

Ocean Observing in Alaska's Arctic: Challenges and Opportunities

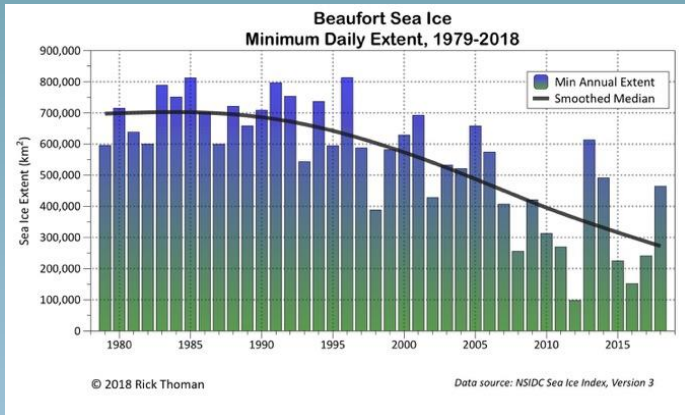


Oceanology International
Qingdao, China
October 23, 2018
Molly McCammon
AOOS Executive Director

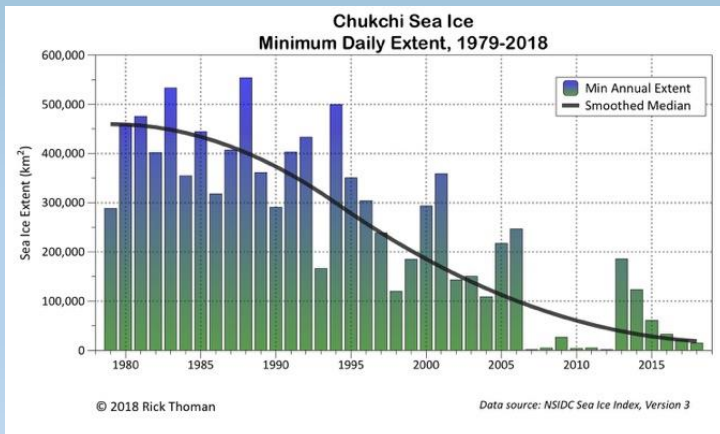
Key Points

- 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)

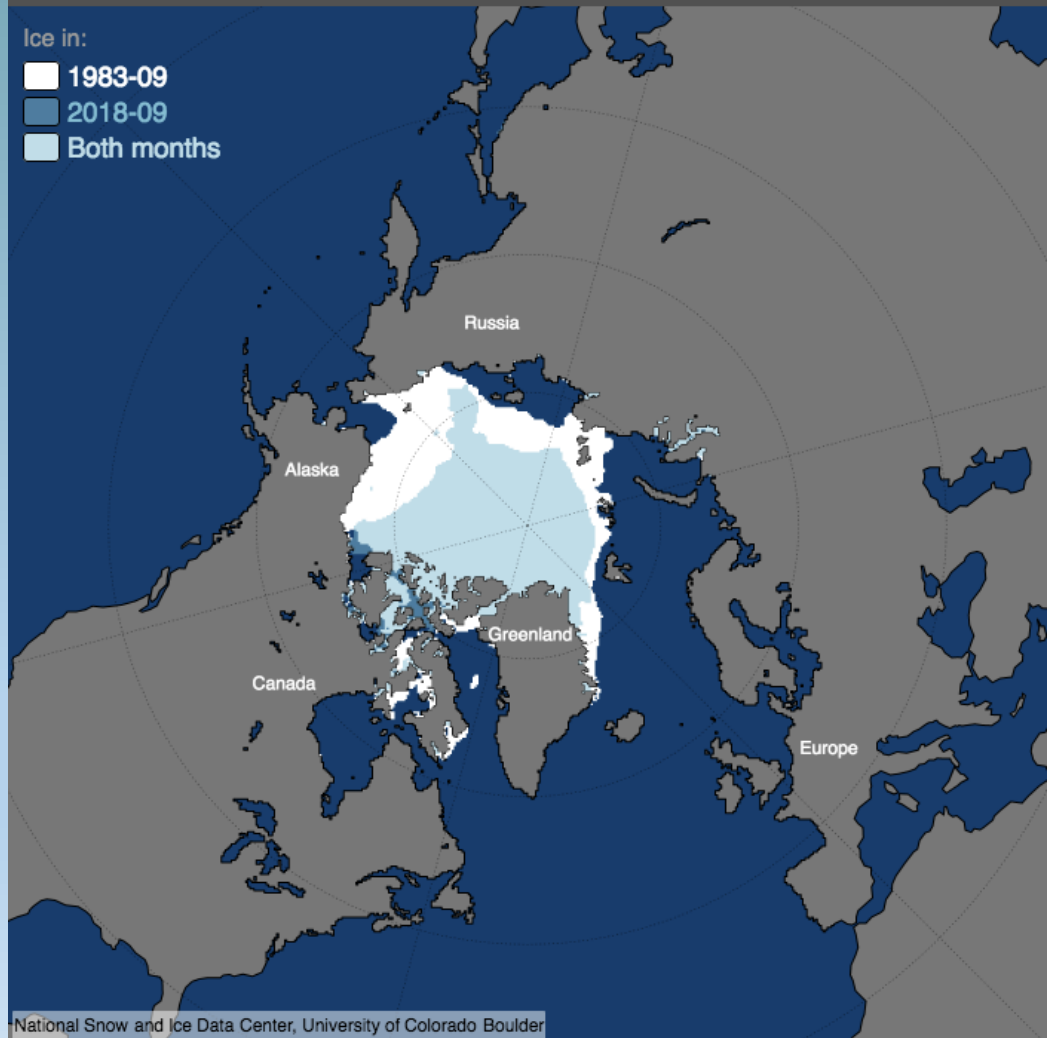


Beaufort Sea min extent fallen by > 50% since early 1980s

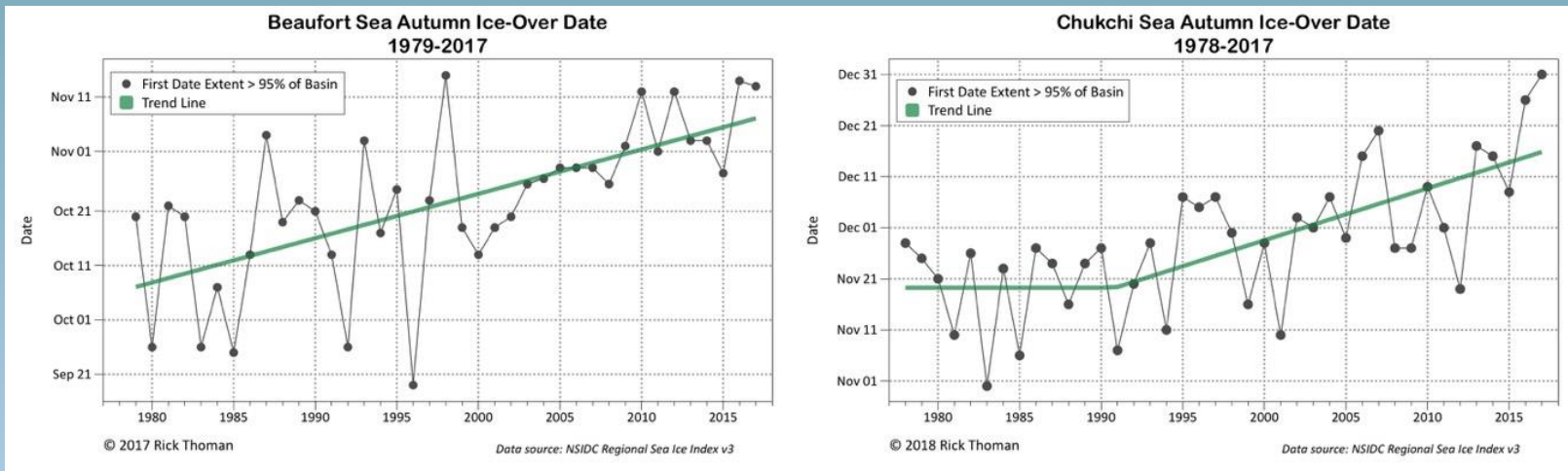


Chukchi Sea approaching
“seasonally ice free” status

Sea Ice Extent




Beaufort and Chukchi Ice-Over



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

Biological responses



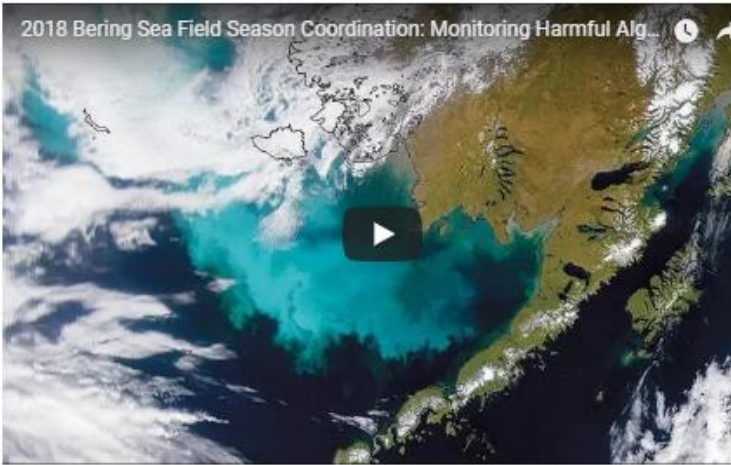
Search...

Home Updates People Teams Documents Events

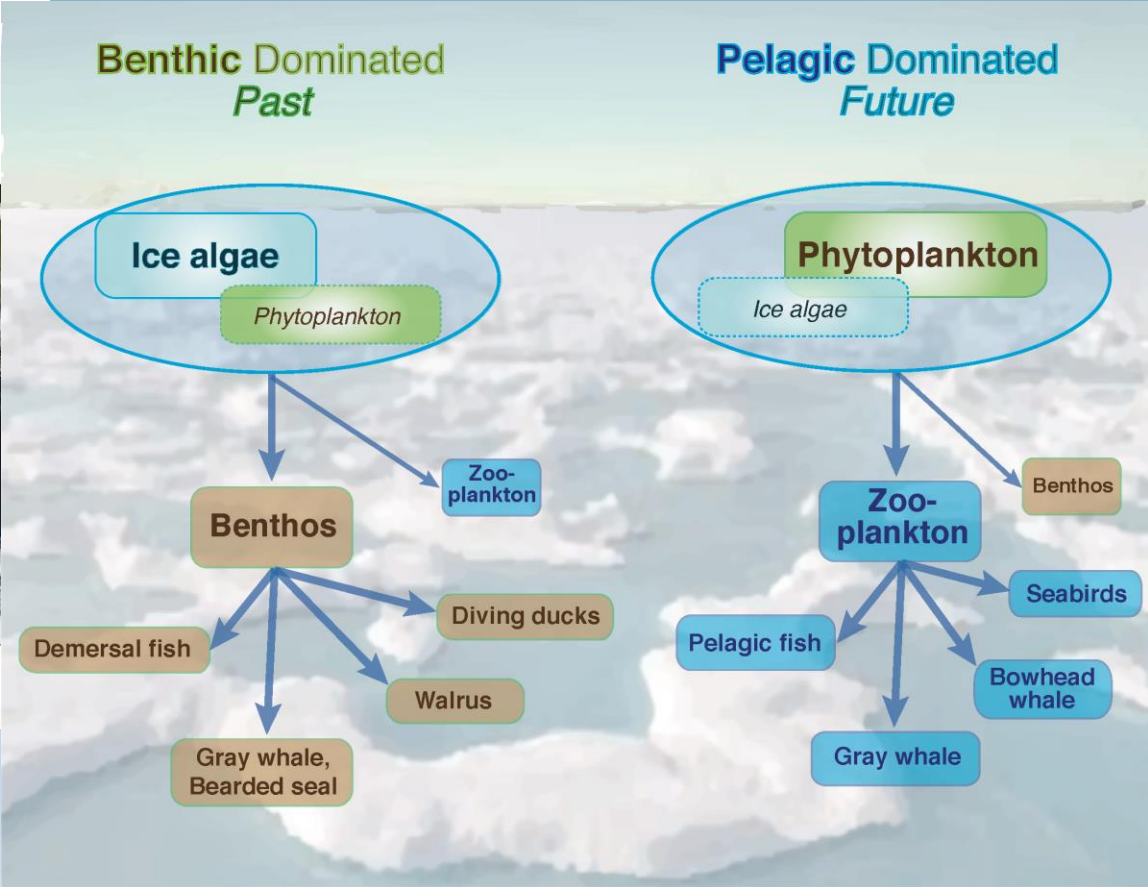
2018 Bering Sea Field Season Coordination: Monitoring Harmful Algal Blooms

Edit event Delete

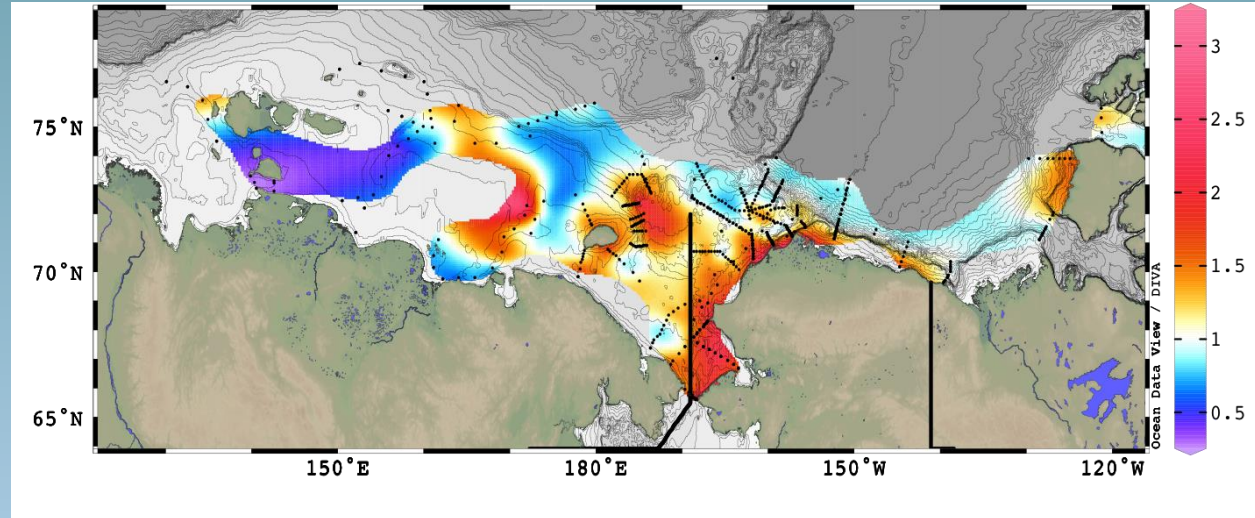
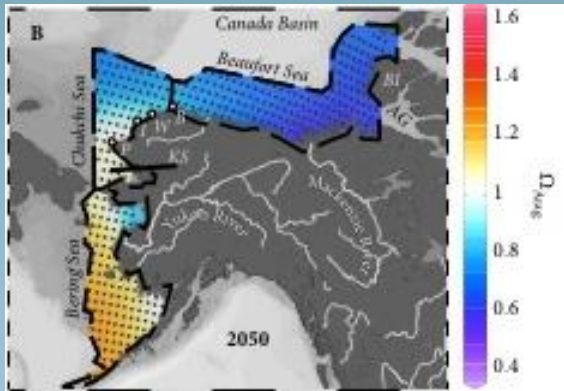
May 15, 2:00 to 3:30pm EDT



Purpose: summary of activities, POCs for possible additional engagement with communities concerned about this year's ice and ocean conditions and potential for



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



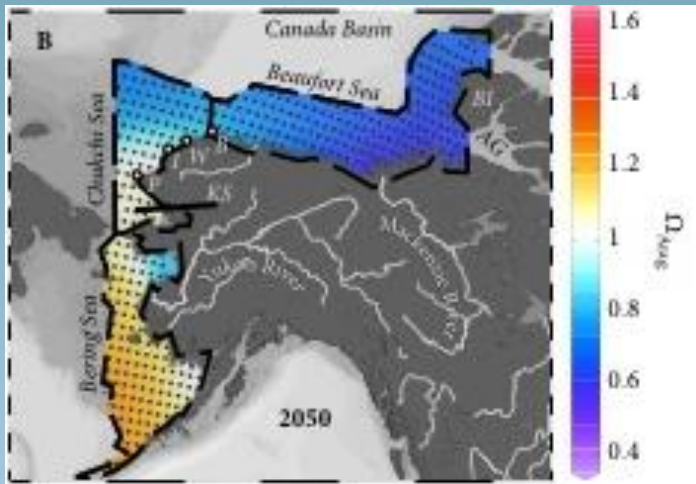
Deep Sea Research Part II: Topical Studies in Oceanography
Volume 152, June 2018, Pages 67-81

Formation and transport of corrosive water in the Pacific Arctic region

Jessica N. Cross^{a, R. 23}, Jeremy T. Mathis^{b 23}, Robert S. Pickart^{c 23}, Nicholas R. Bates^{d, e 23}

*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, Scripps
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

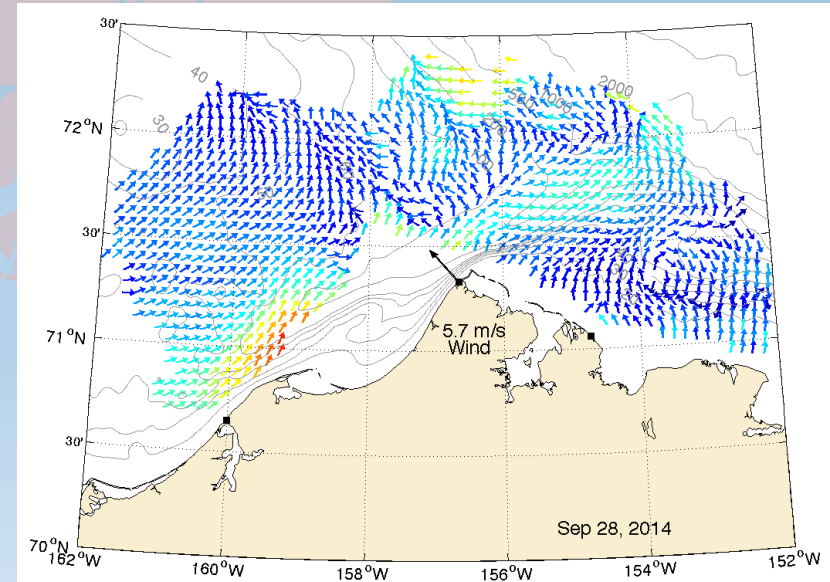
Wainwright, Point Barrow, Cape Simpson
& Bering Strait in 2019

Funded by AOOS

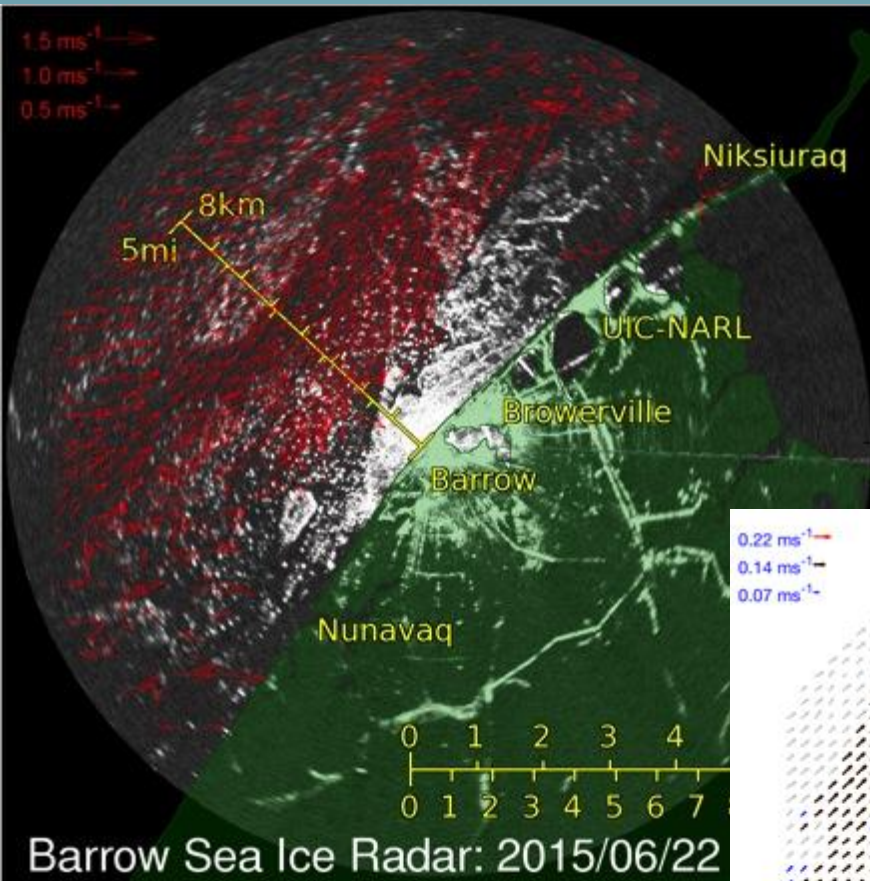
5 MHz systems

Uses

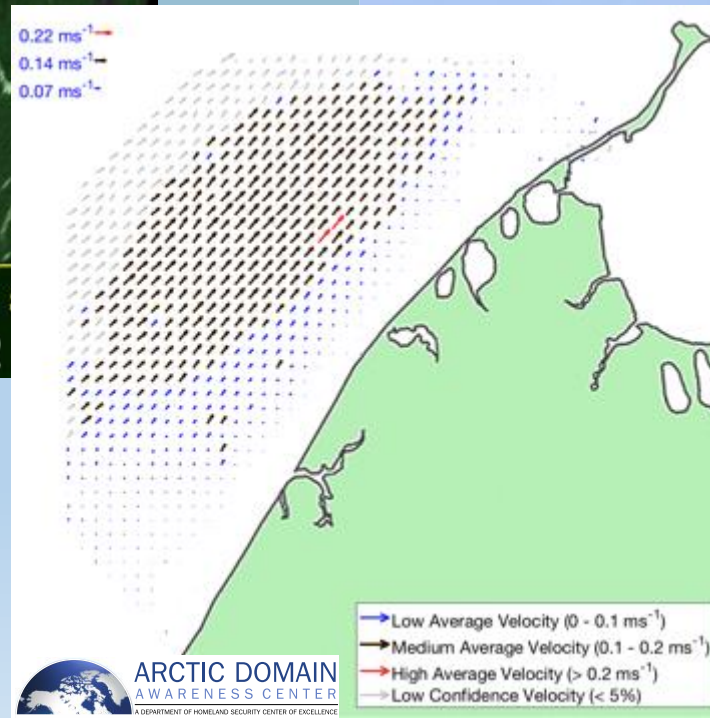
- search & rescue
- navigation safety
- oil/contaminant spill response
- track harmful algal blooms
- complement local knowledge



UAF Barrow/Utqiagvik Sea Ice Radar

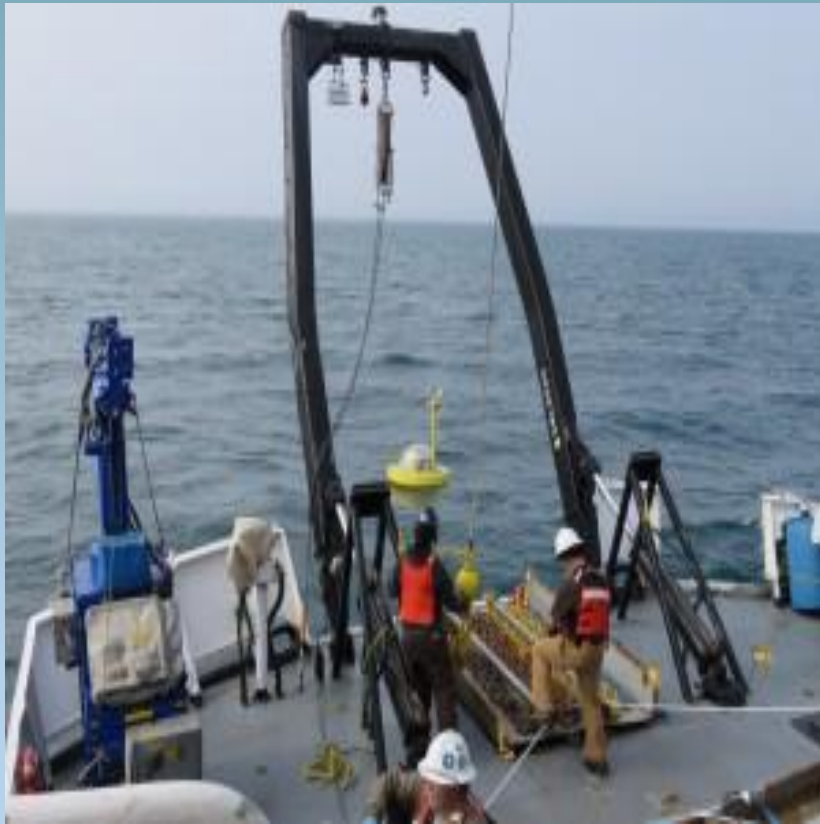


Furuno X-band FAR212 25kW, 2.4 m open array 22 m a.s.l.
digital controller,
internet upload



Waves & Weather

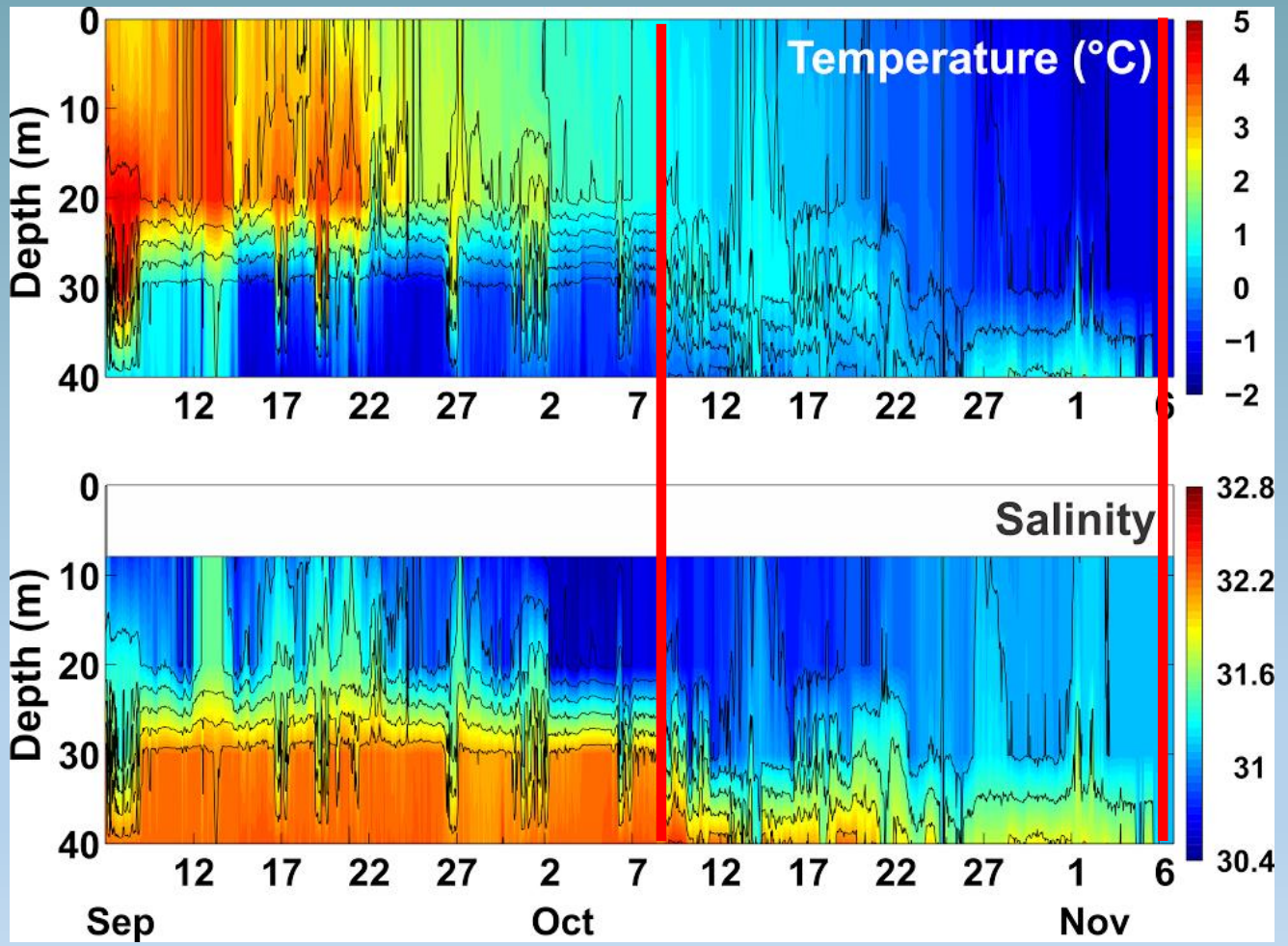
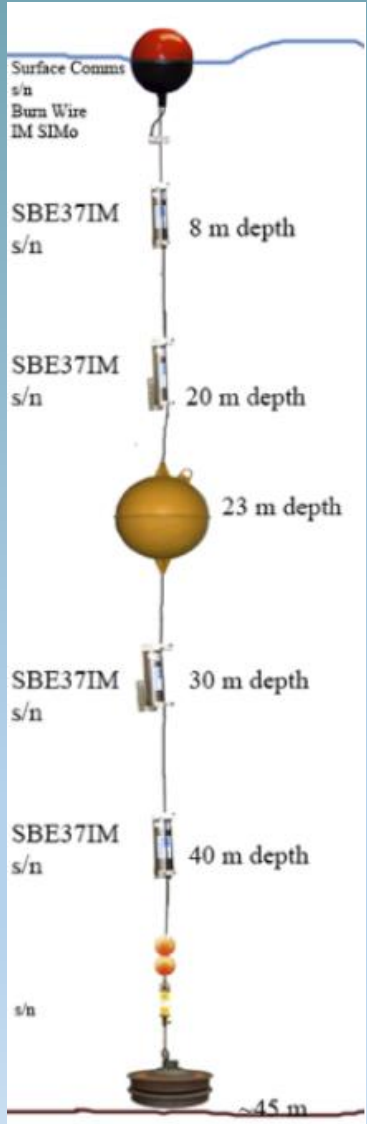
- Most real-time data buoys only operate in ice-free regions
- New wave buoy for Port of Nome
- Shore-based weather stations: not necessarily what is happening on water
- Need shore-side logistical support



Real-Time Ice Freeze-up Detection Buoy Trials

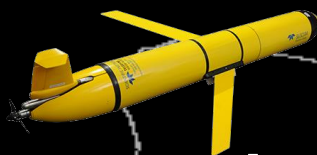
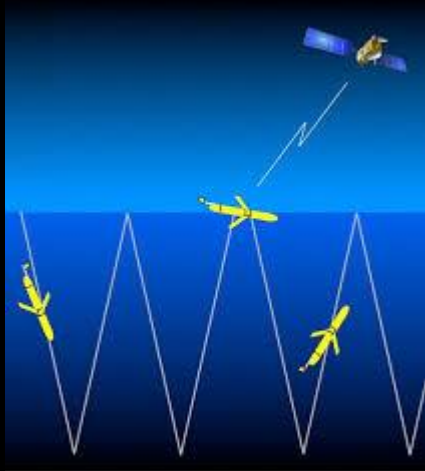
Typically, would think this overturning was Freeze-up

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



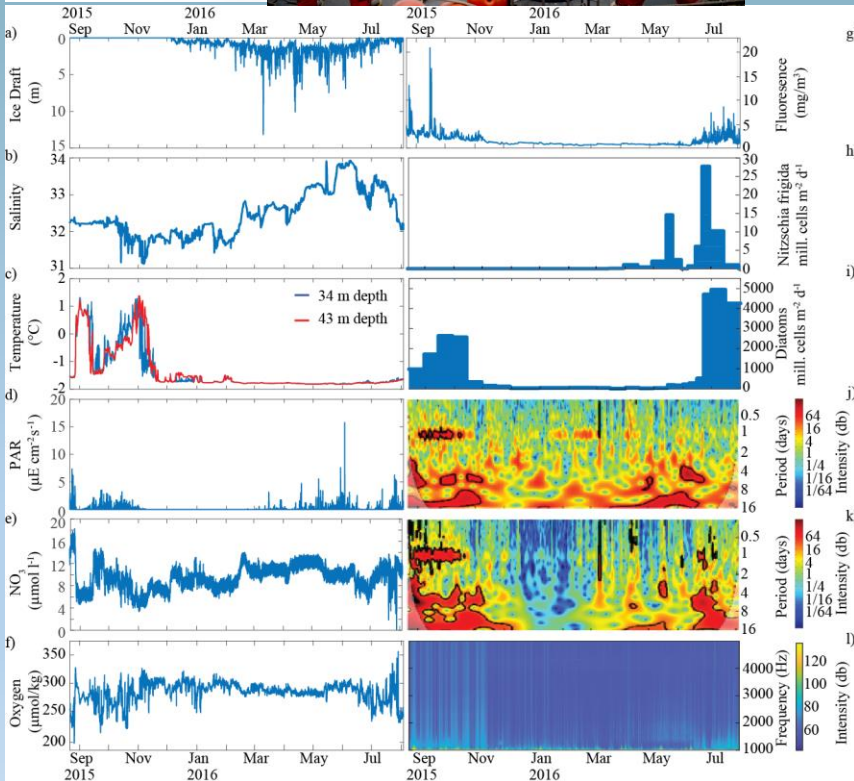
Gliding Through the Bering and Chukchi Seas

Annual Ocean Conditions
Marine Mammal Tracking
Remote Arctic Missions
Since 2013



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

Ecosystem Observatories



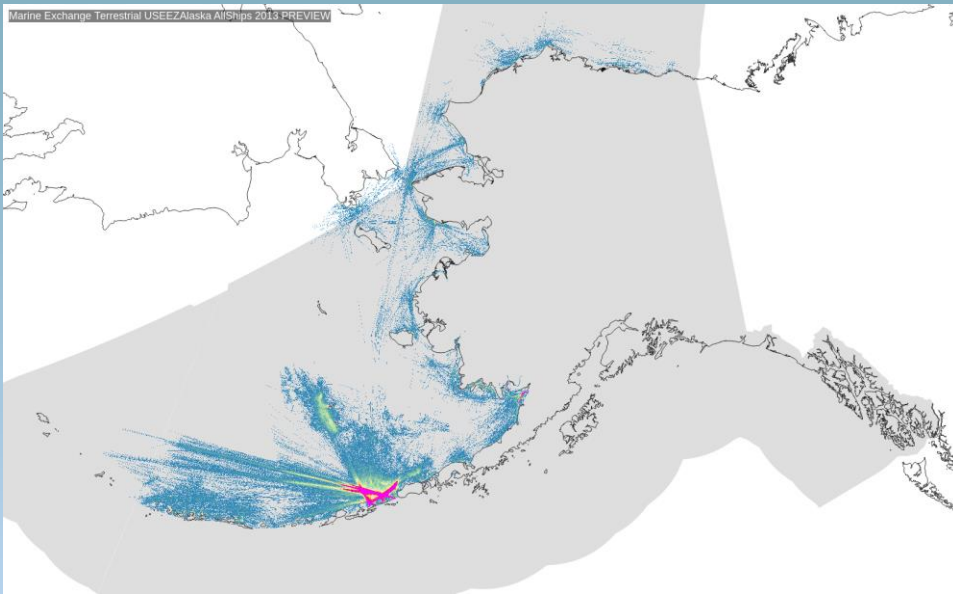
- Statewide plan: 1 in each of 4 LMEs (Chukchi, Beaufort, Bering & Gulf of Alaska): Chukchi since 2014, GOA will be deployed in 2019, Bering Sea follows
- Provide year-round coverage – even during ice covered months
- Anchor for ship transect lines (DBO, Seward Line)
- Cutting edge sensor technologies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

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

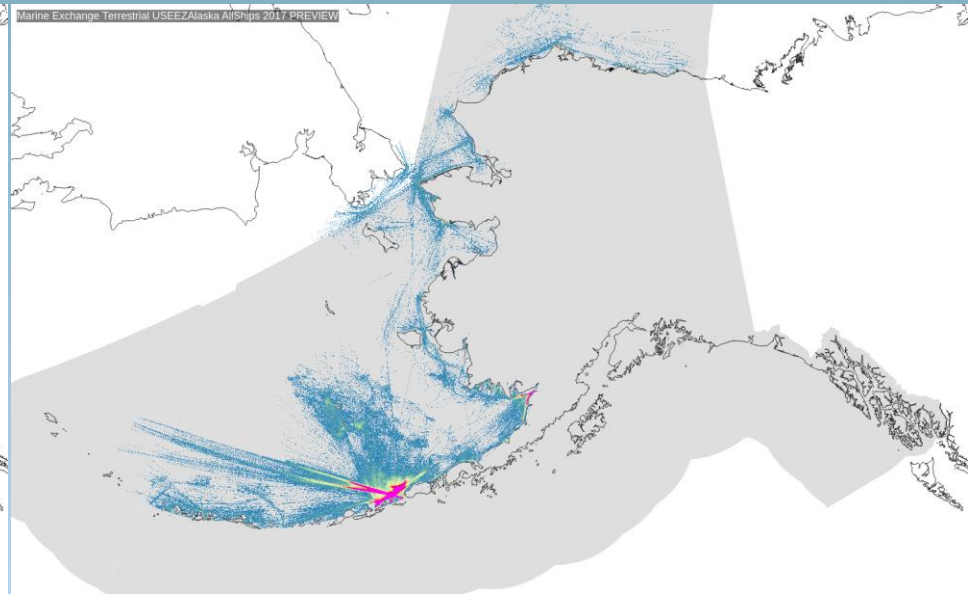
AIS with Weather Stations



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.

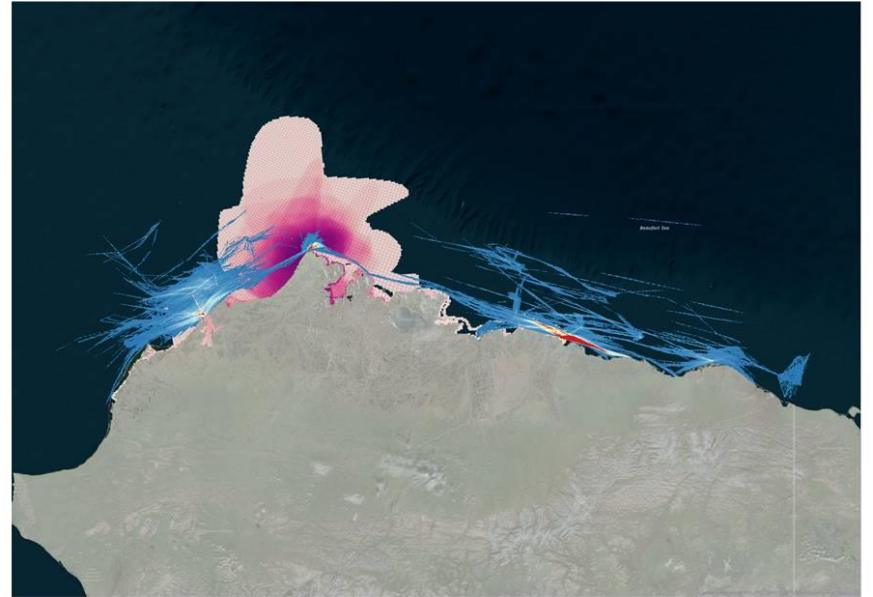
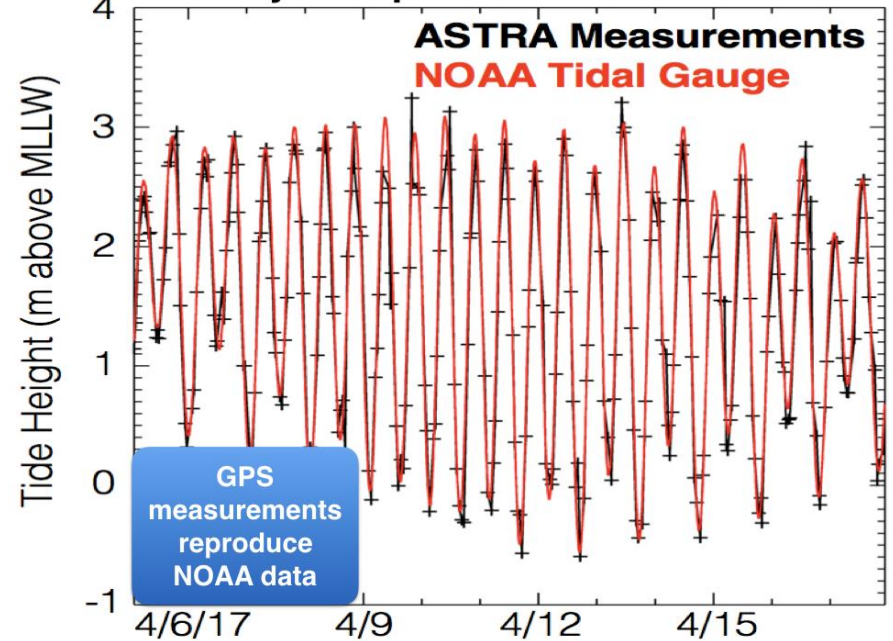


Figure 3. Example image of harvester intensity index for the community of Utqiagvik (formerly Barrow) relative to marine traffic.

Land-Based, GPS Reflectometry for Measuring Water Level



Preliminary Comparison with NOAA Data



Private Sector Partners:

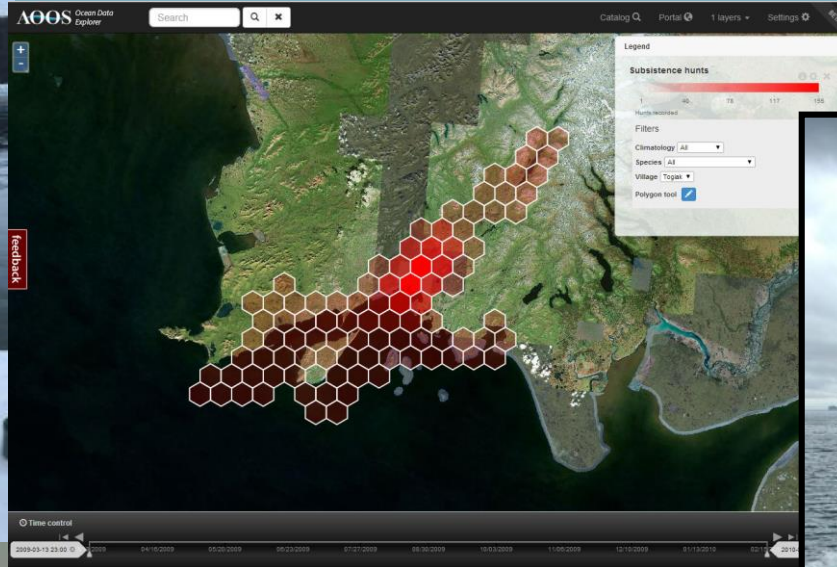
UNAVCO - NSF funded Plate Boundary Observatory

ASTRA, LLC

Indigenous knowledge

Community based monitoring

Citizen science



AOOS Data Assembly Center & Ocean Data Explorer

Ocean Data Explorer

AOOS DATA PORTAL

The Eye on Alaska's Coasts and Oceans

EXPLORE REAL TIME DATA SEARCH 2300+ DATASETS

Ocean Data Explorer

This portal contains scientific and management information including real-time sensor feeds, operational oceanographic and atmospheric models, satellite observations and GIS data sets that describe the biological, chemical and physical characteristics of Alaska and its surrounding waters. This map offers many new updated features that build upon the existing data system, including:

- Data comparison and charting functions
- Featured data views
- Advanced charting features, including climatologies and anomalies
- Station and source level metadata pages
- Shareable custom data views

Please use the "Feedback" tab in the upper right corner to help improve our services.

Explore map Catalog

Jump to a region: Arctic | Bering Sea | Gulf of Alaska

Release notes Documentation

For best results, use the latest version of these browsers: Chrome Firefox

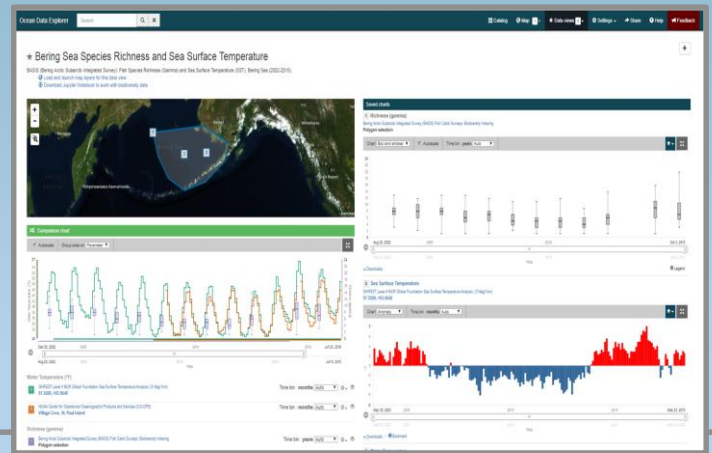
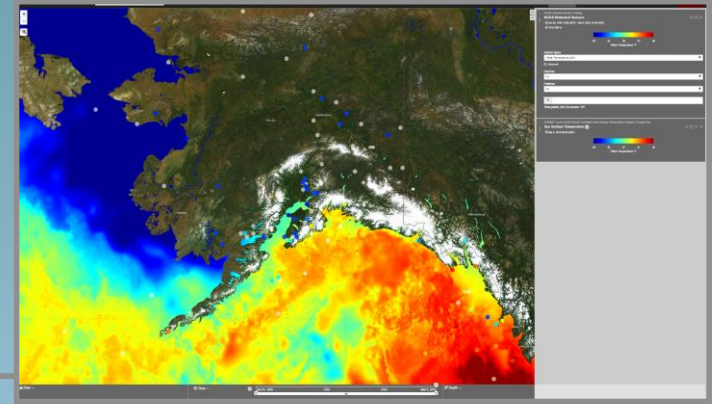
Data Views

Explore highlighted views below. Or, create, save, and share your own custom views.

REAL-TIME DATA AND VIEWS

HISTORICAL DATA COMPARISONS

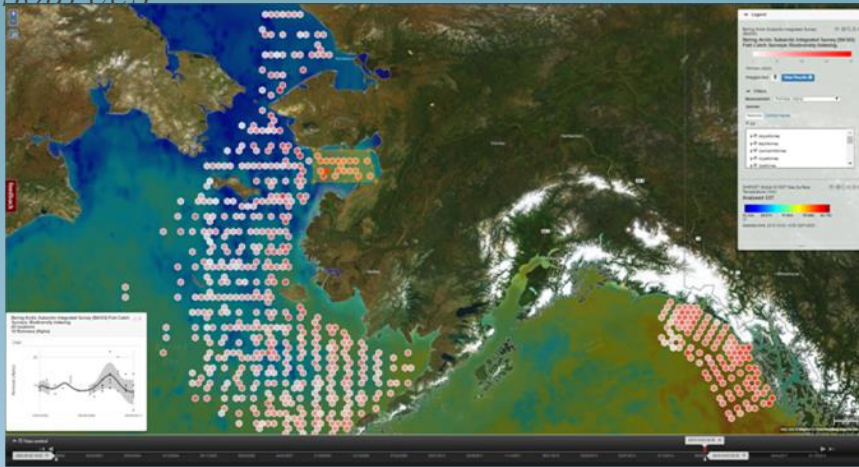
- Phoxo Stream Sound
- Kachemak Bay
- Northwest Gulf of Alaska
- Western and Northern Alaska WAFR VIEWS
- The Bios
- Bering Sea Fish Biodiversity



Portal Components

Map

Integrate & visualize data from many sources

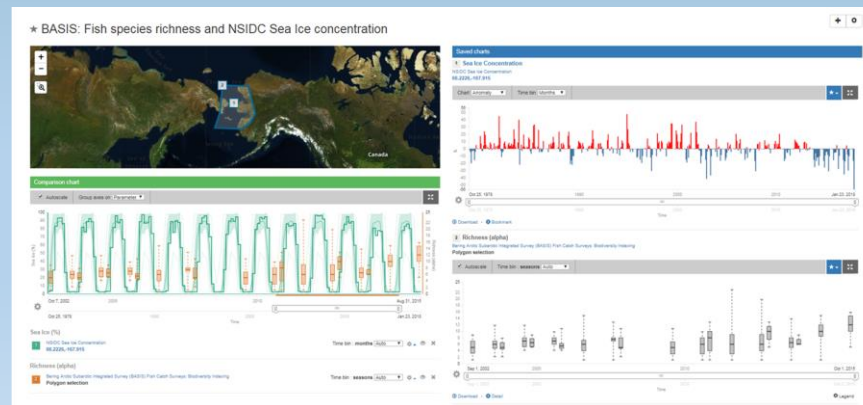


Catalog

Search, metadata, & data download

Data Views

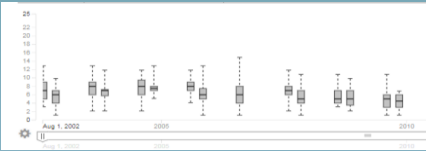
Rapidly assimilate & compare different data streams



Multiple Data Types

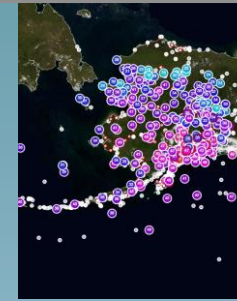
Biodiversity

count, richness, diversity indices



Platforms

moorings, shore stations



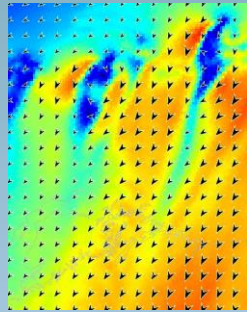
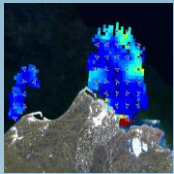
Products

skill assessment, shoreline change, etc.



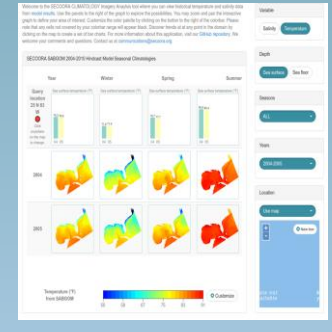
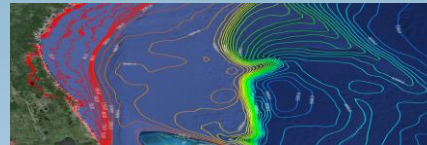
Grids

models, satellite, radar



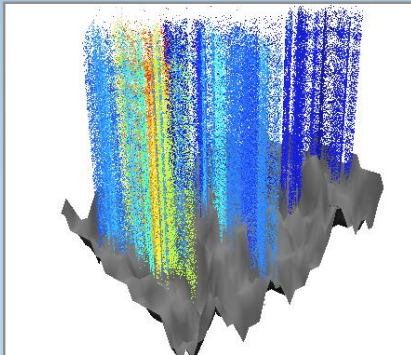
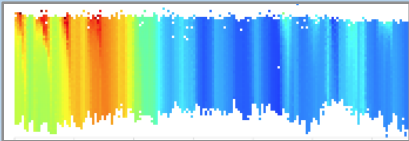
GIS

Habitat types, bathymetry, fishing zones, etc.

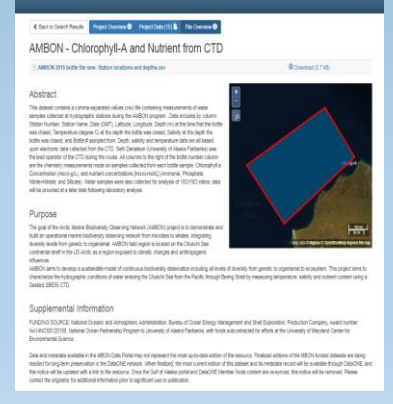
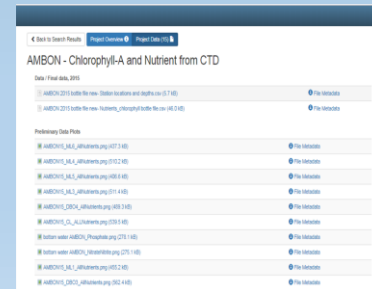


Mobile sensors

gliders, animal telemetry

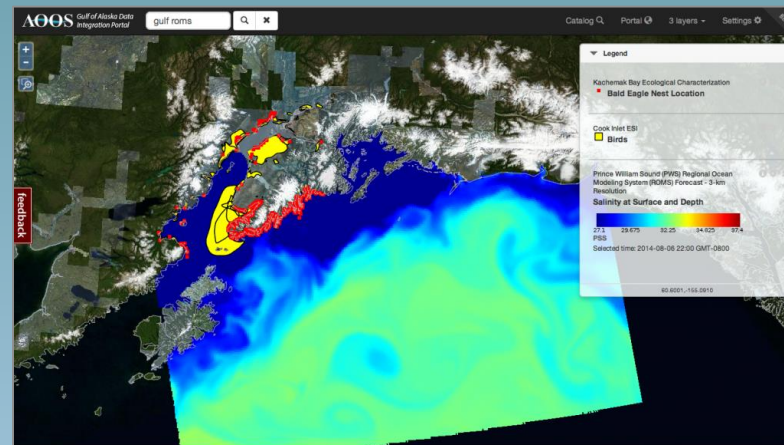
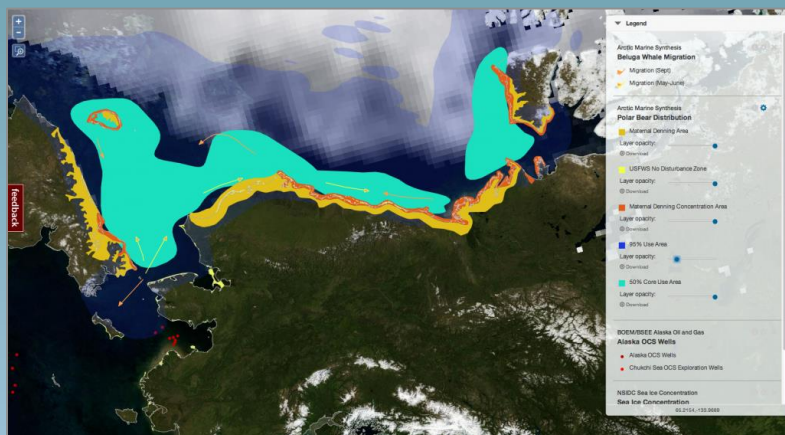


RESEARCH WORKSPACE

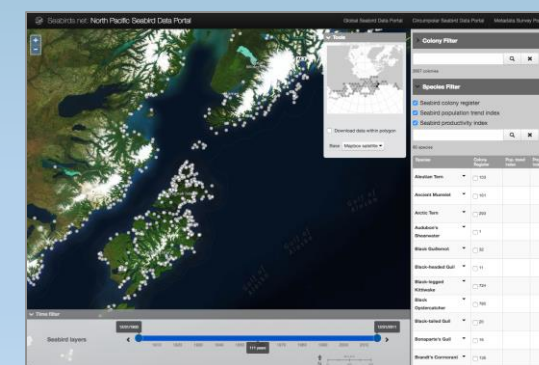
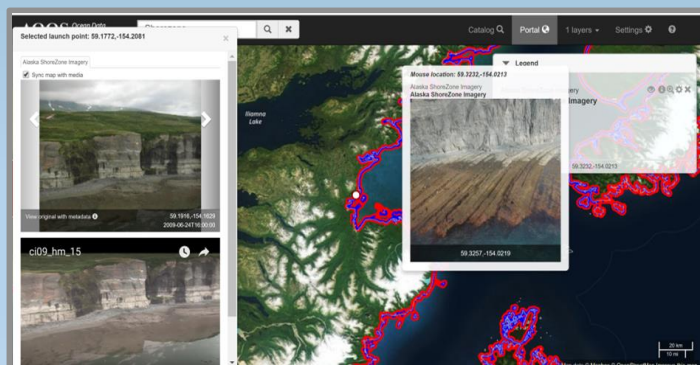


RAPID DEPLOYMENT OF FOCUSED TOOLS

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

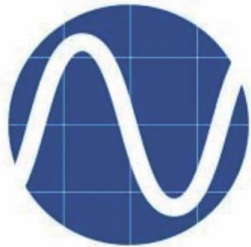
Short-term

- The “Blob”: blog & AK working group
- Bering Strait Response

Networking activities

- Local, regional, national and international

Alaska Water Level Watch



Alaska Water Level Watch

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](#)

AOOS
Alaska Ocean Observing System



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



Alaska Ocean Acidification Network

About the Network About OA Monitoring Biological Impacts Data Resources & Links Find an Expert



Alaska Ocean Acidification Network



Starting in October, Alaska ferry will measure ocean acidification along 1,000 miles of coastline

Ketchikan's KRBD radio shares the story of a project 3 years in the making.

1 2 3 4 5 6 7 8 9 10

[Alaska Ocean Acidification Network News Features archive](#)

Scientist Interview

Allison Bidlack is the director of the Alaska Coastal Rainforest Center at the University of Alaska Southeast in Juneau. Through her focus on temperate rainforests and carbon cycle dynamics, she has been one of the leading proponents behind using the Alaska State Ferry system to collect OA data.



How did you get into the field of ocean acidification, and what drew you to this type of work?

I actually kind of stumbled into it in the course of my current job. My background is in

News feed

- September 26, 2017 [Alaska writer Nancy Lord publishes new novel on ocean acidification](#)
- September 14, 2017 [Southeast residents learn about OA at Petersburg festival](#)
- September 1, 2017 [R/V Healy now collecting data in the Arctic](#)

Video



Watch the trailer for Nancy Lord's recent book "pH: A Novel"

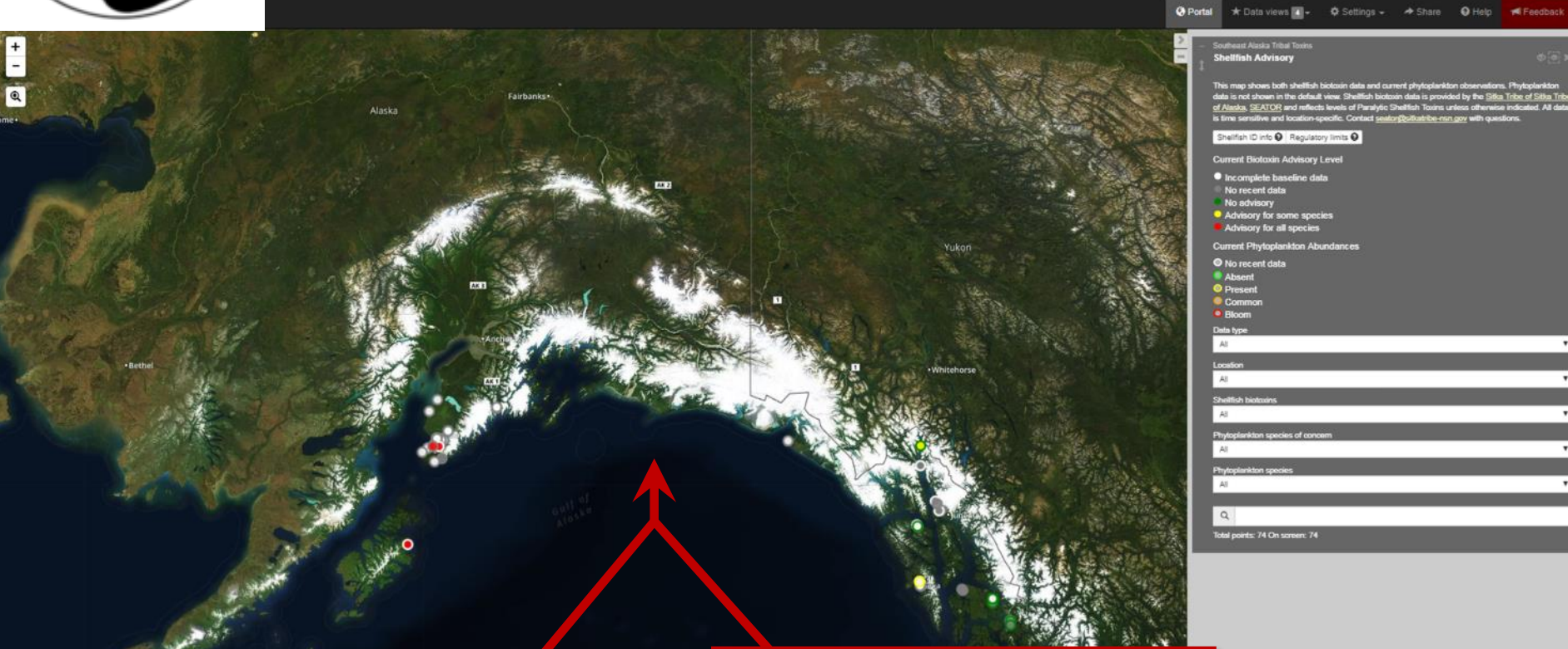
Upcoming events

- Oct 3: First sailing of the state ferry M/V Columbia equipped with OA sensor package (2x/wk between Bellingham, WA to Skagway, AK)
- Oct 4: OA talk at UAA Campus Bookstore (Anchorage)
- Nov 2-3: Subsistence Advisory Council (Juneau) – OA presentation

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



Harmful Algal Bloom Network, Data Portal & Tools



Portal | Data views | Settings | Share | Help | Feedback

Southeast Alaska Tribal Toxins Shellfish Advisory

This map shows both shellfish biotoxin data and current phytoplankton observations. Phytoplankton data is not shown in the default view. Shellfish biotoxin data is provided by the Sitka Tribe of Alaska, SEATOR and reflects levels of Paralytic Shellfish Toxins unless otherwise indicated. All data is time sensitive and location-specific. Contact seator@sitkatriben-nsn.gov with questions.

Shellfish info | Regulatory limits

Current Biotoxin Advisory Level

- Incomplete baseline data
- No recent data
- No advisory
- Advisory for some species
- Advisory for all species

Current Phytoplankton Abundances

- No recent data
- Absent
- Present
- Common
- Bloom

Data type: All

Location: All

Shellfish biotoxins: All

Phytoplankton species of concern: All

Phytoplankton species: All

Total points: 74 On screen: 74

SEATOR
SITKA TRIBE OF ALASKA

Home | New | Basic Info | STAERL | Data | Ocean Acidification | Clean Water | Links List

Shellfish Advisories

Welcome to the new SEATOR shellfish advisory page! This page is updated as soon as we have new shellfish information. Our advisories are based on shellfish and phytoplankton observations at each listed location. We follow the FDA regulatory levels of 80 µg toxin/100 g shellfish tissue for paralytic shellfish toxins and 30 µg/m for domoic acid. We do not recommend consuming shellfish with higher levels of toxins. **A few notes of caution when using this tool:** 1) This does not "verify" any of our monitored sites. Shellfish harvesting will always be at your own risk. 2) Data is site specific and time sensitive. Please pay attention to locations and the date of the last sample. 3) Some shellfish species will remain toxic long after an algal bloom is over! Know your shellfish species and pay attention to species-specific advisories. 4) Conditions may change rapidly, especially in the summer. Check frequently and contact us with questions at seator@sitkatriben-nsn.gov.

For expanded information, click on the arrows to the left of each region. These advisories will soon be available in map form. Thank you for your patience as we update this site.

Advanced Search and Information Data Entry

ID#	Program	Name	Use
0001	Shellfish	Shellfish	
0002	Algal Bloom	Algal Bloom	
0003	Algal Bloom	Algal Bloom	
0004	Algal Bloom	Algal Bloom	
0005	Algal Bloom	Algal Bloom	
0006	Algal Bloom	Algal Bloom	
0007	Algal Bloom	Algal Bloom	
0008	Algal Bloom	Algal Bloom	
0009	Algal Bloom	Algal Bloom	
0010	Algal Bloom	Algal Bloom	
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0013	Algal Bloom	Algal Bloom	
0014	Algal Bloom	Algal Bloom	
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0016	Algal Bloom	Algal Bloom	
0017	Algal Bloom	Algal Bloom	
0018	Algal Bloom	Algal Bloom	
0019	Algal Bloom	Algal Bloom	
0020	Algal Bloom	Algal Bloom	

Map of Alaska showing monitoring locations.

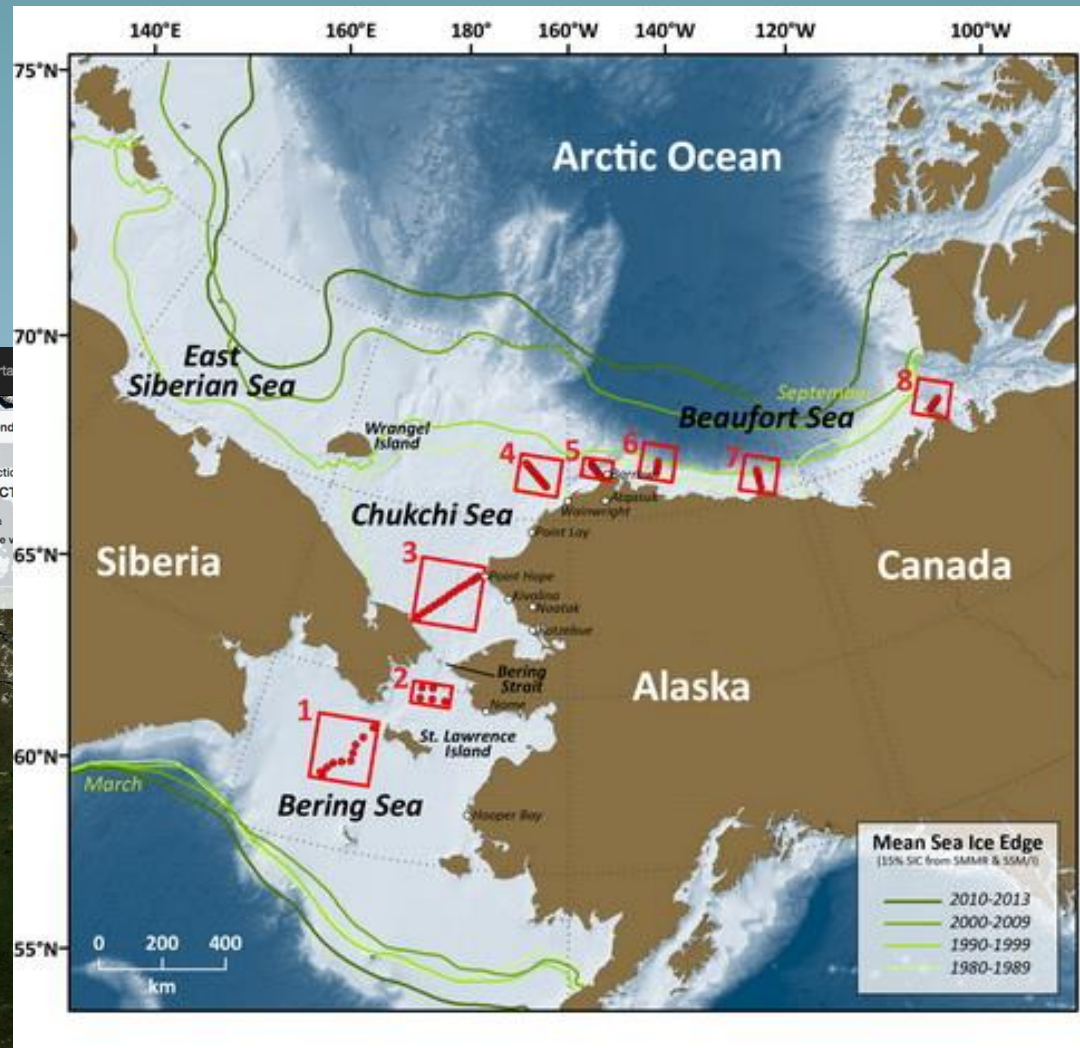
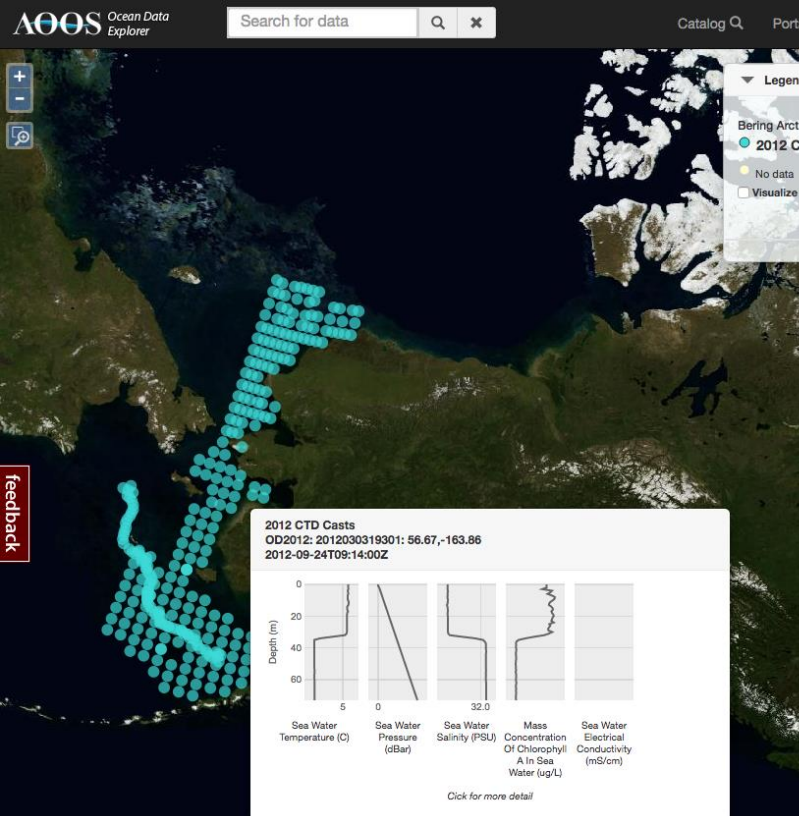
National & International Collaborations



Distributed Biological Observatory
Linking Physics & Biology



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

Molly McCammon

www.aoos.org

