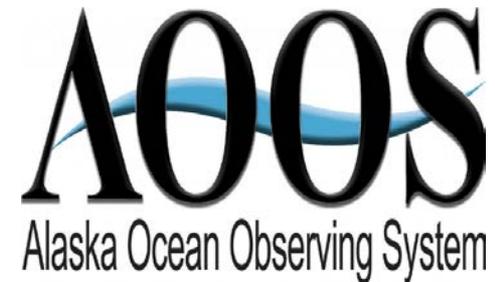
Next Steps-OA

APSH is actively seeking to add additional coastal communities to the ever-expanding OA monitoring network. With added sampling stations, data on OA across the State will be added and compared to existing locations. This information will be used to identify which areas in Alaska may be sensitive to OA and determine if there are spatial and temporal patterns. This information can be combined with the current BIA sampling project in south-central Alaska and will be used by oyster and other shellfish farmers, local residents, regulators, and policy makers to get a sense of the OA measurements in their region and determine if they may be required to develop adaption plans. It will also ensure production of healthy local seafood in aquaculture communities and supporting traditional fishing communities.



Existing OA Sampling Location (green), Expanded OA Sampling Locations (yellow), and Expanded Aquatic Farm OA Sampling Locations (red).

Questions



Acknowledgements: We'd like to thank the The EPA IGAP program for supporting our village monitoring program, Alaska Ocean Observing System for their support of our continuous monitoring, and Hakai for data interpretation and so much more. We also thank our citizen samplers for their commitment to this project and their communities.