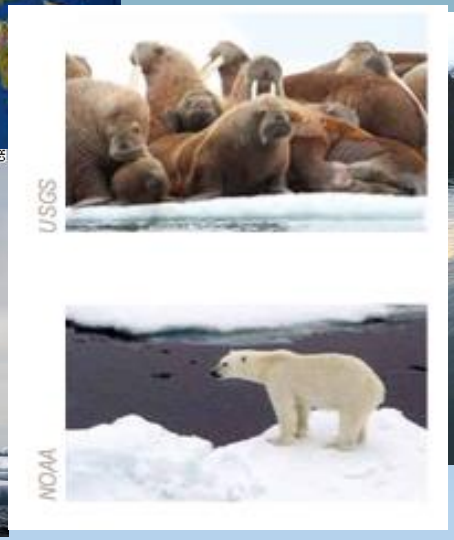
Ocean Observing in Alaska's Arctic: Challenges and Opportunities



Oceanology International
Qingdao, China
October 23, 2018

Molly McCammon
AOOS Executive Director

AOOS
Alaska Ocean Observing System

IOOS
Integrated Ocean Observing System

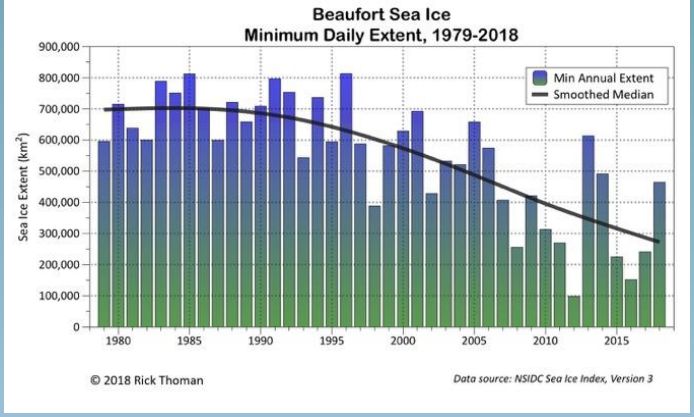
Key Points

- Alaska's arctic is experiencing extremely rapid changes due to global warming and decreased sea ice, and including increased ocean acidification, harmful algal blooms, invasive species, and species migrating northward.

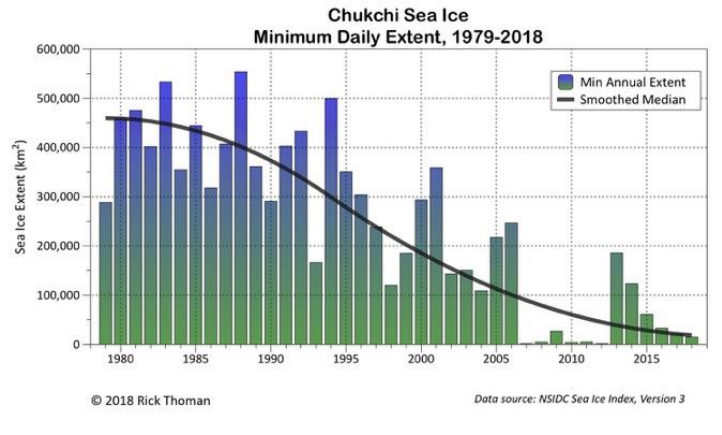
- Alaska's remoteness, harsh weather, seasonal sea ice and limited telecommunications requires new observing methods, technologies and collaborations.

- Ocean observing in the Arctic requires increased networks and collaborations at all levels - local, regional & international

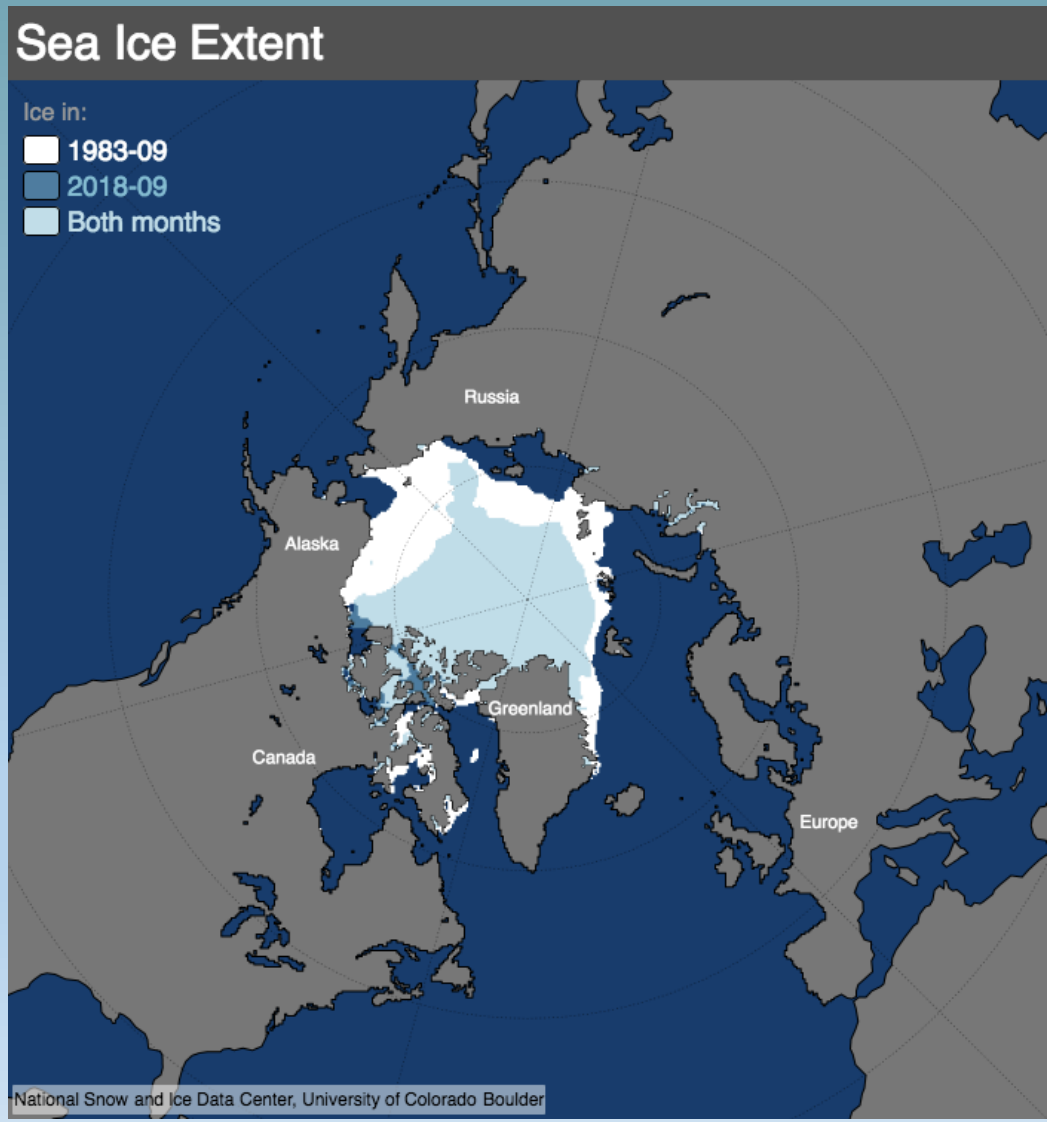
Minimum Sea Ice Extent (1979-2018)



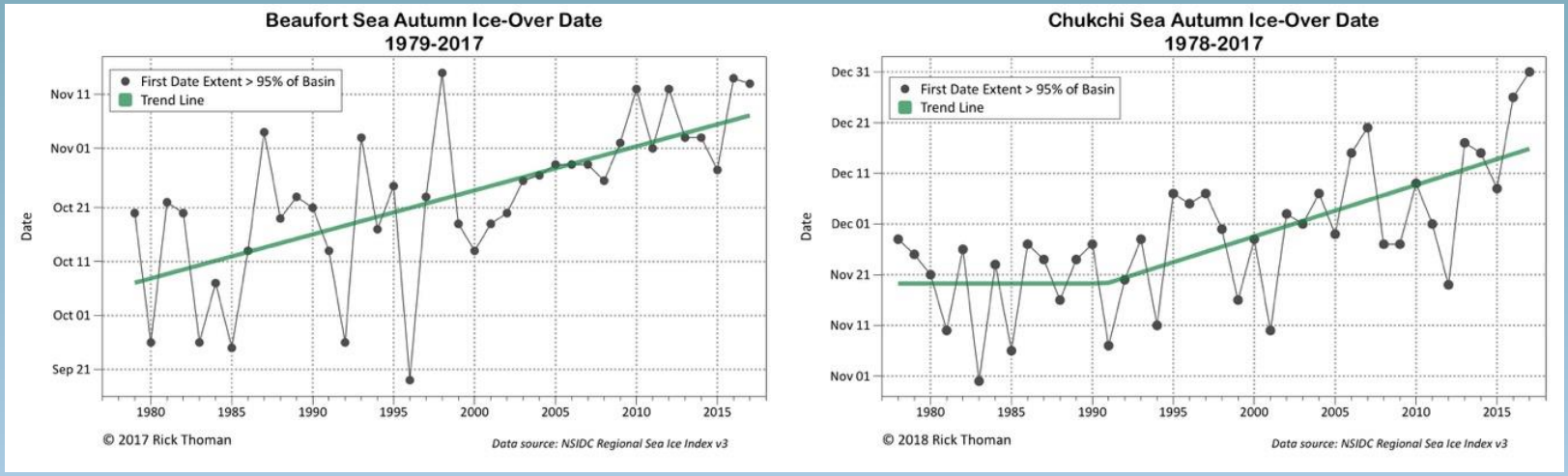
Beaufort Sea min extent fallen by > 50% since early 1980s



Chukchi Sea approaching "seasonally ice free" status

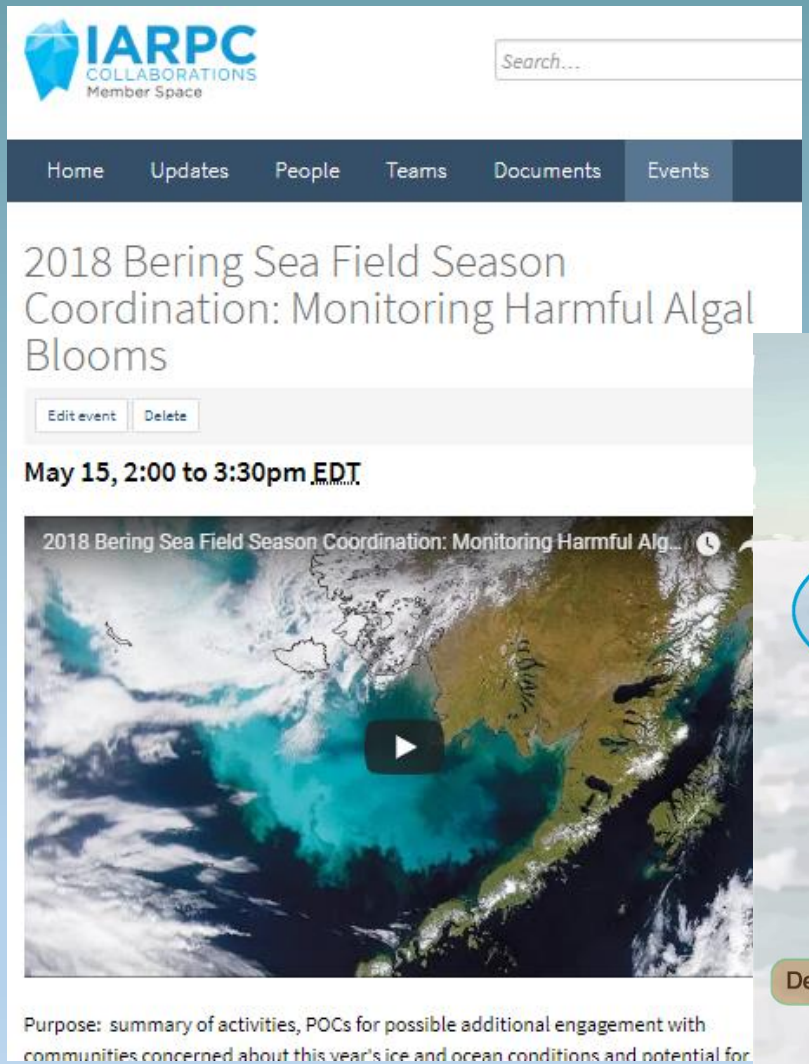


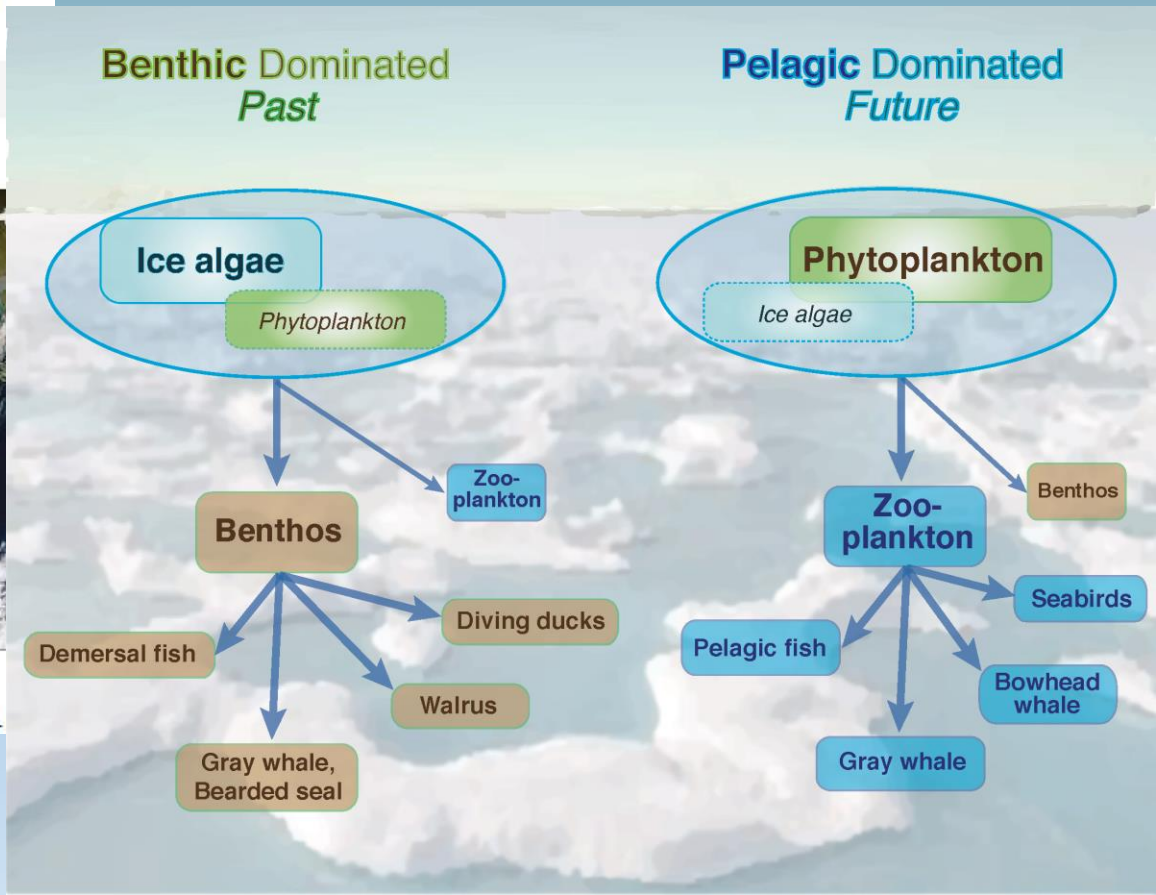
Beaufort and Chukchi Ice-Over



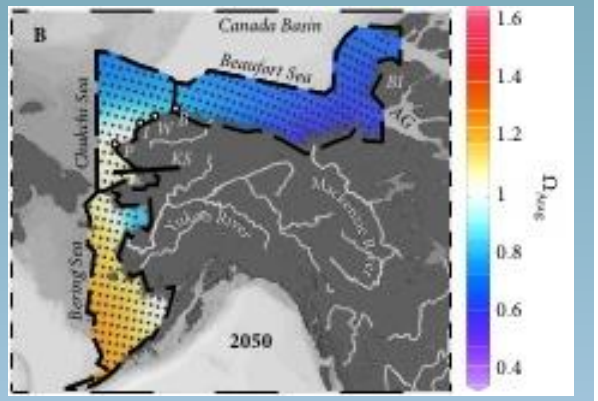
Ice-over (<95% of basin) now 3 to 4 weeks later than early 1980s

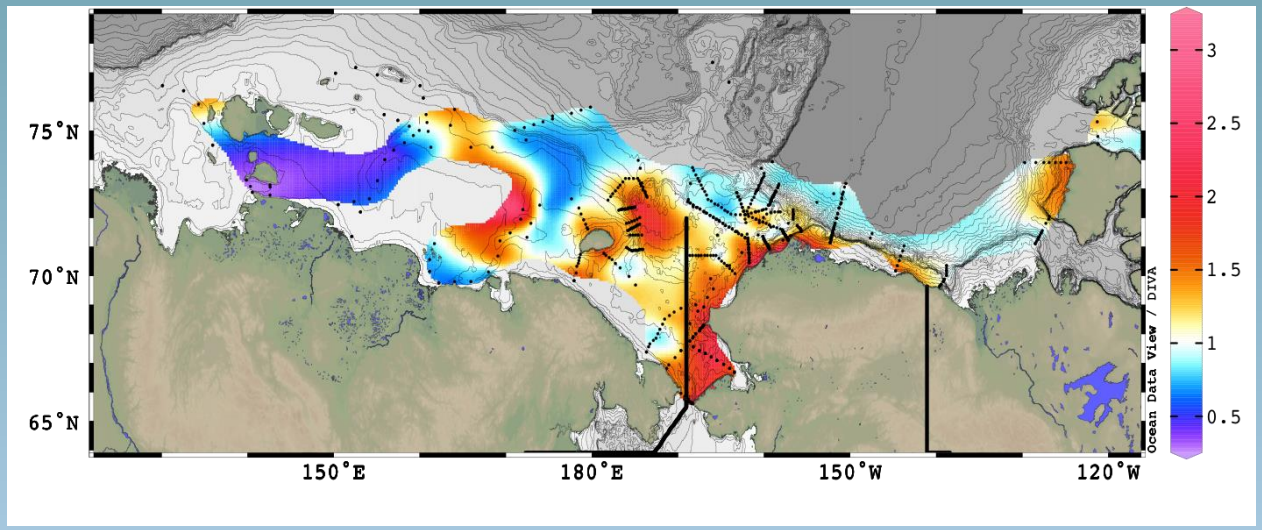
Biological responses





Early onset of sustained acidification





Ocean Acidification in the Surface Waters of the Pacific-Arctic Boundary Regions

Jeremy T. Mathis, Jessica N. Cross, Wiley Evans and Scott C. Doney
Oceanography
Vol. 28, No. 2, SPECIAL ISSUE ON EMERGING THEMES IN OCEAN ACIDIFICATION SCIENCE (JUNE 2015), pp. 122-135

NATURE CLIMATE CHANGE | LETTER

Increase in acidifying water in the western Arctic Ocean

Di Qi, Liqi Chen, Baoshan Chen, Zhongyong Gao, Wenli Zhong, Richard A. Feely, Leif G. Anderson, Heng Sun, Jianfang Chen, Min Chen, Liyang Zhan, Yuanhui Zhang & Wei-Jun Cai

ELSEVIER

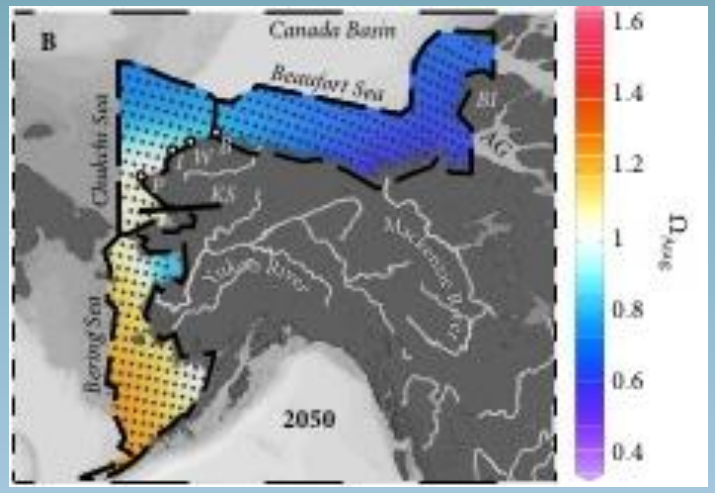
Deep Sea Research Part II: Topical Studies in Oceanography
Volume 152, June 2018, Pages 67-81

Formation and transport of corrosive water in the Pacific Arctic region

Jessica N. Cross [a], Jeremy T. Mathis [b], Robert S. Pickart [c], Nicholas R. Bates [d, e]

We don't know much about Arctic ecosystem-level OA impacts, but we do know ***exposure is increasing.***

What will happen to the Arctic?



Charlie Wright, USFWS

Daniel Yang, Scrippts
Caitlin Meadows

Role of AOOS: Mission and Philosophy

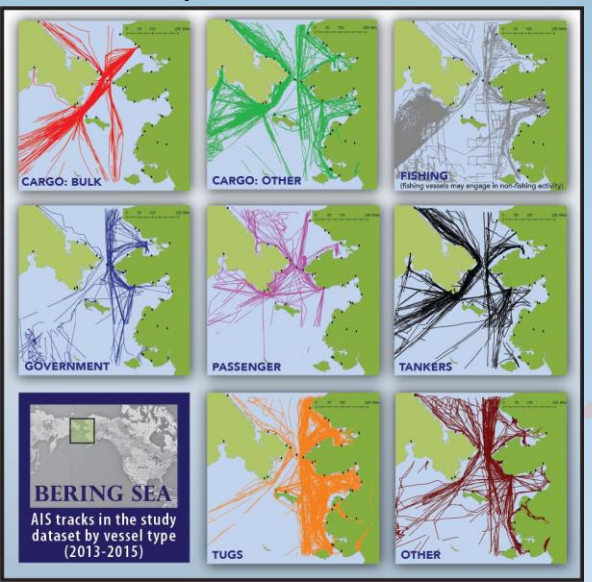
- Stakeholder driven, science based
- Identify and fill observing gaps: pilot new technologies
- Measure once, use many times
- Provide easy access to data
- Develop information products and tools to meet stakeholder needs
- Coordinate private sector, local, state & federal agency efforts

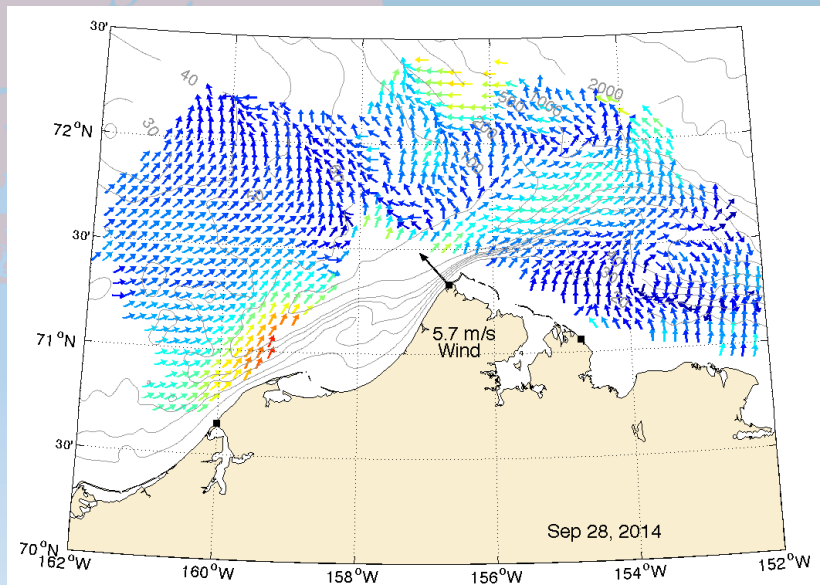
Present & Future Alaska HFR Sites

Chukchi/Beaufort Sites
Wainwright, Point Barrow, Cape Simpson
& Bering Strait in 2019
Funded by AOOS
5 MHz systems

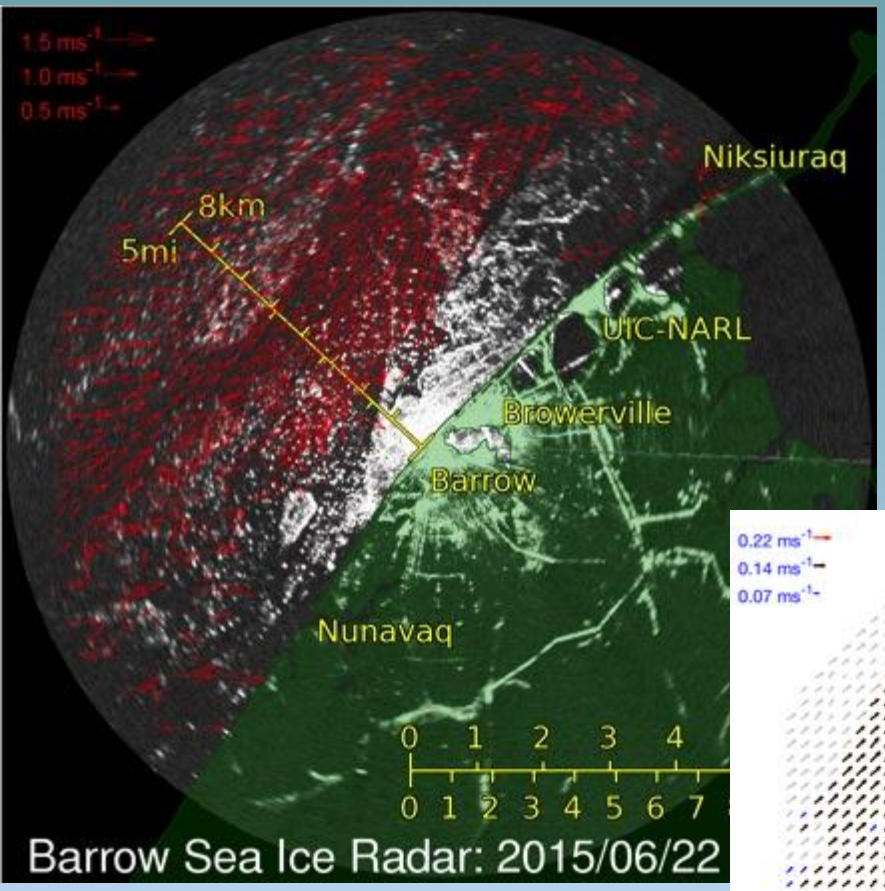
<u>Uses</u>

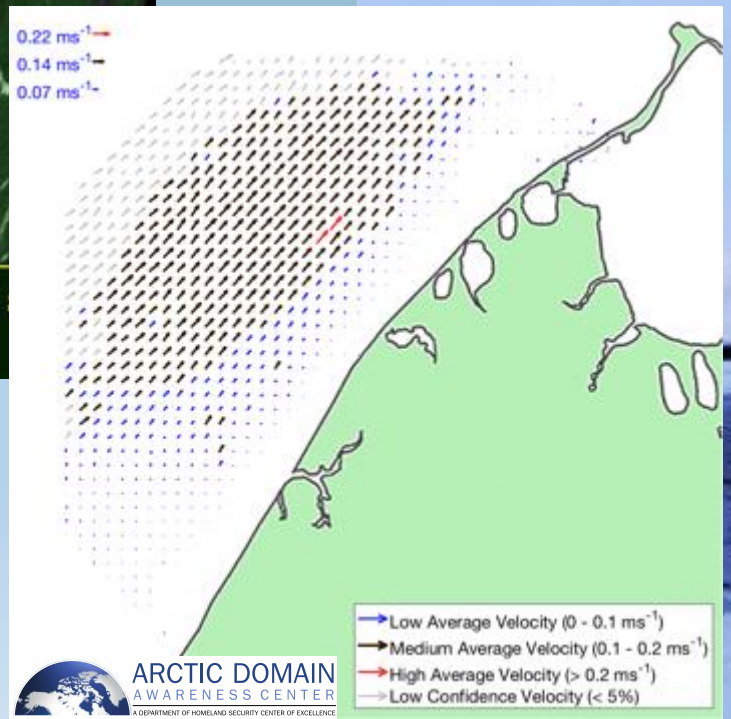
search & rescue
navigation safety
oil/contaminant spill response
track harmful algal blooms
complement local knowledge





UAF Barrow/Utqiaġvik Sea Ice Radar



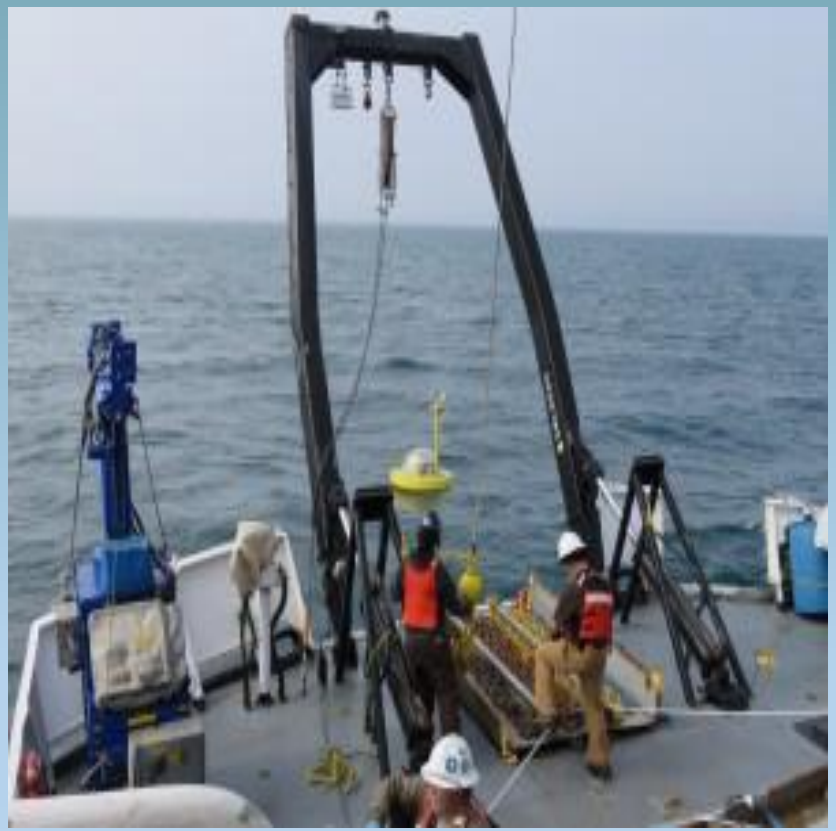


Furuno X-band FAR212 25kW, 2.4 m open array 22 m a.s.l.
digital controller,
internet upload

UNIVERSITY OF ALASKA FAIRBANKS

Waves & Weather

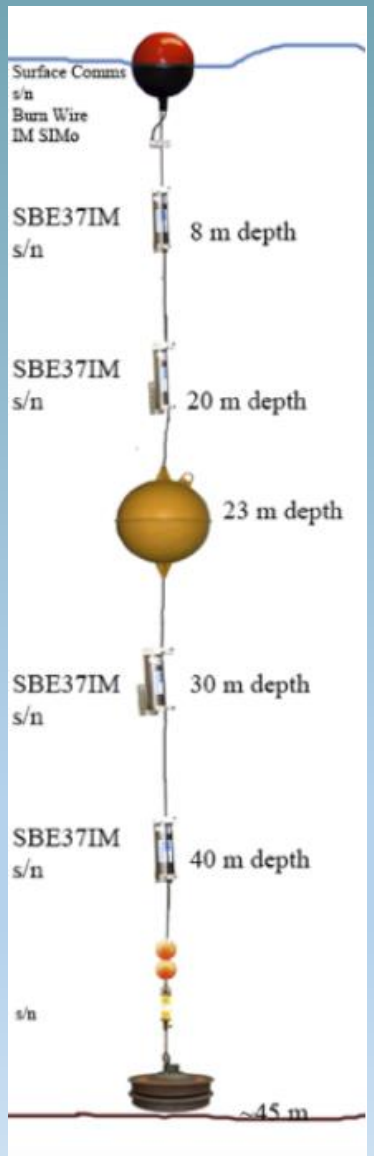
- Most real-time data buoys only operate in ice-free regions
- New wave buoy for Port of Nome
- Shore-based weather stations: not necessarily what is happening on water
- Need shore-side logistical support

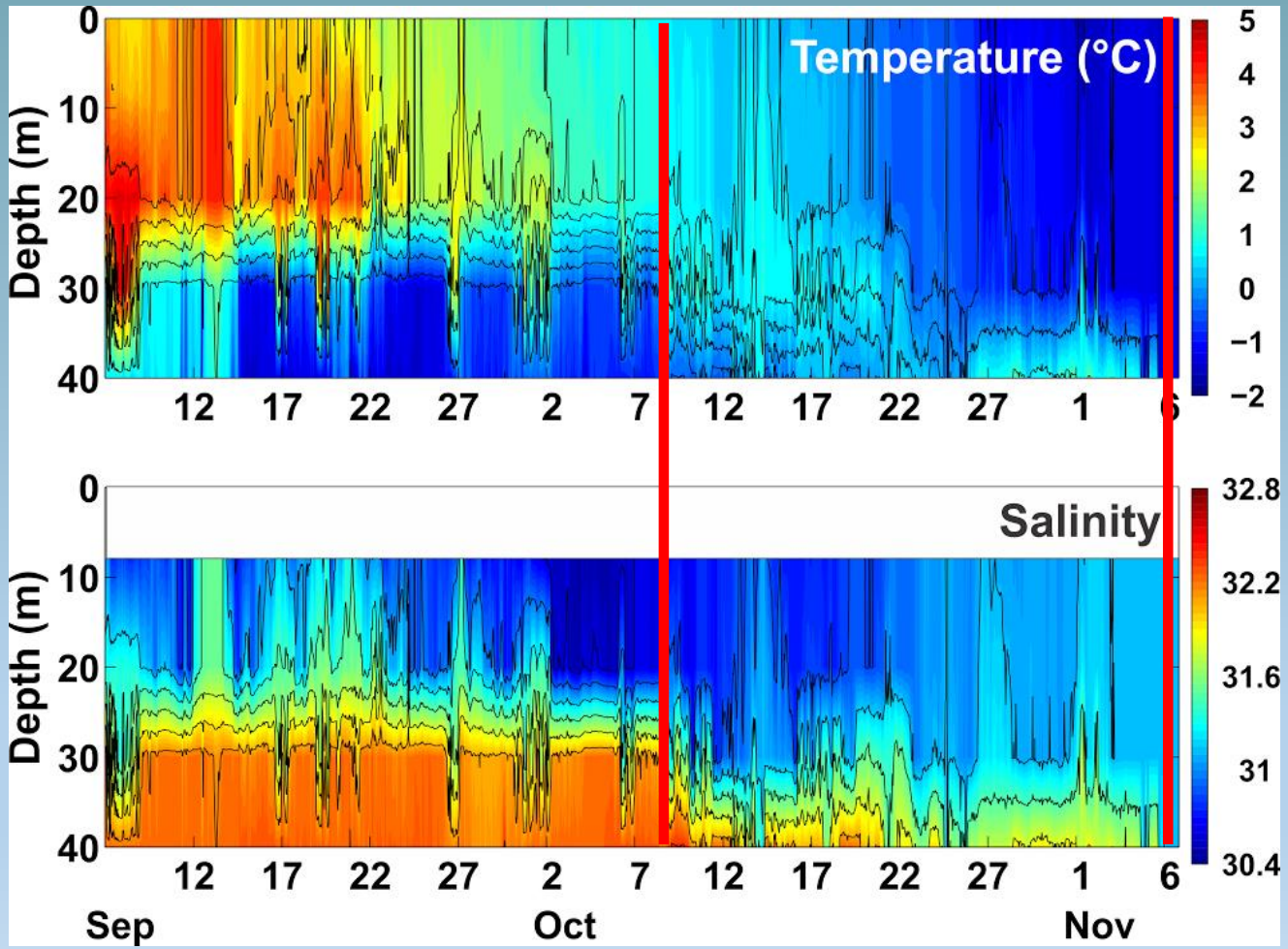


Real-Time Ice Freeze-up Detection Buoy Trials

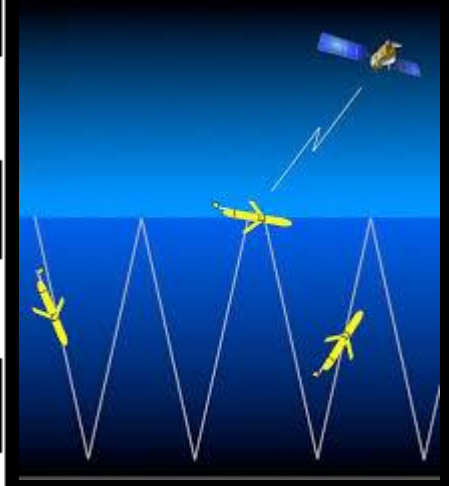
Typically, would think this overturning was Freeze-up

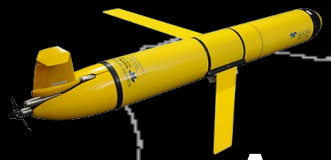
Time of surface float release & actual time water column well-mixed





Gliding Through the Bering and Chukchi Seas





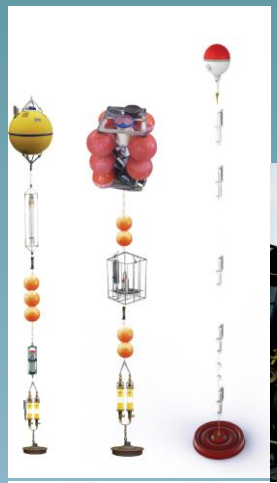
Annual Ocean Conditions
Marine Mammal Tracking
Remote Arctic Missions
Since 2013

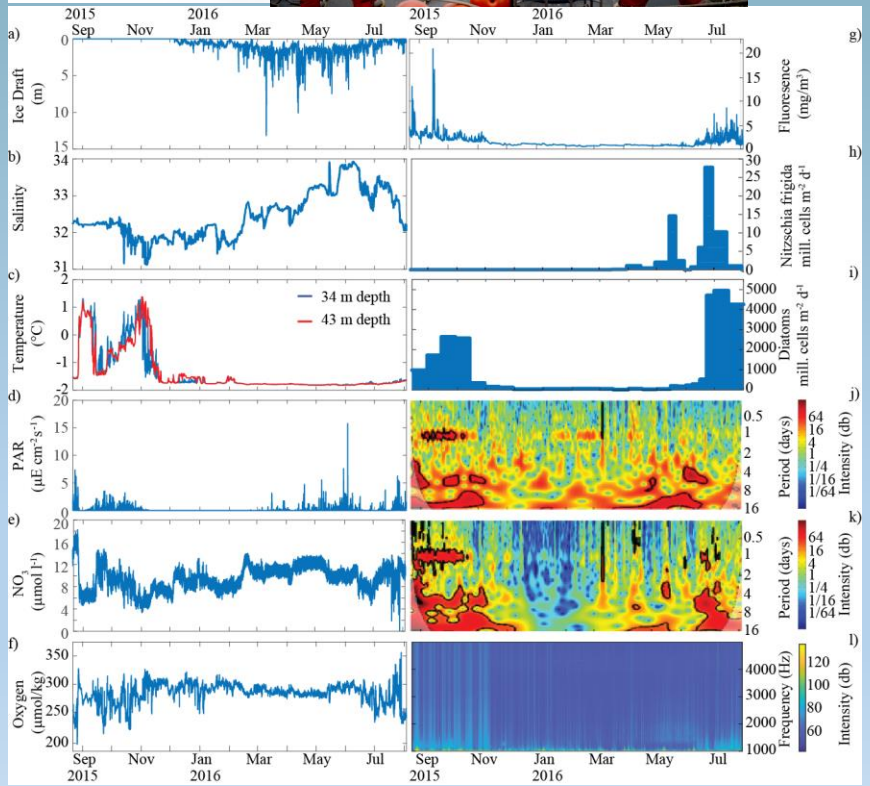
Scale (km)
25 0 25 50 75 100

Start (07/11/15 20:00)
Last (09/08/15 11:15)

Partners: Baumgartner-WHOI, Stafford UW, Winsor and Statscewich-UAF, NPRB

Ecosystem Observatories



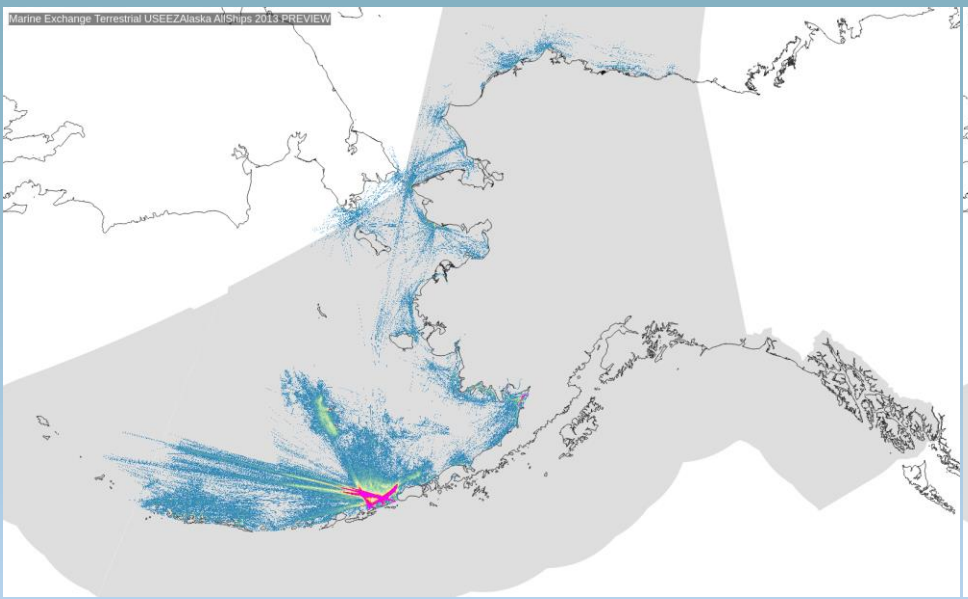


- Statewide plan: 1 in each of 4 LMEs (Chukchi, Beaufort, Bering & Gulf of Alaska): Chukchi since 2014, GOA will be deployed in 2019, Bering Sea follows
- Provide year-round coverage – even during ice covered months
- Anchor for ship transect lines (DBO, Seward Line)
- Cutting edge sensor technologies used on a "mooring array" – leading the way for national plan

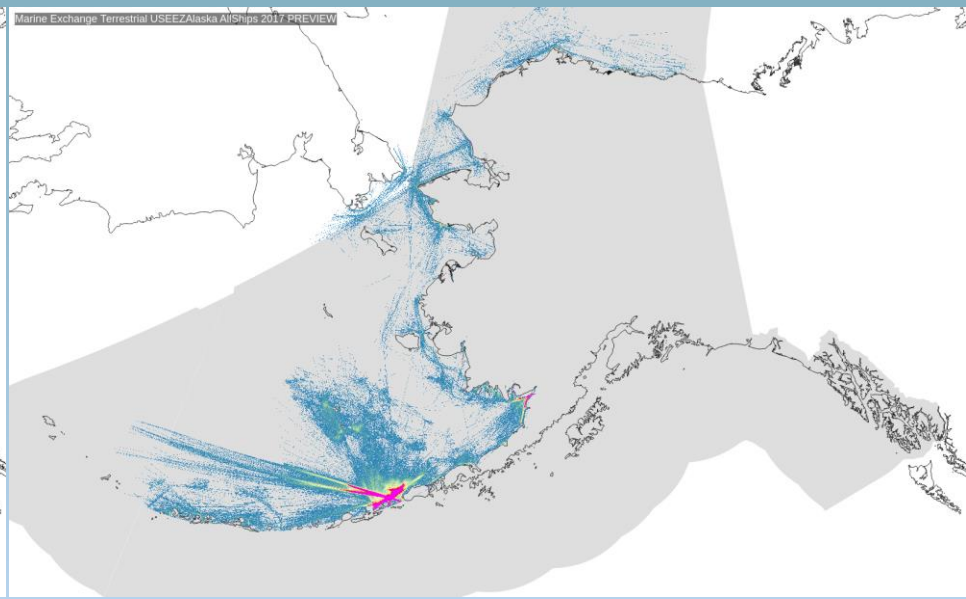
Partners: Danielson-UAF, NPRB,
Murdock-Charitable Trust, and numerous others

AIS with Weather Stations

Use of Vessel Tracking data: Looking for Trends in 2013 & 2017



2013



2017

Developing a Community Impacts Decision Support Tool for Alaska Beaufort

Goals:

- Understand where a spill is most likely to occur based on the frequency of vessels (using AIS data), and
- How could different subsistence activities and their relative timing be impacted in the event of a spill.

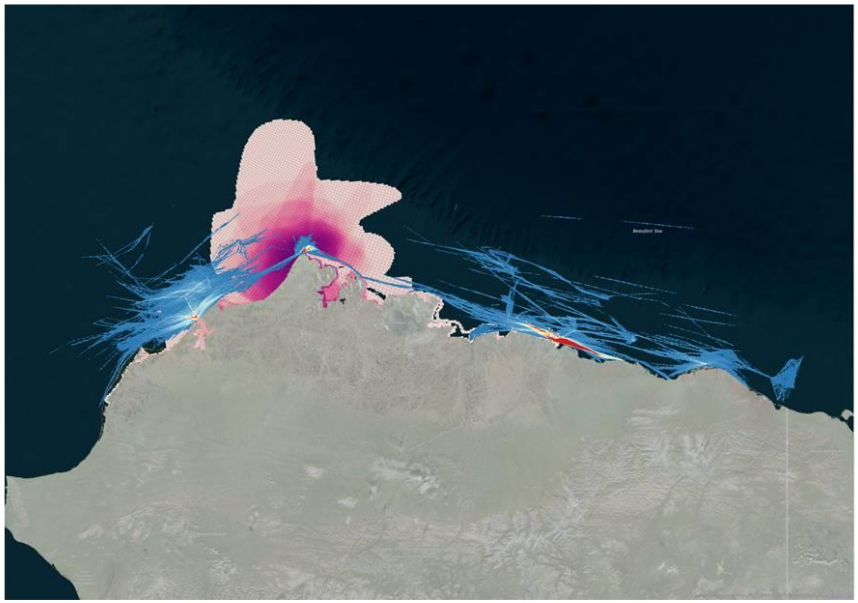
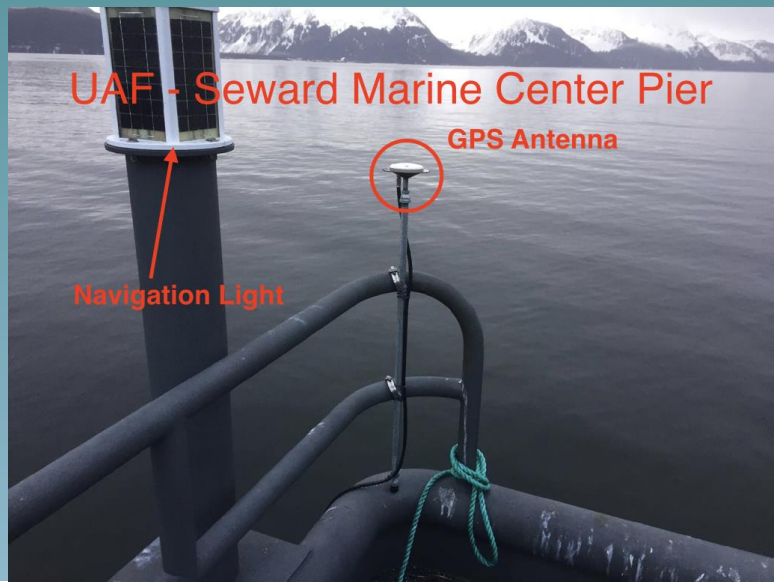
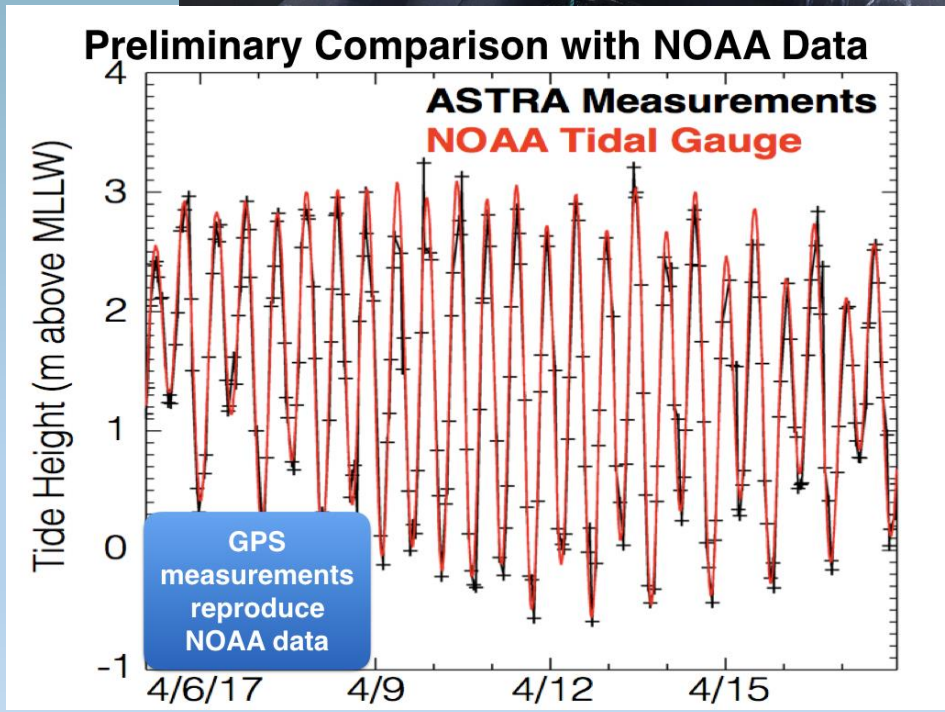


Figure 3. Example image of harvester intensity index for the community of Utqiaġvik (formerly Barrow) relative to marine traffic.

Land-Based, GPS Reflectometry for Measuring Water Level



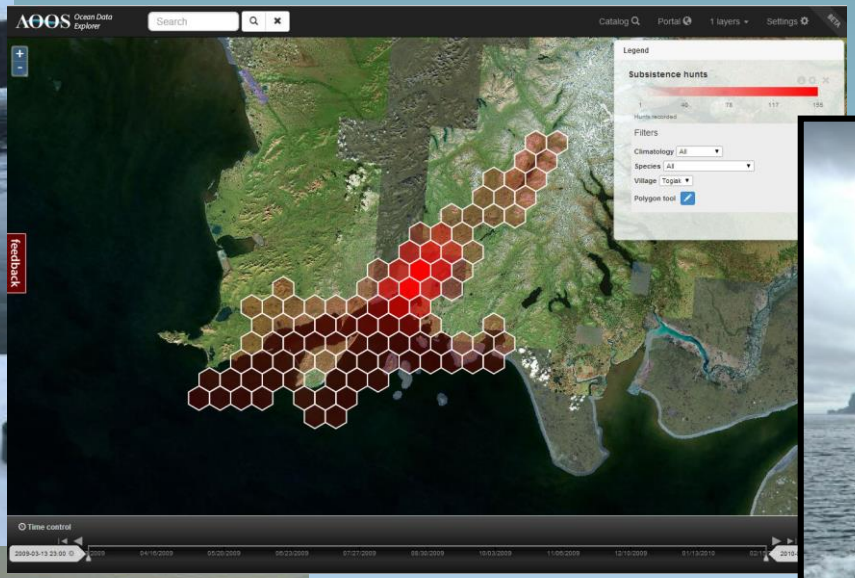


Private Sector Partners:

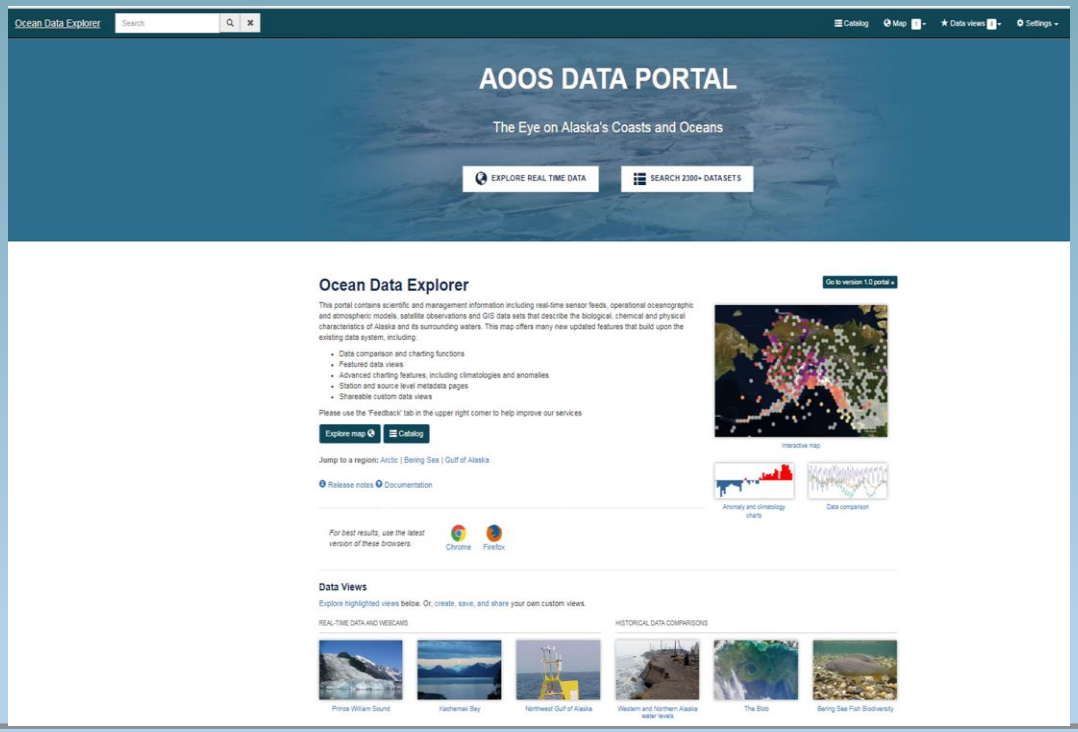
UNAVCO - NSF funded Plate Boundary Observatory

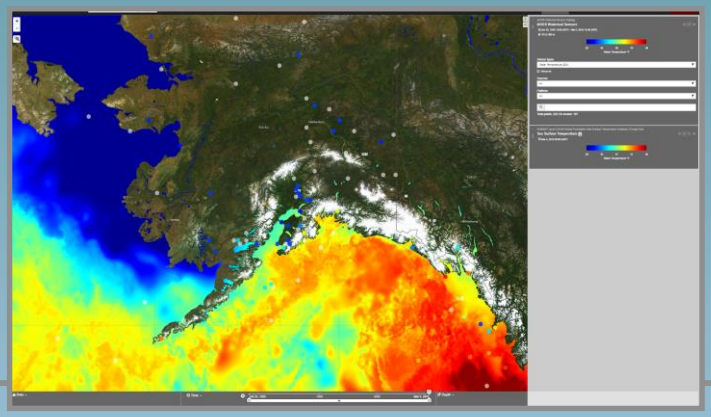
ASTRA, LLC

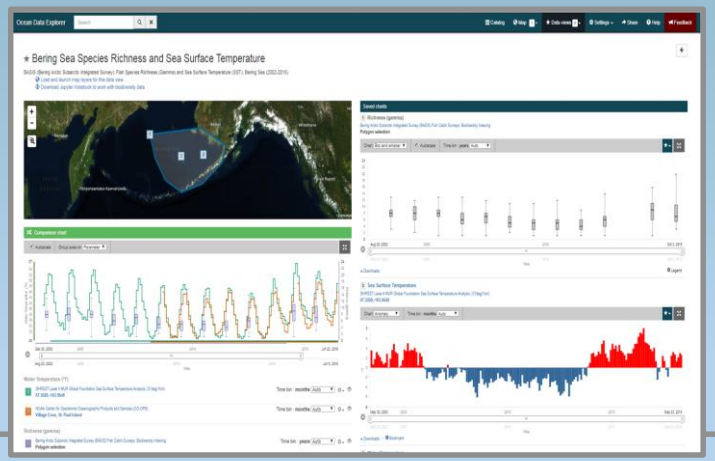
Indigenous knowledge
Community based monitoring
Citizen science



AOOS Data Assembly Center & Ocean Data Explorer



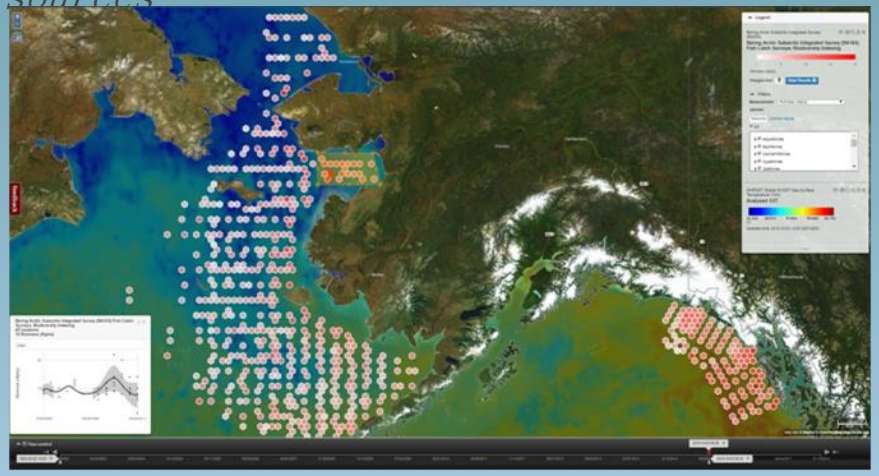




Portal Components

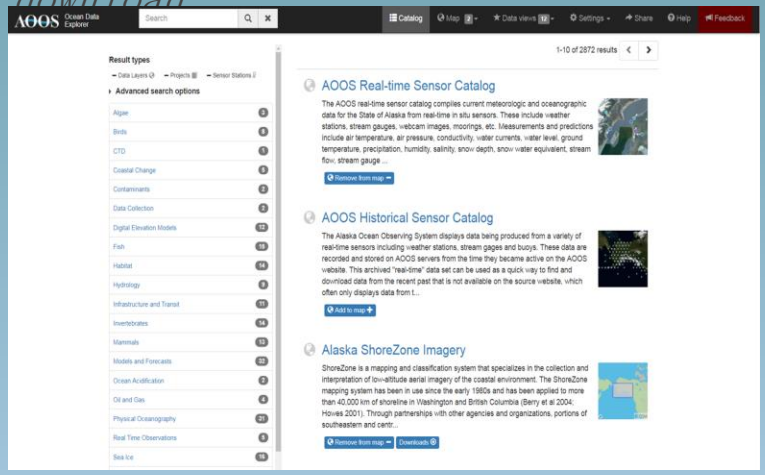
Map

Integrate & visualize data from many sources



Catalog

Search , metadata, & data download



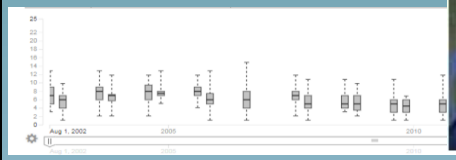
Data Views

Rapidly assimilate & compare different data streams

Multiple Data Types

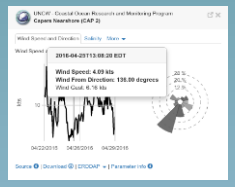
Biodiversity

count, richness, diversity indices



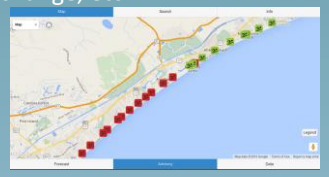
Platforms

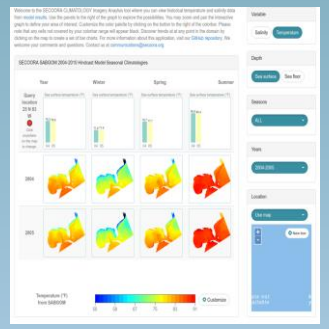
moorings, shore stations



Products

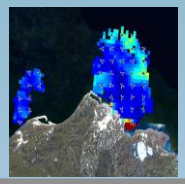
skill assessment, shoreline change, etc.

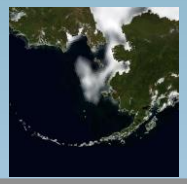


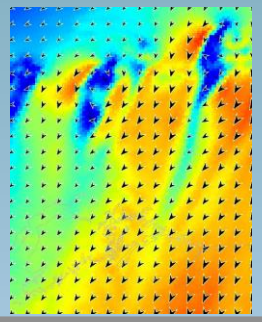


Grids

models, satellite, radar

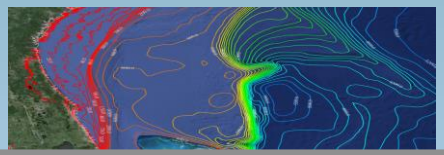






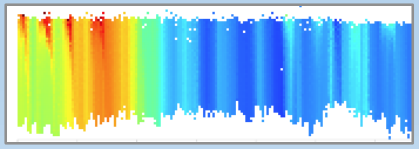
GIS

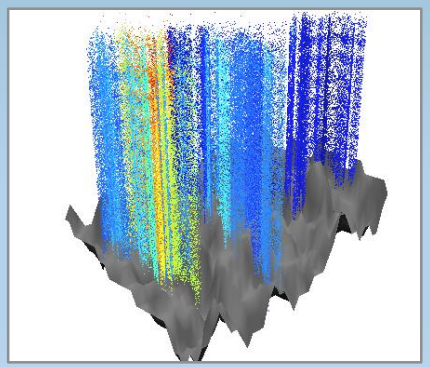
Habitat types, bathymetry, fishing zones, etc.



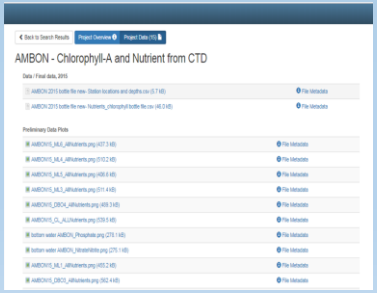
Mobile sensors

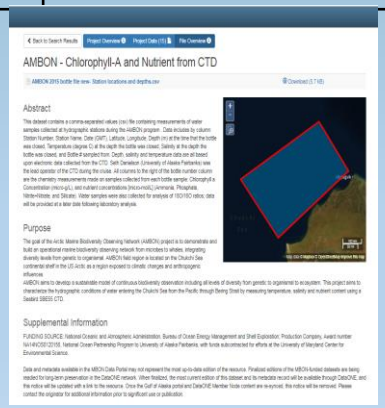
gliders, animal telemetry





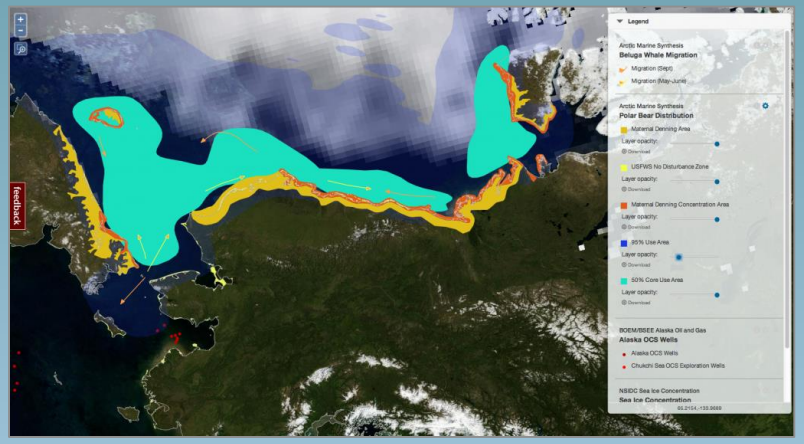
RESEARCH WORKSPACE

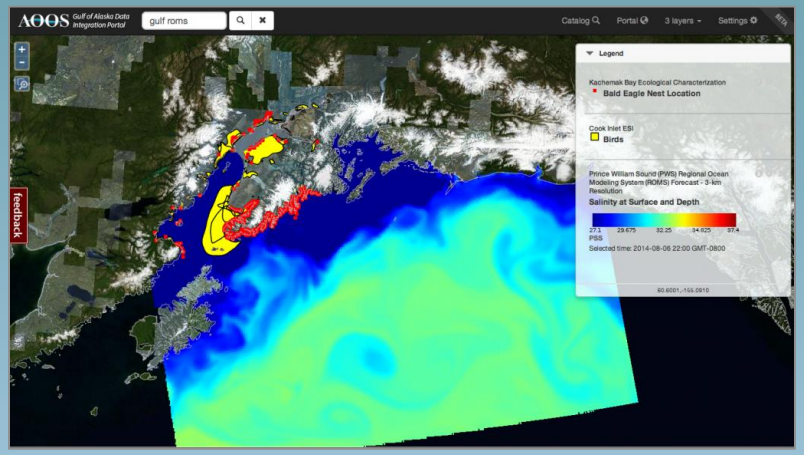




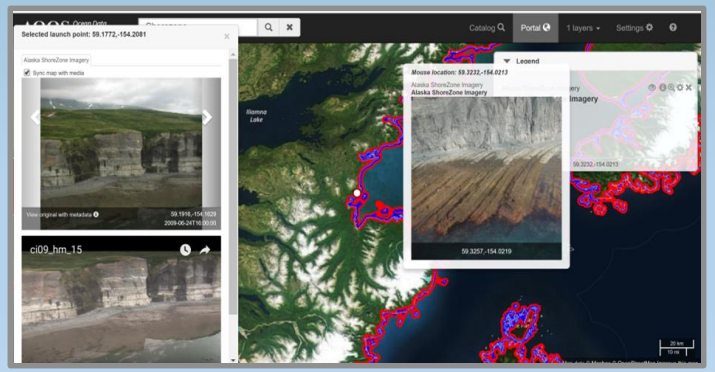
Rapid Deployment of Focused Tools

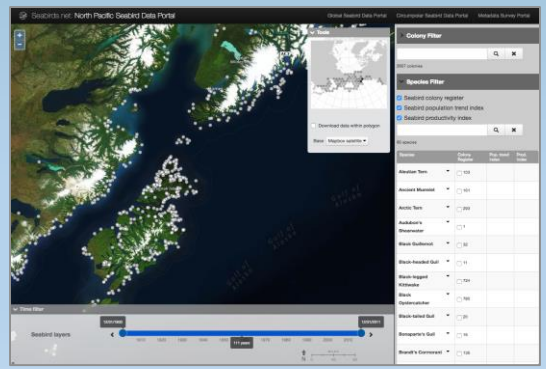
Regional:





Thematic:





Coordination & facilitation: Convener Role

Ongoing

- **AK Water Level Watch**
- **Integrated Coastal Mapping for COTNA (Coastal Onshore, Tidal & Nearshore Areas)**
- **AK Ocean Acidification Network**
- **AK Harmful Algal Bloom Network**

Short-term

- **The "Blob": blog & AK working group**
- **Bering Strait Response**

Networking activities

- **Local, regional, national and international**

.

Alaska Water Level Watch

Alaska Water Level Watch

AOOS
Alaska Ocean Observing System

Alaska Water Level Watch

UAF Deploys Storm Surge Monitoring Tripods in Three Northwest Coastal Communities

Northwest Alaska is no stranger to large fall storms. From October until the sea ice arrives, the region experiences multiple coastal storms each year that heavily impact the region leading to inundation and coastal erosion.

1 2 3 4

Alaska Water Level Watch Features archive

Resources

Observations

- NWLON Tide Gauges
- GPS Reflectometry
- Community-Based Observation Data Sheets
- Rapid Deploy Sensors

Real-Time Data

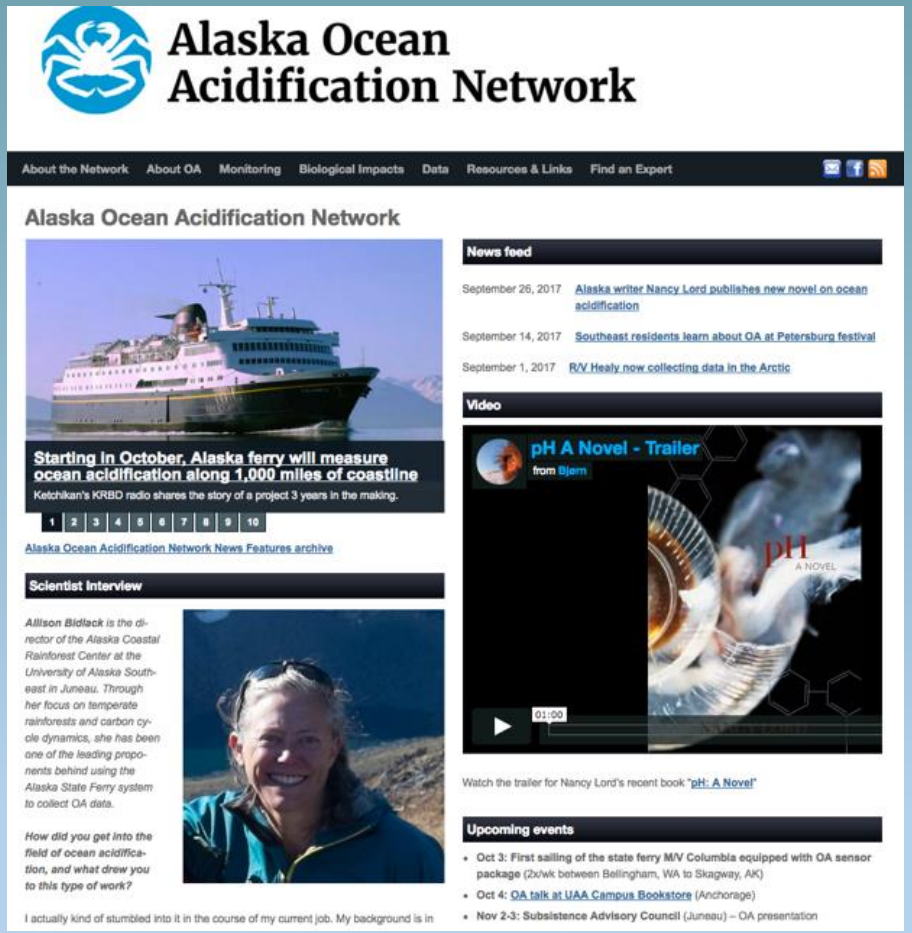
- Real-Time Data Portal
- IOOS QARDOD Manual for Real-Time Quality Control of Water Level Data

Tidal Datums

- About Tidal Datums
- Convert Between Datums
- Compute Tidal Datums from Water Level Time Series

Published Resources

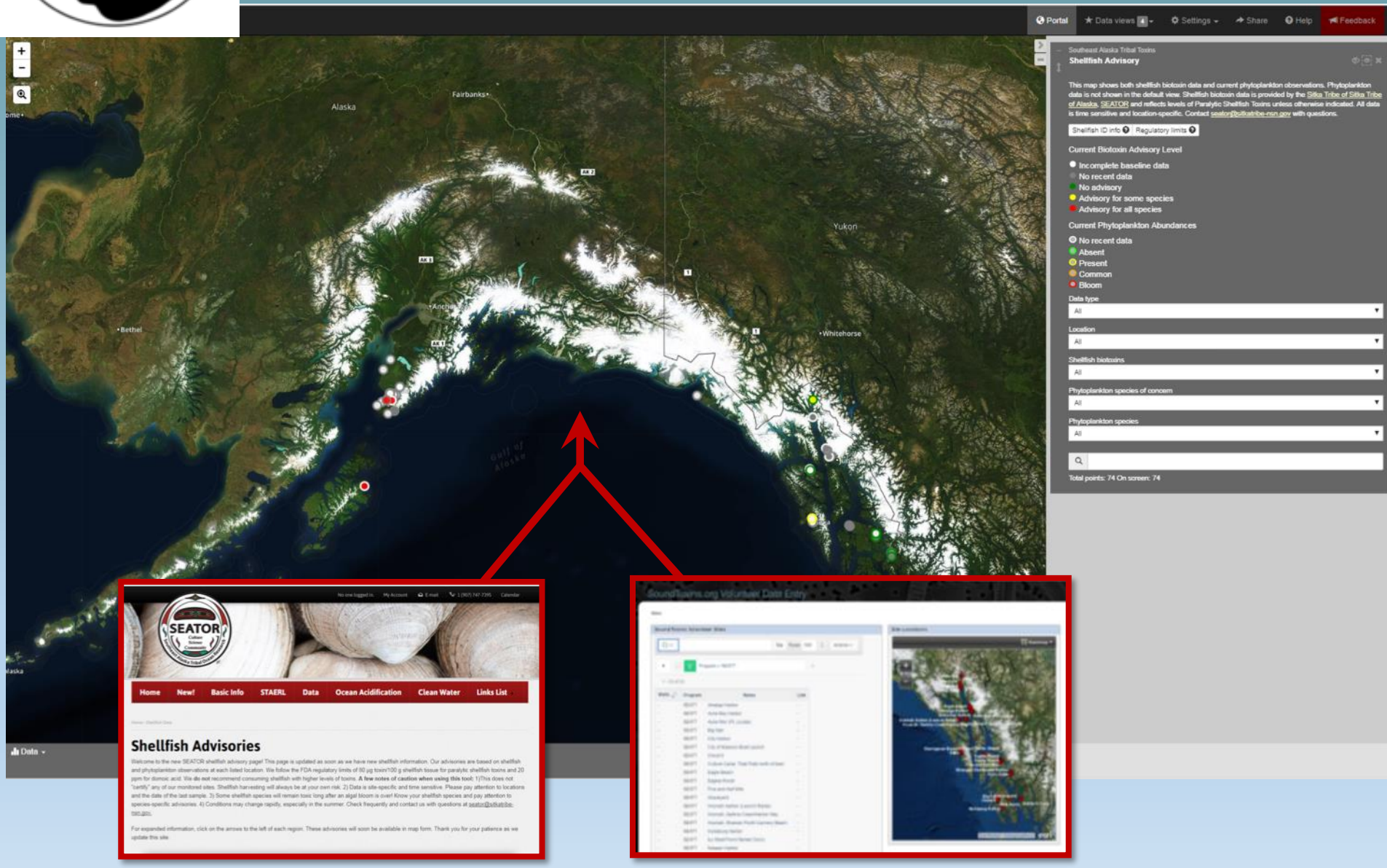
Alaska Ocean Acidification Network



- Engage with communities to expand understanding
- Identify information needs and monitoring priorities
- Share best practices
- Promote data sharing

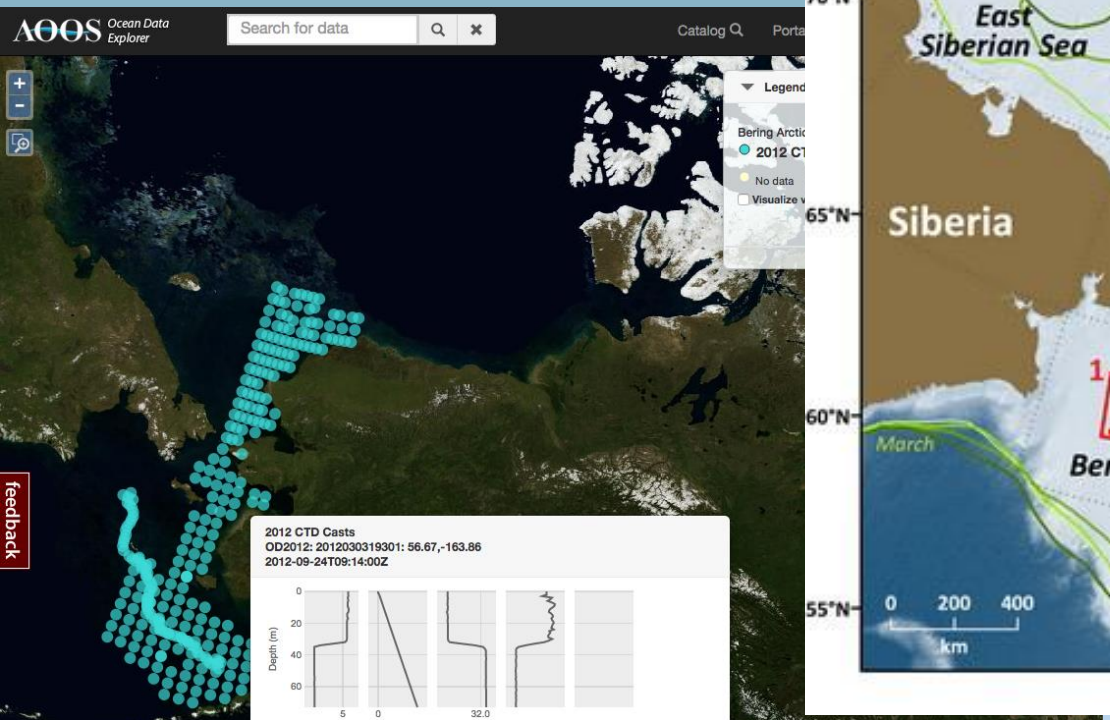
http://www.aoos.org/alaska-ocean-acidification-network/

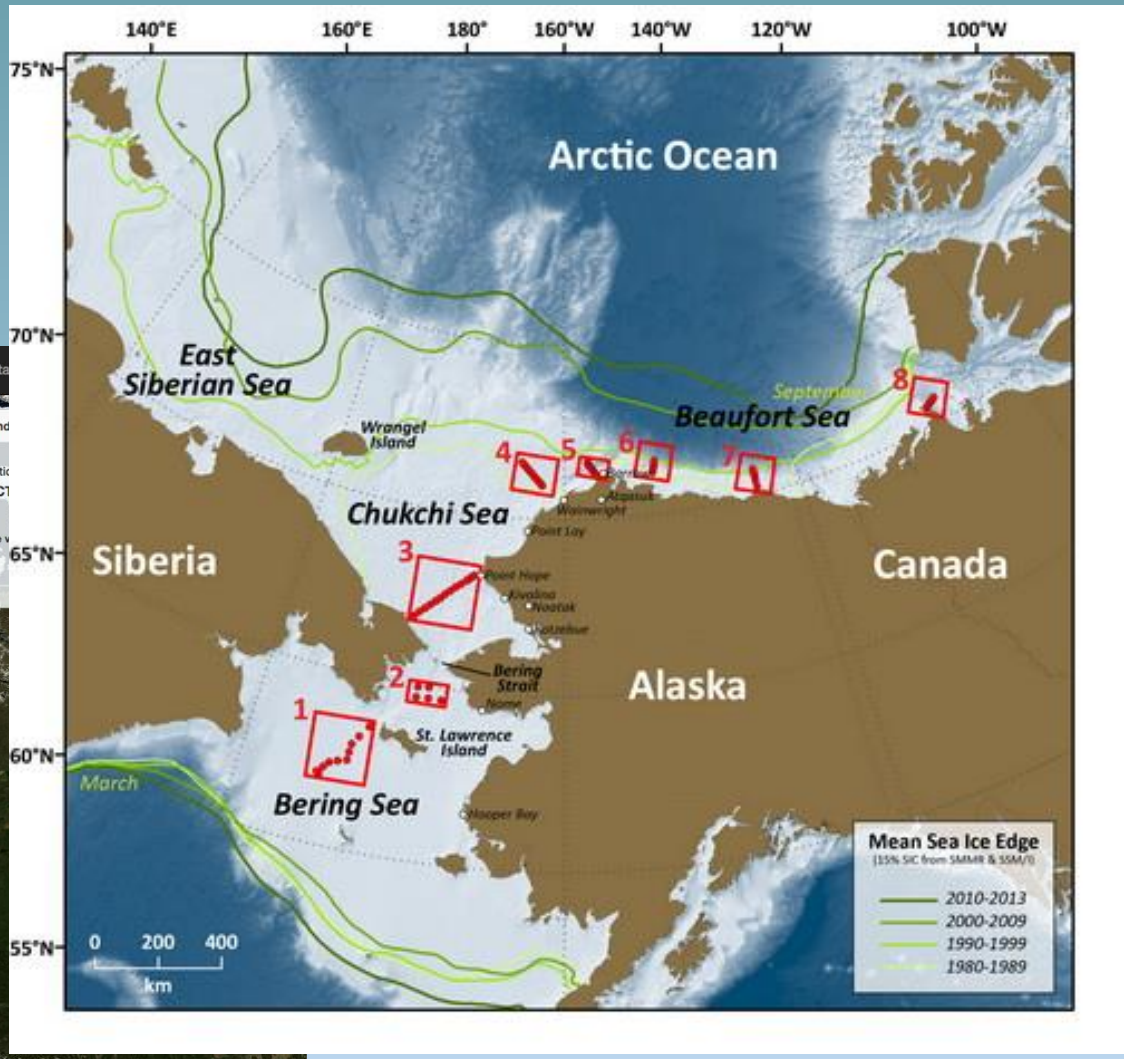
Harmful Algal Bloom Network, Data Portal & Tools



National & International Collaborations

Ship Transects: DBO & Fish Surveys





Recommendations to meet the challenges & embrace the opportunities

- Have each platform meet many stakeholder needs
- Need local science/technical support to reduce costs
- Industry partners can provide critical logistical support, possible future financial support
- Networking, outreach, communication, coordination, collaboration: all are essential

THANK YOU
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