AOOS
Alaska Ocean Observing System

The Eye on Alaska's Coast's and Oceans

BERING REGION
Ocean Data Sharing Initiative

IOOS
Integrated Ocean Observing System

U.S. INTEGRATED OCEAN OBSERVING SYSTEM
CERTIFIED
REGIONAL ASSOCIATION

Photo courtesy of Kathy Kuletz

My Background

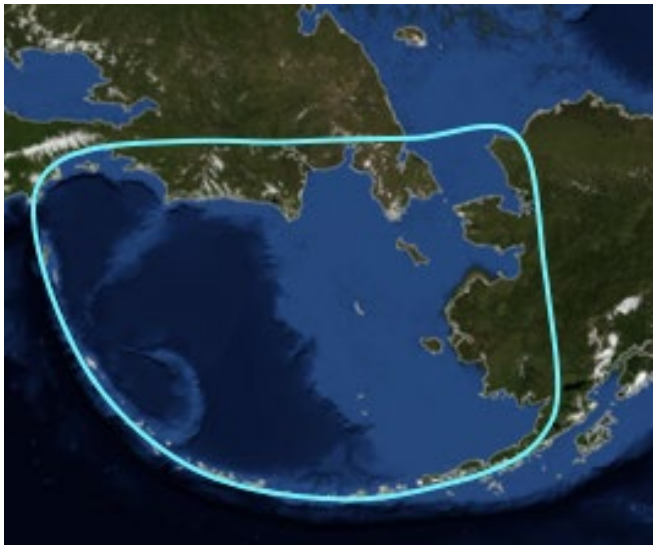
- M.Sc. From University of Alaska Anchorage
  - Harbor seal physiology
- Alaska SeaLife Center (2007-2013)
  - Marine mammal research
- North Atlantic Marine Mammal Commission (2013-2018)
  - Marine mammal management – Norway/Iceland/Greenland/Faroe Islands
- NOAA Alaska Region – PRD (2018-2020)
  - ESA analysis (mainly marine mammals)
- **AOOS (started April 2020)**
  - **marine mammals and so much more!**

AOOS
Alaska Ocean Observing System

Bering Ocean Data Sharing Initiative (BODSI)

- Funded by Executive Order "to enhance capacity for sharing and integration of Federal and non-Federal data in support of regional coastal, ocean, and Great Lakes management priorities"

- AOOS focus: on Bering Sea and Strait and adjacent regions for at least next 2 years



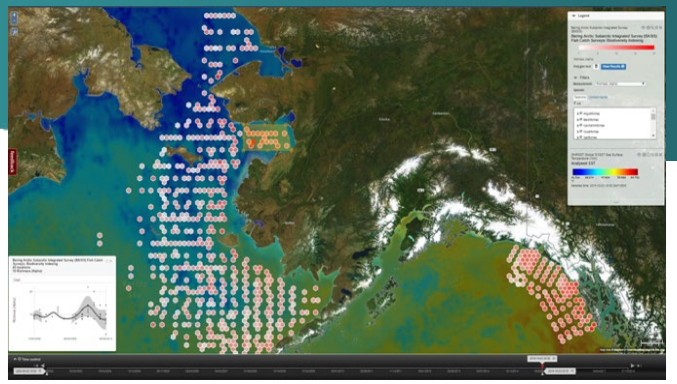
BERING REGION
Ocean Data
Sharing Initiative

A collaborative program of the Alaska Ocean Observing System

BODSI Goals

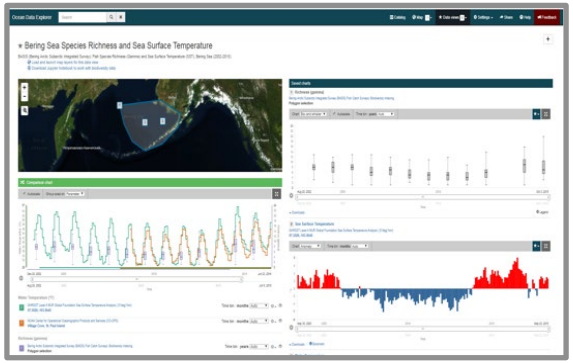
- Increase regional data sharing among federal, state, tribal, community and private sector partners
- Provide information that stakeholders need to respond to rapid ecosystem change in the Bering Sea region
- Support agency management & community decision-making and enhance economic opportunities

What has been done so far?



- Workshops at AMSS & AFE (Jan & Feb)
  - With NPRB, USARC & NOAA

- Ensure that existing data is findable and useable
  - **In Progress: Data Portal – Axiom**
  - **Planned - new tools for users based based on their feedback**



- Spring Bering Region Ocean Update report
  - **In preparation (with ACCAP), to be printed late May**

- Work with communities, tribes, agencies and stakeholders to identify what information and data products are needed to help with decision-making
  - **Stakeholder one-on-one meetings (& pre-meeting questions)**

- Facilitate greater researcher coordination
  - **IARPC Environmental Intelligence Collaboration Team call(s)**
  - **2020 Research Vessel Status**

Spring Bering Region Ocean Update report

In preparation (with ACCAP), to be printed late May

BERING SCIENCE

Spring 2020 Bering region ocean update—learn what's changing

Learn more at www.beringregionoceandata.org

A scientist stands on top of a blind used to study eiders. The blind overlooks the Tutakoke River which had flooded during a very rare spring storm tide.

NAVIGATION

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WHAT IS THIS? sharing science

The Bering region is changing at a rate never before seen. Loss of sea ice and record high ocean and air temperatures impact wildlife and all aspects of life for coastal communities. 2019 saw many notable events such as unusual mortality of ice seals, whales and sea birds, and the movement of new, more southern species, into northern waters. We created this publication to share what scientists are learning about these changes. It focuses primarily on what we saw in 2019, a bit about what we expect to see in 2020 and more than we would like about what we don't know.

This is our first effort, we appreciate questions from readers, suggestions for changes to future reports, and thoughts about other information you would like to receive. We also hope to provide periodic updates throughout the year.

WHO ARE WE? scientists

We are Bering Sea scientists, mostly federal, state and university. This report is facilitated by a partnership between the Alaska Ocean Observing System (AOOS) and the University of Alaska Fairbanks, International Arctic Research Center (IARC) with funding given to AOOS from a national initiative to increase sharing of ocean data. Our team worked with scientists from across the region to compile current updates of Bering Sea science. In the following pages you'll find information on climate and weather, seabirds, marine mammals, fish, ocean acidification, algal blooms and more.

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SUMMER TEMPERATURE records

OCEAN TEMPERATURES warmer than usual

Ocean surface temperatures were very warm in the Bering and southern Chukchi seas during summer 2019. Except for a small area in the Bering Strait, the May–October sea surface temperatures were more than 5°F above the 1971–2000 average. In some areas, these were the warmest average ocean surface temperatures on record. No Alaska waters were colder than normal.

Sea ice vanished from Alaska waters very early during the summer. By August there was no sea ice within 100 miles of the entire Alaska coast. Sea ice did not start forming until early October.

Top: 2019's warm (red color) ocean surface temperatures compared to the 1971–2000 average. **Bottom:** Water temperatures at the ocean floor in summer 2019 (right) compared to 2010 (left) when the cool pool was intact.

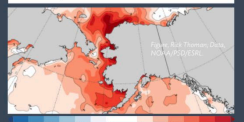
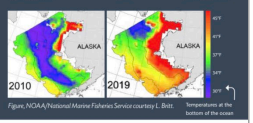


Figure: Rick Thoman, Data: NOAA/PSD/ERL

COLD POOL smaller

The Bering Sea "cold pool" is a large mass of frigid water that forms near the ocean floor in areas with sea ice. Water temperatures in the cold pool are usually less than 36°F.

The cold pool is an important feature of the Bering Sea. It acts as a barrier between southern species, like pollock and Pacific herring, and Arctic waters where northern species flourish. In 2019, the cold pool was the second smallest ever recorded. Only 2018 was smaller. For the first time ever, the temperature at the seafloor in the southern Bering Sea was over 46°F.

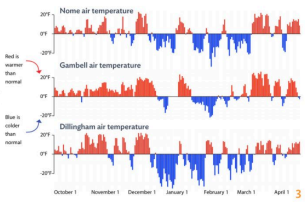


Figure, NOAA/National Marine Fisheries Service courtesy L. Britt. Temperatures at the bottom of the ocean

AIR TEMPERATURES

Fall 2019 was very mild, and in most parts of the state it was warmer than usual. The graphs show examples of winter air temperatures in Bering Sea communities. At times, November and December temperatures were 20°F warmer than normal.

All of Alaska became colder by mid-December. Late January to early March was the coldest period. While cold compared to recent years, no records were set. Conditions since mid-March were generally milder throughout the Bering region.



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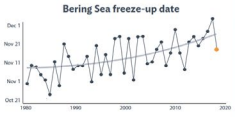
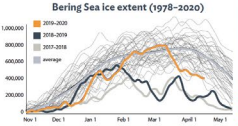
WINTER SEA ICE

FALL FREEZE-UP

Sea ice in the Bering and southern Chukchi Seas developed slower than normal during fall 2019. Even so, freeze-up was not as late as recent years. As is common, ice formed first in protected areas with larger river outlets. Rivers keep near-shore water brackish, which freezes more quickly than saltier sea water.

Some sea ice formed in Kotzebue Sound and Norton Bay by November 1. Nome even had ship traffic until the end of November. Ice grew slowly until mid-December. The ice extent remained far below average.





WINTER ICE high quality

Thanks to the cold weather after New Year's Day, sea ice became thicker and of much higher quality compared to recent winters. Shorefast ice, which had been mostly absent in 2018 and 2019, formed in the usual areas such as Norton Bay, along the southern Norton Sound coast and Yukon Delta area.

SEA ICE TIMELINE, WINTER 2020

JANUARY 1
Weather changed in mid-December. Bering Sea ice grew out from the coast, reaching the north shore of St. Lawrence Island just before New Year's Eve. Storms in mid-January broke up the new ice and it shrunk by 20% before growing again.

FEBRUARY 1
For about five weeks, starting in early February, ice extent was above the long term average.

MARCH 1
The ice pack in early March briefly reached as far southwest as St. Paul Island, before pulling back. The sea ice extent dropped dramatically after a stormy period in mid-March with repeated episodes of south winds.

APRIL 1
Between early and late March the sea ice extent plummeted, faster than ever before in the 42 years of satellite data. Average ice extent the first half of April was lower than all other years, except for 2018 and 2019.

4 Page 3 & 4 information from: Rick Thoman, UAF International Arctic Research Center, Alaska Center for Climate Assessment & Policy rthoman@alaska.edu

OCEAN ACIDIFICATION

WHAT IS OA?

Cars, factories and other human activities release carbon dioxide into the atmosphere. The ocean absorbs about a quarter to a third of this carbon dioxide. In the ocean, the carbon dioxide reacts with seawater. The seawater becomes more acidic, which corrodes shells and skeletons of marine animals. This process is called ocean acidification (OA).

OA, CRABS & OTHER ANIMALS

When the acidity of ocean water changes it affects marine animals. More acidic water makes it difficult for some animals like clams and oysters to build and maintain their shells, which can make them vulnerable to predators.

OA also changes the blood chemistry of animals, causing stress.

NOAA laboratory studies on Alaska crabs show that OA reduces growth and increases mortality for many Alaska crab species. Such a response could reduce crab populations and lower the number of crab available for fisheries over the next few decades.

Photo by NOAA Fisheries

BERING SEA cold water & OA

The cold waters of the Bering Sea make it especially vulnerable to ocean acidification. Cold water naturally holds more carbon dioxide. So, it only takes a little extra carbon dioxide emitted by humans to make Alaska waters corrosive to shells and skeletons.

Where are the OA hotspots?

Ocean acidification varies seasonally and geographically. In the Bering and Chukchi seas, OA hotspots are often found in fall and wither in areas with slow tides or currents where carbon dioxide has time to build up at the bottom of the ocean. The Bering Sea is also often more acidic near the mouth of the Yukon River where freshwater mixes with seawater.

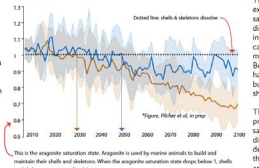
MONITORING OA

The Alaska Ocean Acidification Network is working to better understand OA and its consequences in Alaska. The network monitors OA in the Bering & Chukchi seas several ways:

- Ship-based surveys
- Sensors tethered to the ocean floor (called moorings)
- Ocean gliders that sample across large areas
- People in Nome and Kotzebue gather water samples

MODELING OA along the Bering Sea shelf

Scientists are modeling various aspects of OA to understand if Alaska waters were corrosive in the past and what conditions may be like in the future. The Bering Sea Shelf model to the right explores when seawater may permanently become corrosive to shelled animals. The model focuses on water at the bottom of the ocean, where crabs live.



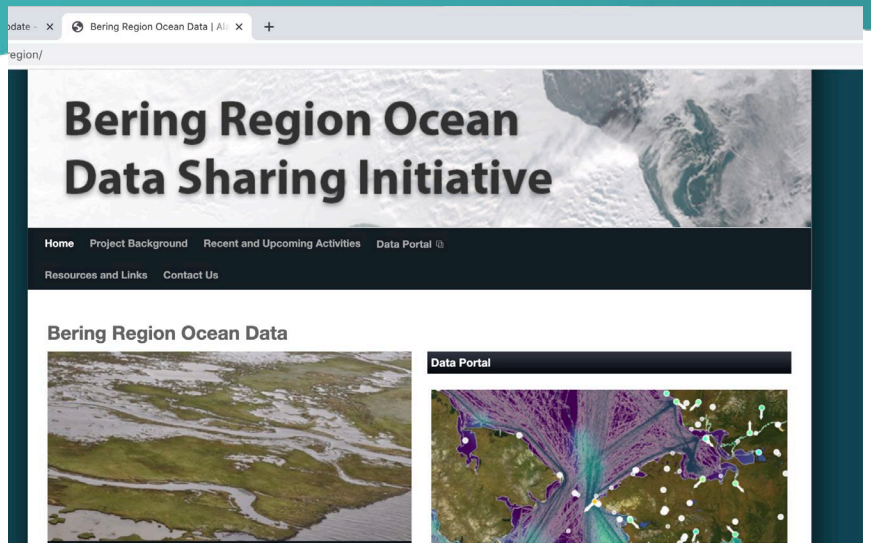
This is the aragonite saturation state. Aragonite is used by marine animals to build and maintain their shells and skeletons. When the aragonite saturation state drops below 1, shells and skeletons may start dissolving.

The brown line is the expected aragonite saturation state if carbon dioxide emissions continue increasing. In this "worst case scenario," the OA model suggests that the Bering Sea shelf may not have enough aragonite for building and maintaining shells by 2030.

The blue line is the predicted aragonite saturation state if carbon dioxide emissions slowly decline. In this scenario, there won't be enough aragonite by 2050.

Information from: Jessica Cross & W. Chris Long, NOAA Pacific Marine Environmental Lab; Darren Pilcher, University of Washington; Darcy Dugan, Alaska Ocean Observing System aoos.org/alaska-ocean-acidification-network 5

www.beringregionoceandata.org



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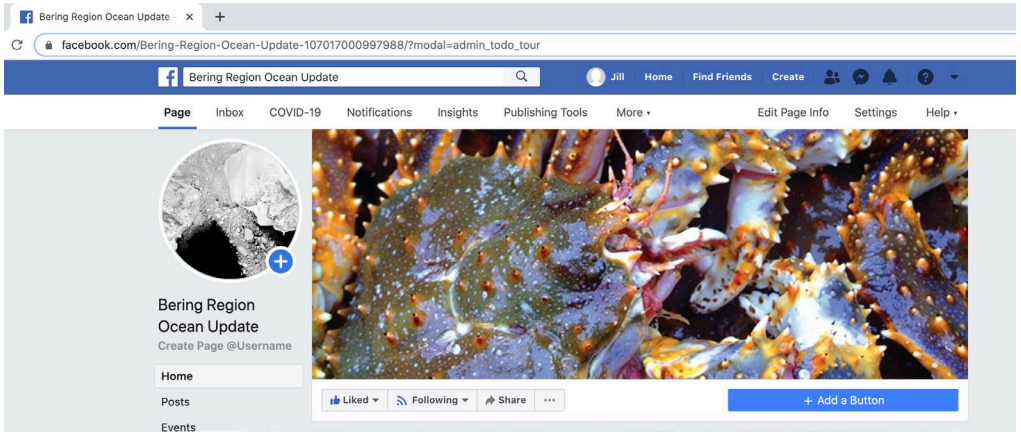

What's Next? Planned Products and Activities

- **Many possibilities – soliciting stakeholder feedback to help guide us**
  - **Stakeholder meetings in progress**
- Continue Bering Sea portal – plus new tools for users
- Outreach:
  - Website, Facebook, story maps, seascapes
  - Newsletters, handouts and posters for coastal community boxholders
- Continue IARPC EICT scientific collaboration – mid-summer & fall calls
- *Science workshops in hub communities in collaboration with tribes & communities*
- *Community road shows: share scientific results, hear community concerns and observations, and gather feedback on products*

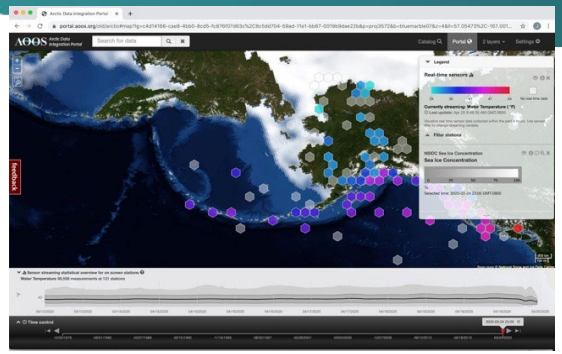

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Photo courtesy of Kathy Kuletz