Ikaaġvik Sikukun

Fall 2019 newsletter

Bridging scientific & Indigenous communities: Sea ice change in Kotzebue

Learn more!

To learn more about Ikaaġvik Sikukun visit us online at www.ikaagviksikukun.org or email questions/comments to ikaagvik_all_pis@lists.ldeo.columbia.edu.

Support

Ikaaġvik Sikukun thanks the Gordon and Betty Moore Foundation for funding and Selawik National Wildlife Refuge for logistical support.

Participants

NATIVE VILLAGE OF KOTZEBUE
KOTZEBUE IRA

UNIVERSITY OF ALASKA FAIRBANKS

Lamont-Doherty Earth Observatory
COLUMBIA UNIVERSITY | EARTH INSTITUTE

LATITUDE

Ikaaġvik Sikukun—Ice bridges

The frozen environment around Kotzebue Sound is changing. Ocean water is warming, sea ice is shrinking, and open water periods are increasing. These changes are impacting marine mammals and the Iñupiaq way of life.

Ikaaġvik Sikukun—Iñupiaq for ice bridges—is a research effort in Kotzebue, Alaska that connects the community with scientists to understand sea ice change in Kotzebue Sound. Under guidance from the Ikaaġvik Sikukun Elders Advisory Council, we use state-of-the-art observing techniques to understand sea ice, ocean physics, and marine mammals. This newsletter discusses how unmanned aerial vehicles—commonly known as drones—are being used to help answer the science questions posed by the Elders Advisory Council.


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Many parts to Ikaaġvik Sikukun

Ikaaġvik Sikukun uses a diverse research approach that includes Indigenous Elders, unmanned aerial vehicles (UAV), a documentary, and much more.

Local Indigenous Knowledge The Elders Advisory Council is involved from start to finish in all aspects of Ikaaġvik Sikukun research.

Unmanned aerial vehicles Ikaaġvik Sikukun uses long-range unmanned aerial vehicles to observe sea ice during spring melt.

On ice measurements Ikaaġvik Sikukun measures sea ice growth and melt over the winter and spring, and tracks snow depth.

Measuring seal habitat In spring, Ikaaġvik Sikukun surveys the sea ice and snow roughness and depth to learn about ringed seal habitat.

Filming the documentary Ikaaġvik Sikukun's filmmaker is creating a community-based documentary film about the project.

Ocean mooring Ikaaġvik Sikukun tethered a mooring (science instrument attached to a buoy) in the Sound to measure water temperature.

PROJECT TIME LINE

2017
- Project start, work w/ Elders to ID science questions

2018
- Spring, on-ice & UAV surveys
- Summer, install mooring

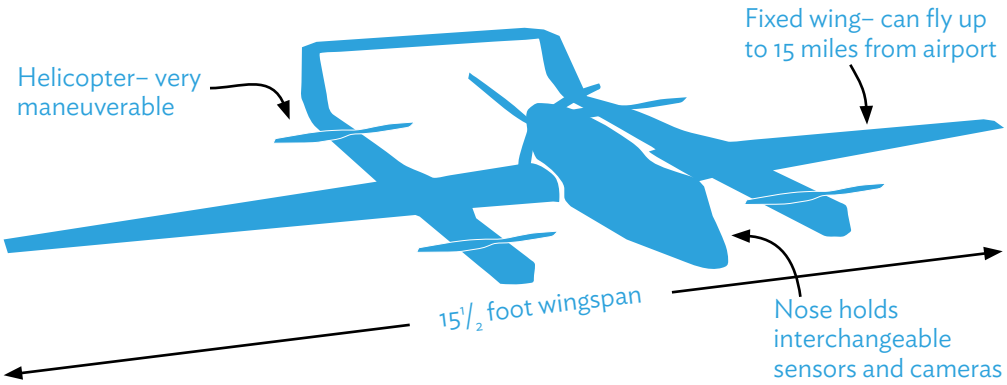
2019
- Meeting w/ Elders
- Spring, on-ice & UAV surveys
- Summer, recover mooring

2020
- Meeting w/ Elders
- Processing data
- Interpreting results w/ Elders

2021
- Project finish, documentary showing

UAVs ... not your average drone

Ikaaġvik Sikukun uses unmanned aerial vehicles to answer research questions about the melt season. Why use UAVs to study Kotzebue Sound? One of the main reasons is that they can fly during spring break-up when it is often unsafe to travel on the ice to directly collect data.



Research questions that UAVs can help answer

Ikaaġvik Sikukun scientists and the Elders Advisory Council spent a year identifying six research questions. UAVs help answer aspects of five of them.

Q1. What environmental factors control marine mammal use of Kotzebue Sound?

UAVs determine ice type and how ice melt changes during spring break-up.

Q2. What environmental factors control the length of the bearded seal hunting season in Kotzebue Sound?

UAVs determine physical processes (in addition to channel melt) that most strongly impact the timing and speed of break-up, and thus the hunting season.

Q3. What determines ice transport processes in Kotzebue Sound?

Once the landfast ice breaks up, UAVs help determine if the sea ice melts in place or its "flushed" out of the Sound by winds, tides, and currents.

Q4. What snow and ice surface properties promote ringed seal denning & pupping?

UAVs detect and identify where adult and pup seals are found in the Sound and the type of ice and snow they occupy.

Q5. What role does sea ice play in sediment transport/accumulation in the Sound?

UAVs monitor the effect of sea ice on channel and shoal formation in the Sound and how this might change as sea ice retreats.

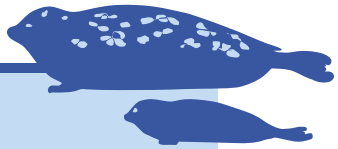
© Sarah Betcher
Farthest North Films

UAV cameras & sensors

Ikaaġvik Sikukun uses four main UAV science instruments, also referred to as payloads: VNIR and ATOM are cameras, MET and RAD are sensors. These cameras and sensors sit inside the nose of the UAV. Read below to see what these instruments do and how they work together to answer complex questions.

VNIR camera

Specialized camera that captures color variations of a surface, this reveals features in the ice like ridges, ponds, and open water.



ATOM camera

The ATOM is a thermal camera that shows heat given off by seals. A separate high resolution color camera helps identify hot spots as adult or pup seals and the ice features the seal was using.

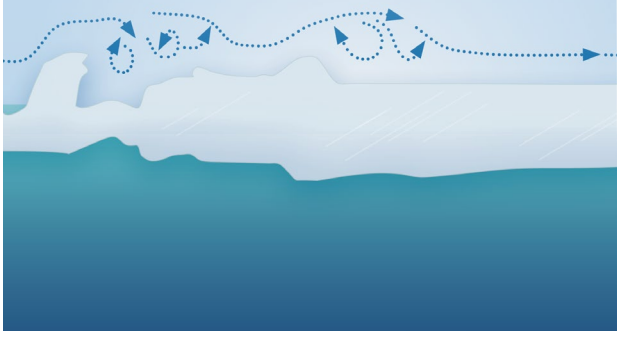
We often fly the MET & VNIR together to see what sea ice features are associated with which wind patterns.

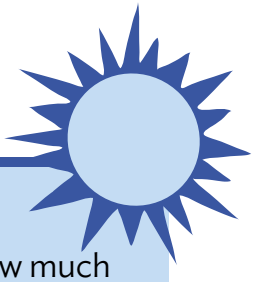
We often fly the RAD & VNIR together to see which sea ice features absorb the most heat from the sun.

MET sensors

The MET sensors measure wind properties like speed, direction, and turbulence.

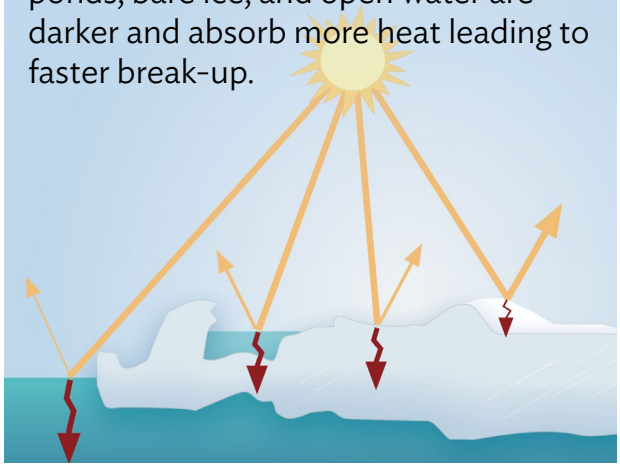
Wind swirls and has irregular patterns across rough ice, this motion can make the ice break-up faster.





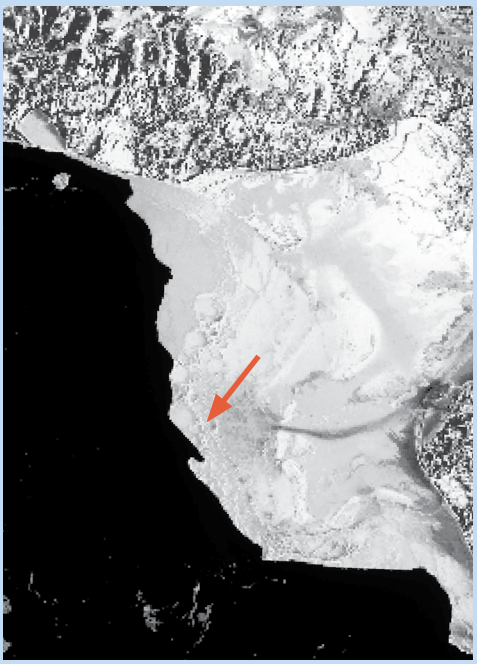
RAD sensors

The RAD sensors measure how much heat from the sun is absorbed by a surface. Snow covered ice absorbs little solar heat. Other features like melt ponds, bare ice, and open water are darker and absorb more heat leading to faster break-up.



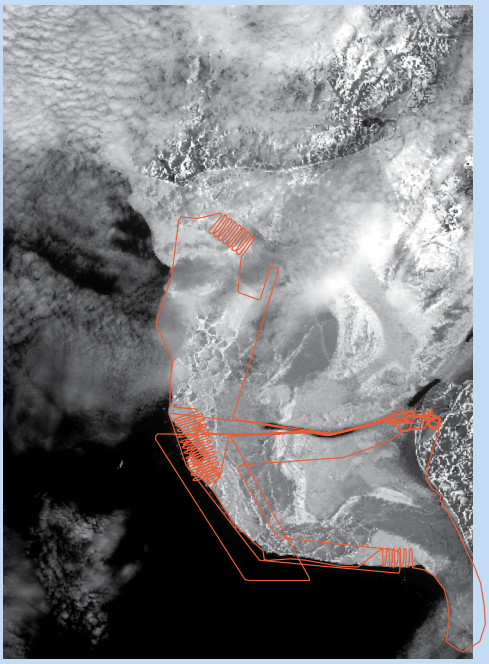
Focusing on break-up

What happens when the channel out of Kotzebue Sound opens up and ice begins breaking up? Ikaaġvik Sikukun intensively observed the Sound from April 1 to May 19, 2019 to find out. During this period, the team surveyed for seal habitat, gathered sea ice samples, and completed 22 UAV science flights.



May 6

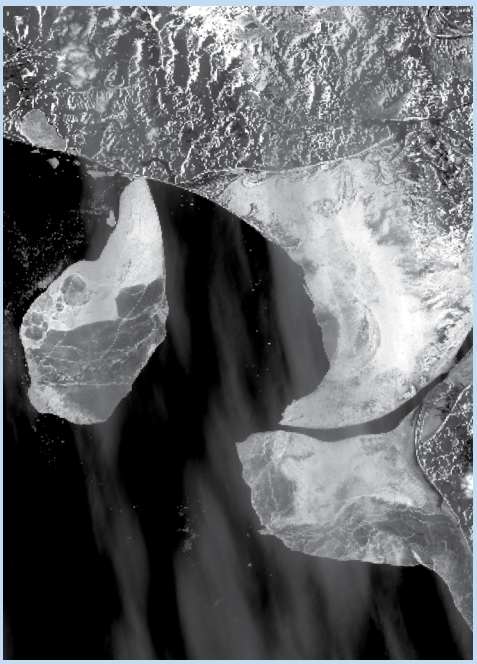
Pre break-up. The section of the ice edge nearest the river channel (orange arrow) was identified as an area to repeatedly survey throughout break-up to see how sea ice melt evolves.



May 9

Darker colored melt ponds identified with the VNIR camera showed that ice was disintegrating.

The UAVs targeted the channel as often as possible during surveys (orange lines show UAV survey routes).



May 14

A large section of ice broke off, likely related to a crack near the channel that was identified by the color camera (see page 7).

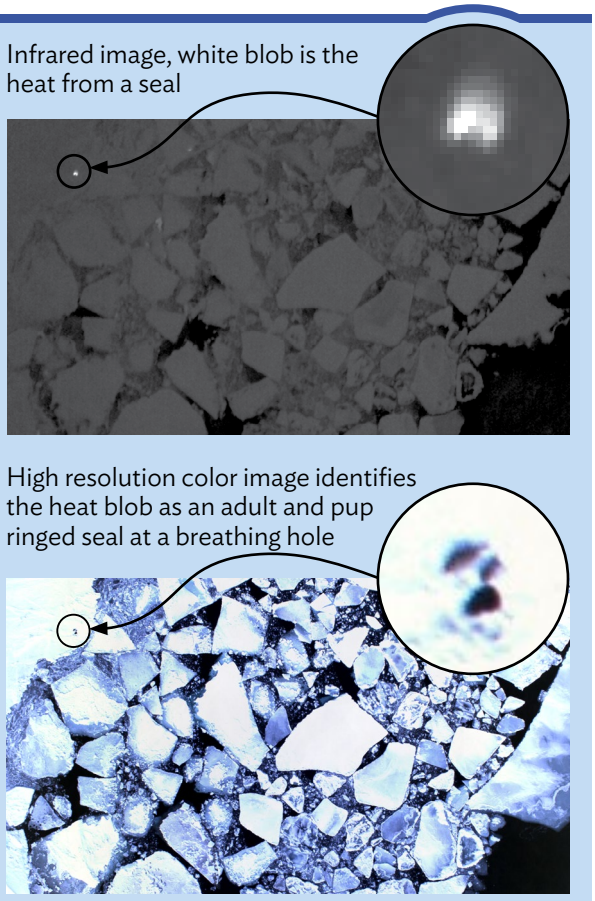
The Noatak, Kobuk, and Selawik Rivers flow into Kotzebue Sound. In spring they break up the sea ice, forming a channel that hunters use to access bearded seals. How the channel breaks up can help us understand ice melt in the Sound!

Finding seals with UAVs

Where are the seals in Kotzebue Sound? What type of ice and snow features do they prefer? To answer these questions, UAVs carried the ATOM infrared camera along with a high-resolution color camera.

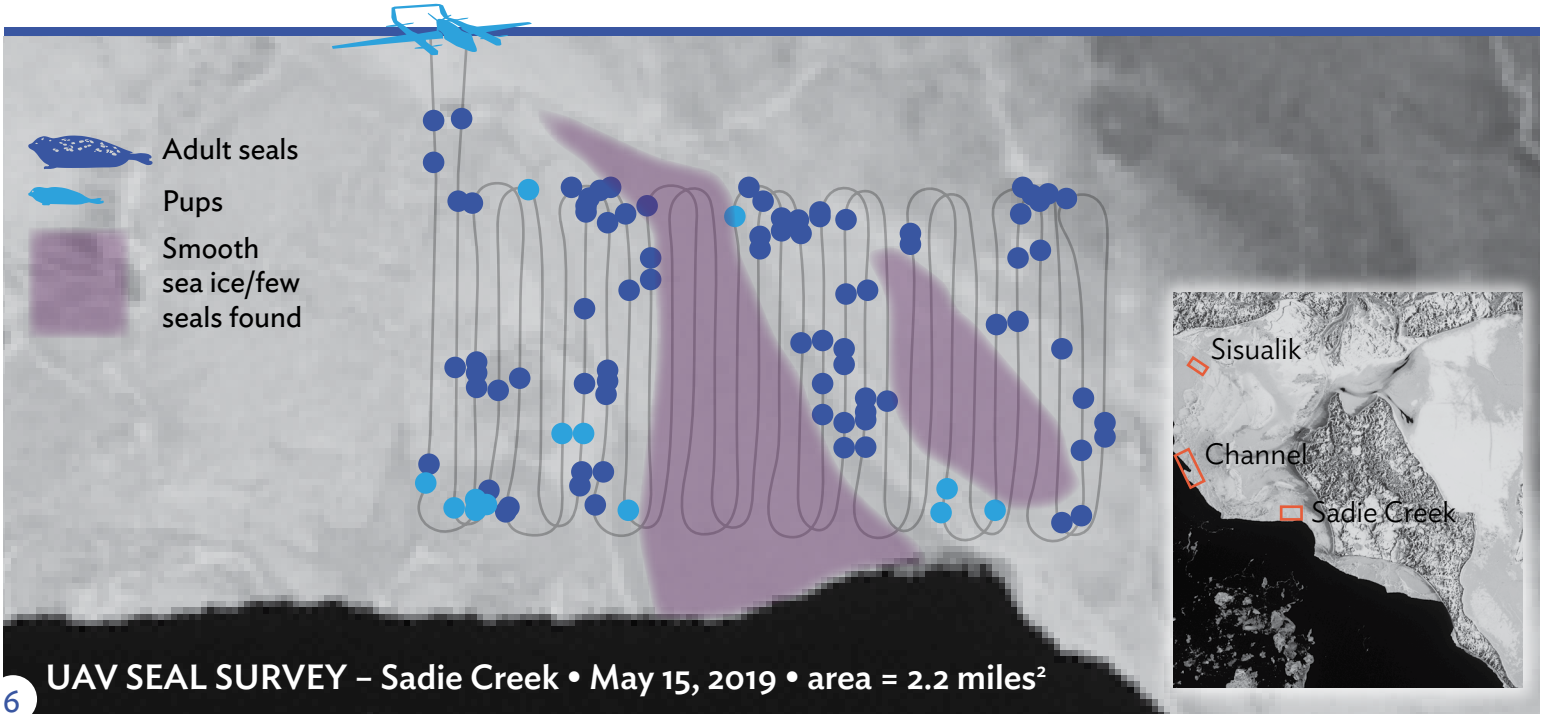
Being warm-blooded in a cold Arctic environment, seals give off heat which is seen by the infrared camera as a white "blob" against a dark background. Once a heat blob is found, scientists zoom in with the high-resolution color camera to determine the species of the seal and whether it is an adult or pup.

Jessie Lindsay
NMFS Permit No. 19309



How many seals?

UAVs carrying the ATOM camera found 953 adult ringed seals and 87 pups during the spring 2019 surveys! Most seals were on rougher ice and the seals seemed to avoid sections of smooth ice (highlighted in purple). Most of the seals in these preliminary counts were in three survey areas: Sisualik, the river channel, and Sadie Creek. The sites were chosen by the Elders Advisory Council and based on on-ice ringed seal searches. The UAV seal surveys were repeated up to three times during the intensive observing period.



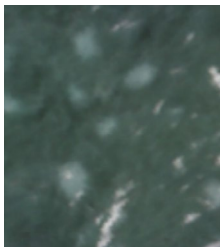
Ice & snow features

Ice color is important!

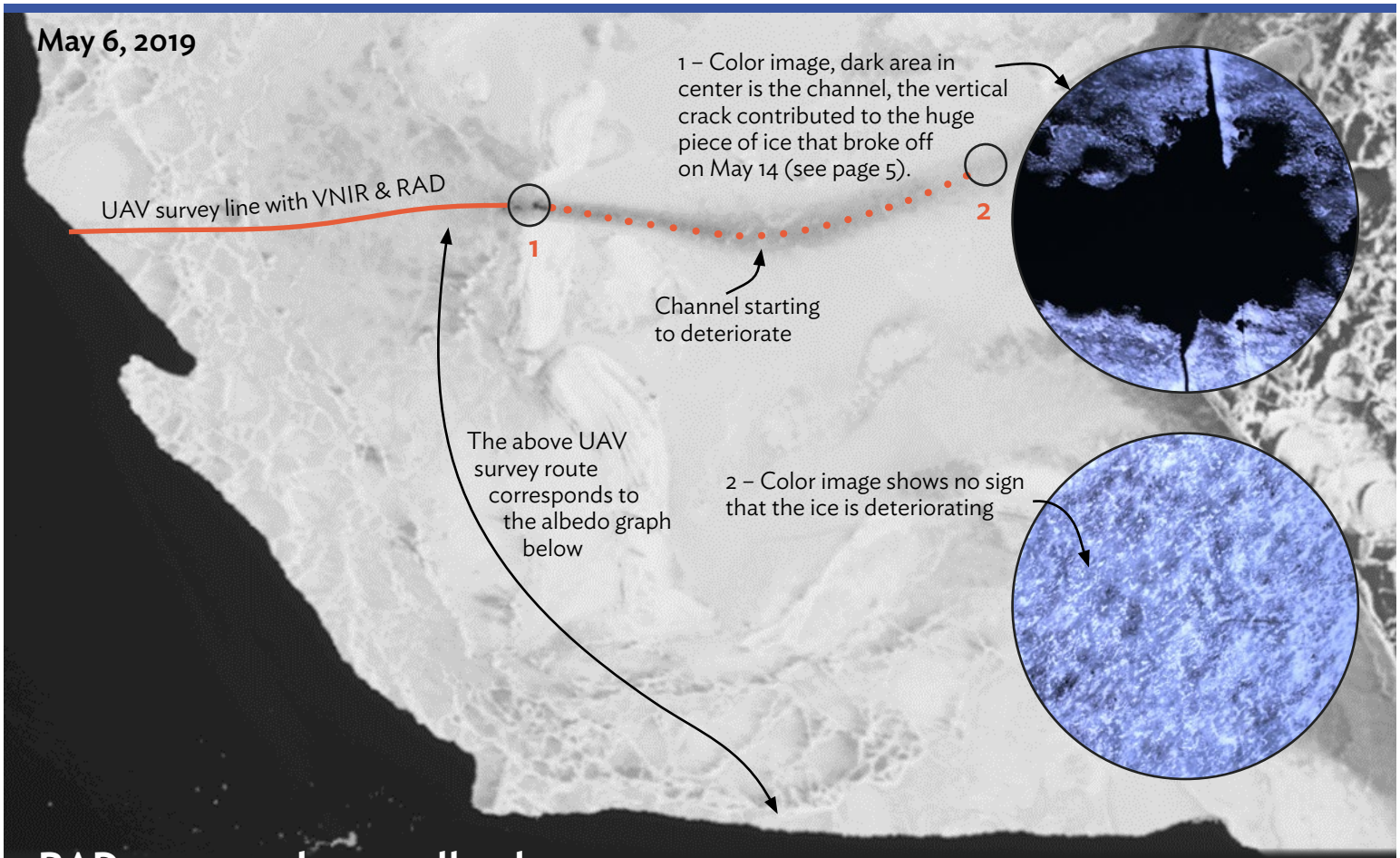
Ikaaġvik Sikukun's Elders Advisory Council says that the color of ice is important, for example, bearded seals prefer white ice. Bright white, snow covered ice is also often more stable and absorbs less heat than darker ice with melt ponds. The VNIR camera allows us to explore wavelengths of light that our eyes cannot see. It reveals colors and features in the ice, such as ponds, ridges or cracks, that would not be picked up using a regular camera.

Little melt, stable ice

Some melt, less stable



Near ice edge, lots of melting



RAD sensor shows albedo

Knowing which areas absorb the most heat from the sun can help us predict where break-up will happen first. This graph from the RAD sensor shows the 'whiteness,' known as albedo, of the above survey line.

Open water is the darkest, absorbs the most heat, and has the lowest albedo (left side of graph). On the ice, the albedo varies depending on where there are ponds, cracks or other dark features. The section on the image and graph labeled "1" has the lowest albedo of all the ice areas and is where the river channel is opening.

You may see us in Kotzebue

Our team is regularly in and out of Kotzebue gathering data, connecting with the advisory council, and interacting with the community. Here are a few folks you may see around town. Feel free to ask us questions!

Elders Advisory Council

Roswell Schaeffer Sr.
Kotzebue elder

Cyrus Harris
Sisualik elder

Bobby Schaeffer
Kotzebue elder

John Goodwin
Kotzebue elder

Our Elders Advisory Council grew up on the sea ice and waters of Kotzebue Sound hunting, fishing, learning from their Elders, and observing the environment and character of the Sound.

Researchers

Vince Schaeffer
Collects snow, ice and ocean data

Nathan Laxague
Studies air-sea-ice interactions

Carson Witte
Studies air-sea-ice interactions

Jessie Lindsay
Studies ringed seal lairs & habitat

Project leaders

Chris Zappa
Studies air-sea-ice interactions

Andy Mahoney
Studies sea ice & impacts to humans

Alex Whiting
Native Village of Kotzebue Environmental Director

Sarah Betcher
Documentary filmmaker

Ajit Subramaniam
Studies remote sensing and marine ecosystems

Donna Hauser
Studies marine mammal ecology

Jessie Lindsay
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