

Witness The ARCTIC

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ARCUS Member Highlight - AOOS

Introduction

The Alaska Ocean Observing System (AOOS) (<https://aoots.org/>) was established in 2004 as the Alaska regional component of the Integrated Ocean Observing System (IOOS) (<https://ioos.noaa.gov/>) of the U.S., an interagency program housed



within the National Oceanic and Atmospheric Administration (NOAA) (<https://www.noaa.gov/>). The organization is tasked with supporting ocean observations throughout Alaska's waters, including the Arctic Ocean/Chukchi and Beaufort Seas, the Bering Sea and Aleutian Islands, and the northern Gulf of Alaska, to meet stakeholder needs (see photos in Highlights from the Chukchi Sea Ecosystem Mooring Project section below).

AOOS is governed by a Memorandum of Agreement signed by its member organizations, which include federal and state agencies, research and academic institutions, and stakeholder and private sector organizations. A board of directors sets policy and makes funding decisions. AOOS stakeholders are users of the marine environment in Alaska including fishermen, resource managers, tribes, researchers, recreational boaters, the Mariculture industry, subsistence users, the shipping industry, and the general public. AOOS operates as a non-profit, with the Alaska SeaLife Center as its fiscal sponsor and primary funding through a cooperative agreement with NOAA. AOOS was certified as a Regional Association of IOOS in 2017 ensuring that federal standards for operations and data management under the [Integrated Coastal and Ocean Observation System \(ICOOS\) Act of 2009](https://www.congress.gov/bill/111th-congress/house-bill/367) (<https://www.congress.gov/bill/111th-congress/house-bill/367>).

AOOS provides three major services:

- Access to Alaska ocean and coastal data through the AOOS Data System and its interactive web-based data portal, the Ocean Data Explorer (ODE) (<https://portal.aos.org/>);
- Support for identifying and filling gaps in observing technologies, data and information products; and
- Statewide facilitation and collaboration services, including;
 - Alaska Ocean Acidification Network (AOAN) (<https://aos.org/alaska-ocean-acidification-network/>)
 - Alaska Harmful Algal Bloom Network (AHAB) (<https://aos.org/alaska-hab-network/>)
 - Alaska Water Level Watch (AWLW) (<https://aos.org/alaska-water-level-watch/>)



**Alaska Ocean
Acidification Network**



**Alaska
Harmful Algal Bloom Network**



The Ocean Data Explorer

The [AOOS Ocean Data Explorer \(ODE\) portal](https://portal.aos.org/) (<https://portal.aos.org/>) is its flagship program and operates as a regional data assembly center providing public access to existing coastal and ocean data, including real-time sensor feeds, operational oceanographic and atmospheric models, satellite observations, and geographic information system (GIS) data sets that describe the biological, chemical, physical and human use characteristics of Alaska and its surrounding waters. The ODE consists of an interactive map that can integrate 4,500 data layers selected from a searchable data catalog. This map can automatically analyze and visualize raw data streams from 2,800 sensors representing 94 different parameters from more than 60 data sources in the Alaska region. The data catalog offers the ability to download data and metadata in a variety of formats.

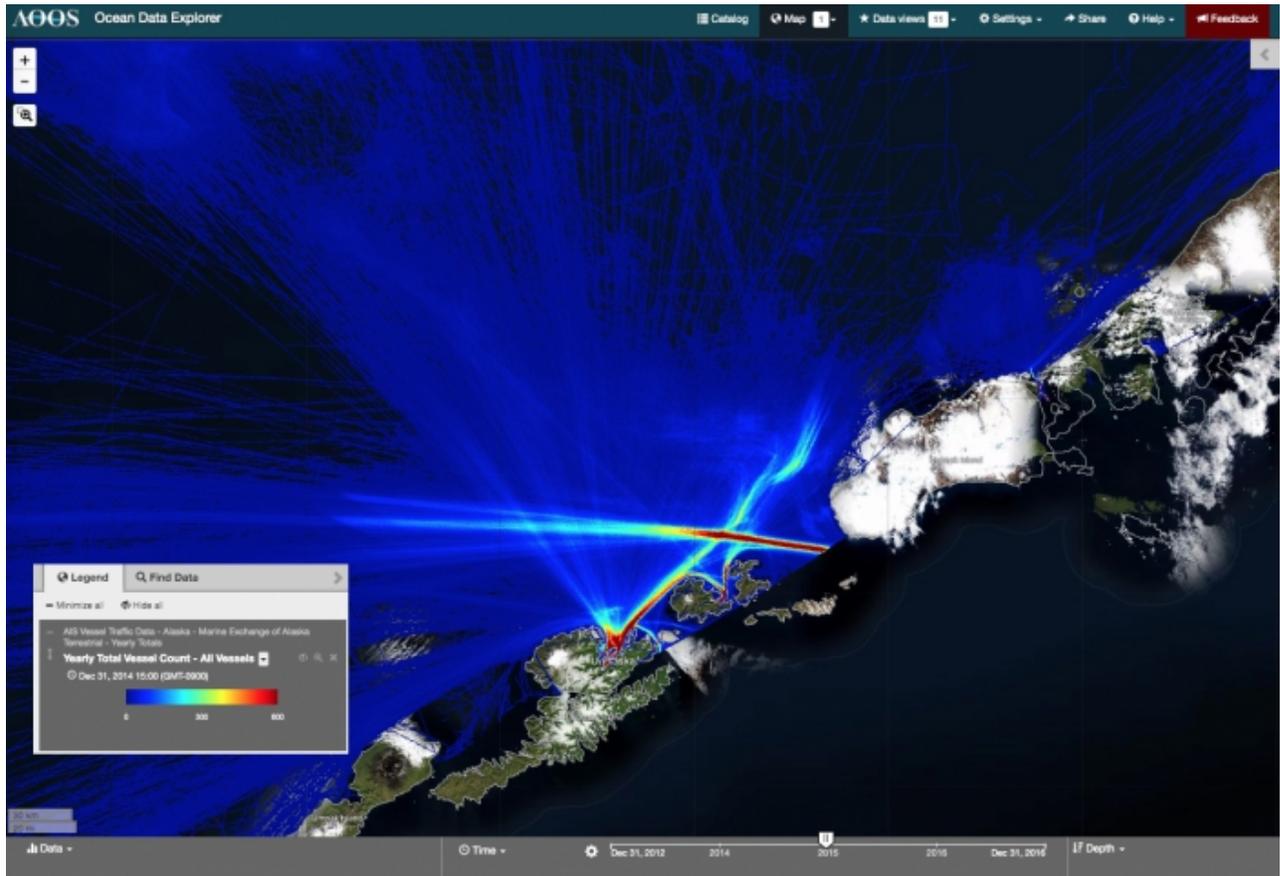


Figure 1. A screen capture from the AOOS Ocean Data Explorer portal map showing historic AIS vessel tracking data from December 2015-December 2016 in the southern Bering Sea. Image courtesy of AOOS.

Through the ODE, AOOS works with stakeholder groups to create data tools and applications to help in decision-making. Among these are an Arctic Oil Spill Risk Assessment for North Slope communities, AIS vessel tracking historical database, and the Alaska Water Level Watch portal, which provides access to Federal, state and private water level data in similar formats. AOOS supports the data management needs of both individual researchers as well as large, integrated research programs (e.g., [Arctic Marine Biodiversity Observation Network](https://ambon-us.org/) (<https://ambon-us.org/>), Marine and Estuarine Goal Setting for South Florida ([MARES](https://coastalscience.noaa.gov/project/goals-south-floridas-marine-estuarine-ecosystems-mares/)) (<https://coastalscience.noaa.gov/project/goals-south-floridas-marine-estuarine-ecosystems-mares/>), the North Pacific Research Board's Arctic Integrated Ecosystem Research Program ([AIERP](https://www.nprb.org/arctic-program/about-the-program/)) (<https://www.nprb.org/arctic-program/about-the-program/>)) through the [AOOS Research Workspace](https://aos.org/aos-ocean-workspace/) (<https://aos.org/aos-ocean-workspace/>), a scientific collaboration and data management tool used to secure, centralize, and ultimately publish data files on public portals, catalogs, and archives. Researchers can use tools within the Workspace to write their own scripts to operate on any of the data stored within the AOOS data system.

Filling Gaps in Observations

AOOS engages with the research community and other stakeholders to identify key gaps in ocean and coastal observations to support these societal benefit areas:

- Navigation safety
- Ecosystem and climate trends
- Coastal hazards, including flooding and erosion
- Water quality, including harmful algal blooms, ocean acidification, and marine debris

AOOS used this process to identify its recent priorities, which include: ecosystem moored observatories in the Chukchi Sea and Gulf of Alaska and ocean acidification buoys in the Bering Sea and Gulf of Alaska; support for the Seward Line ship surveys, Alaska's longest ocean time series; wave buoys in Nome (Figure 2), Kodiak, and Cook Inlet; shore-based high frequency radars (Figure 3) along the northwest coast and most recently in the Bering Strait; weather stations co-located with automatic identification system (AIS) vessel tracking stations; and autonomous underwater glider surveys (Figure 4), including a new program to support commercial fisheries management in the Bering Sea and Gulf of Alaska.



Figure 2. AOOS supported Coastal Data Information Program (CDIP) buoy being deployed off the Port of Nome in Norton Sound.



Figure 3. AOOS funded High Frequency Radar site at Point Lay on the coast of the Chukchi Sea. Photo courtesy of AOOS.



Figure 4. Deployment of AOOS funded autonomous underwater glider in the Arctic for marine mammal acoustic studies. Photo courtesy of AOOS.

Innovative Observing Technologies

One way that AOOS responds to stakeholder identified gaps in observations is through piloting new and innovative technologies. A recent project with the National Weather Service (NWS) (<https://www.weather.gov/>) used stakeholder outreach to identify gaps in active observations of water level variations along portions of Alaska's remote coastline, representing some of the nation's most vulnerable areas to geohazards such as coastal sea level rise, tsunami, extra-tropical storm surge, and erosion. AOOS and the NWS have been testing the efficacy of a land-based, GPS/Global Navigation Satellite System (GNSS) (<https://www.gps.gov/systems/gnss/>) reflectometry water level measurement approach. The GPS/GNSS systems do not rely on coastal infrastructure (mostly lacking in western Alaska) and can be operated and maintained in real-time for a fraction of the cost of a National Water Level Observation Network (NWLON) (<https://hub.arcgis.com/datasets/f8c0f63f80014ab29310264abc535a66>) installation. They also provide the quality level data necessary to improve storm surge forecasts while providing adequate real-time water level conditions for communities. The system has been tested in Seward and Homer, and has been deployed in St. Michael with a new site soon in Utqiagvik.



Figure 5. AOS GPS/GNSS pilot project site at St. Michaels on the coast of Norton Sound. Photo courtesy of AOS.

Highlight Photos from the Chukchi Sea Ecosystem Mooring Project

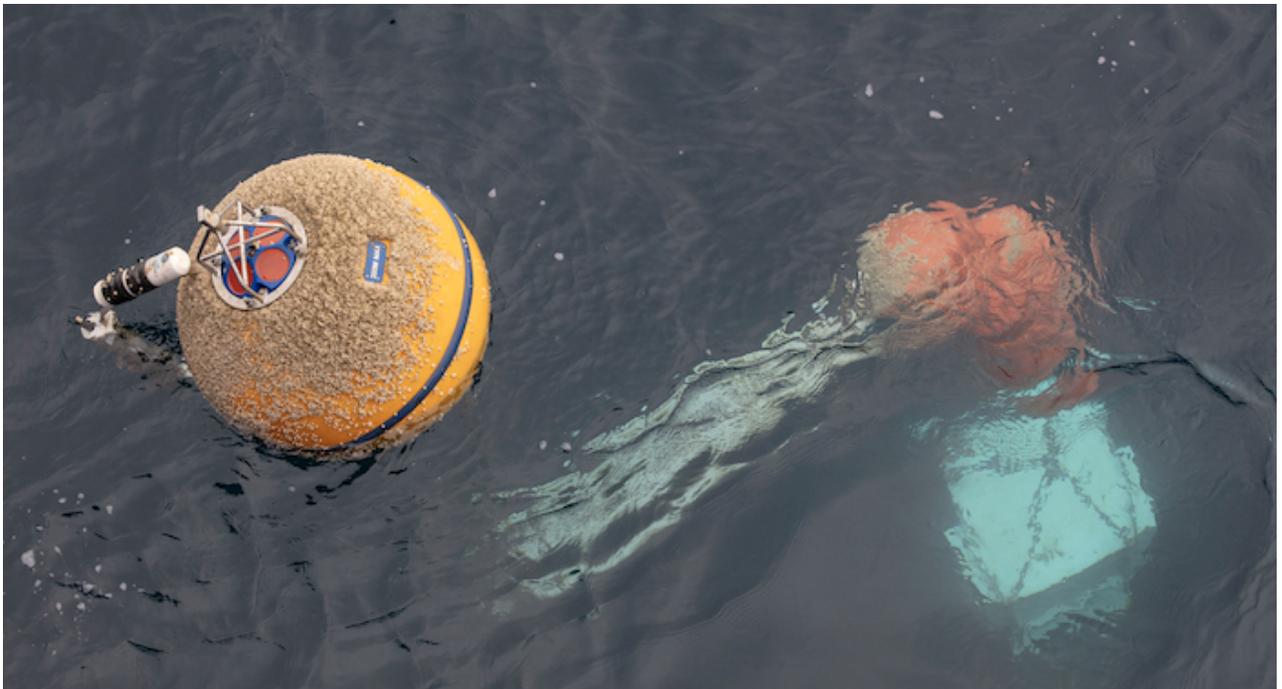


Figure 6. Recovery of a mooring from the Chukchi Sea Ecosystem Observatory showing a yellow buoy with attached acoustic Doppler current profiler, a satellite recovery beacon and a temperature/conductivity/pressure datalogger. Below the surface is a hydrophone, orange floats, and white box of the discrete water sampler, which fills IV bags with water for later laboratory chemical analyses. Photo courtesy of Roger Topp.



Figure 7. Recovery of the Chukchi Sea Ecosystem Observatory water sampler. Photo courtesy of Roger Topp.



Figure 8. Barnacles growing on the casing of the hydrophone from the Chukchi Sea Ecosystem Observatory, which records the vocalizations of marine mammals and other underwater sounds. Photo courtesy of Roger Topp.

Collaborations

A cornerstone of the AOOS mission is facilitating and coordinating marine-related efforts. Currently AOOS co-facilitates the Alaska Harmful Algal Bloom Network, and hosts the Alaska Water Level Watch Network and the Alaska Ocean Acidification Network (AOAN). All three networks work closely with stakeholders, tribes, and the scientific and technical communities. The AOAN, established in 2016, is a national leader in its efforts to engage with scientists and stakeholders to expand the understanding of ocean acidification (OA) processes and consequences in Alaska, as well as potential adaptation strategies. The AOAN has grown to include 35 collaborating organizations, with five separate working groups focused on Tribal engagement, policy, k-12 education, outreach & communication, fishing community engagement, and research & monitoring. The AOAN hosts a website with a wealth of information and resources, sends researchers out to remote Alaskan communities for presentations, produces regular newsletters, and sponsors presentations to industry groups like the Alaska Board of Fisheries. The AOAN just produced its second annual report on the state of OA science in Alaska.

Future plans

AOOS is now reviewing its current portfolio of activities and will be accepting new proposals in preparation for developing the next five-year cooperative agreement with the NOAA IOOS program. If you would like to be put on the AOOS mailing list for future notification, contact Holly Kent, below.

For more information, please contact Holly Kent, Director of Administration & Outreach (kent@aoos.org), or visit the [AOOS website](https://aoos.org/) (<https://aoos.org/>).

Study of Environmental Arctic Change (SEARCH) Update

By: *Brendan Kelly, SEARCH Executive Director and Brit Myers, ARCUS Project Manager*

Arctic Futures 2050: Sustaining the Conversation

In September 2019, the Study of Environmental Arctic Change (SEARCH)

(<https://www.searcharcticscience.org/>) convened 393 Arctic scientists, Indigenous Peoples, and policymakers to collaboratively envision the information that will be needed to inform Arctic policy in the coming decades.

The [Arctic Futures 2050](#)

(<https://www.searcharcticscience.org/arctic-2050>) conference, supported by 19 [sponsor and partner organizations](#) (<https://www.searcharcticscience.org/arctic-2050/conference-2019/partners>), was held over three days and included panel sessions, plenary talks, 181 posters with over 400 authors, and over 1,400 livestream views. Fifteen countries, including all eight Arctic nations, were represented, and 54 Indigenous and early career travel award winners were supported.



Panel discussion at the Arctic Futures Conference. Photo by Joed Polly, ARCUS

For those of us who participated in Arctic Futures 2050, a key challenge moving forward will be finding ways to sustain the important community conversations that emerged from the event. We look forward to highlighting the most promising insights at our upcoming [Town Hall](#)

(<https://www.searcharcticscience.org/meetings/2019/agu>) event at AGU as well as at upcoming sessions of [ArcticNet's Annual Science Meeting](#) (<http://www.arcticnetmeetings.ca/asm2019>)

/home) (2–5 December 2019 in Halifax, Nova Scotia), the [National Council for Science and the Environment's Annual Conference](https://www.ncseglobal.org/event/ncse-2020-annual-conference) (https://www.ncseglobal.org/event/ncse-2020-annual-conference) (6–9 January 2020 in Washington, DC), and the [2020 Arctic Frontiers Conference](https://www.arcticfrontiers.com/event/arctic-frontiers-2020-power-of-knowledge/) (https://www.arcticfrontiers.com/event/arctic-frontiers-2020-power-of-knowledge/) (26–30 January 2020 in Tromsø, Norway).

Available conference products include [posters](https://www.searcharcticscience.org/arctic-2050/conference-2019/posters) (https://www.searcharcticscience.org/arctic-2050/conference-2019/posters), [session videos](https://www.searcharcticscience.org/arctic-2050/conference-2019/stream) (https://www.searcharcticscience.org/arctic-2050/conference-2019/stream), follow-up interviews, and more. Products are available through the [conference website](https://www.searcharcticscience.org/arctic-2050) (https://www.searcharcticscience.org/arctic-2050).

A conference report will be circulated to conference participants and finalized in early 2020. To stay informed about Arctic Futures 2050 conference proceedings, please join the [Arctic Futures 2050 Mailing List](https://www.searcharcticscience.org/arctic-2050/open-science-2019/mailling-list) (https://www.searcharcticscience.org/arctic-2050/open-science-2019/mailling-list) or the [SEARCH mailing list](https://www.searcharcticscience.org/mailling-list) (https://www.searcharcticscience.org/mailling-list).

SEARCH Events at the Fall Meeting of the American Geophysical Union (AGU)

SEARCH Town Hall: Advancing and Sharing Arctic Research

Date: Friday, 13 December 2019

Time: 12:30–1:30pm PT

Location: San Francisco, CA | Moscone Convention Center, Moscone West – 2003, L2

In this AGU Town Hall, SEARCH seeks best practices and ideas to further improve how we share knowledge of the Arctic with policy makers. SEARCH has had a long history of supporting and enhancing Arctic science, and in the past five years we have focused on facilitating cross-disciplinary syntheses and conveying what we know to policy makers and other decision makers. SEARCH facilitated syntheses that improved understanding of:

- greenhouse gas fluxes from thawing permafrost;
- ice sheet contributions to sea level rise;
- the consequences of diminishing sea ice; and
- the relationship of Arctic change to weather at lower latitudes.

SEARCH has shared our understanding of Arctic change with the media and policy makers at all levels of government. Novel collaborations with Indigenous Peoples and policy makers have made scientific understanding more accessible to policy makers through press events, knowledge exchange workshops, [succinct written answers to policy questions](https://www.searcharcticsscience.org/arctic-answers) (<https://www.searcharcticsscience.org/arctic-answers>), Congressional briefings, Intergovernmental Panel on Climate Change meetings, and convenings of Arctic Science Ministers. This town hall will also explore how we can best advance those novel collaborations. All are welcome, and light snacks will be provided.

Permafrost Carbon Network Annual Meeting



The 9th annual meeting of the Permafrost Carbon Network will take place on Sunday, 8 December prior to the Fall AGU meeting. Bringing together the international community of permafrost researchers, the program will feature a series of presentations and speed talks to introduce break-out session topics. Meeting participants will then split into smaller break-out groups to discuss the Permafrost Carbon Network's ongoing and new synthesis research products. The meeting is open to all members of the scientific community with an interest in permafrost carbon research synthesis. However, because capacity for the meeting has been reached, online registration for the event is now closed. For more information about this event, please contact Christina Schädel (christina.schaedel@nau.edu).

Other SEARCH Contributions to AGU

In addition to the events above, SEARCH will be active in several oral and poster sessions; more information is available at [SEARCH at AGU 2019](https://www.searcharcticscience.org/meetings/2019/agu) (<https://www.searcharcticscience.org/meetings/2019/agu>).

More Information about SEARCH

For more information about SEARCH activities, see the [SEARCH website](https://www.searcharcticscience.org/) (<https://www.searcharcticscience.org/>) or contact SEARCH Executive Director Brendan P. Kelly (bpkelly@alaska.edu).

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The International Permafrost Coastal Systems Network

By: Benjamin M. Jones (UAF), Louise Farquharson (UAF), Chris Maio (UAF), Andrey Petrov (UNI), Craig Tweedie (UTEP), Ming Xiao (PSU), Anne Jensen (UAF), Vladimir Romanovsky (UAF)

Permafrost potentially influences 30% of Earth's coastlines (Lantuit et al. 2012). Within the last three decades, changes in the Arctic system have increased the vulnerability of these coasts to erosion and altered coastal morphologies, ecosystems, biogeochemical cycling, infrastructure, cultural and heritage sites, community well-being, and human subsistence lifestyles (Fritz et al. 2017; Jones et al. 2018). Better understanding of the pace and nature of rapid changes occurring along permafrost coastlines is urgent, since a high proportion of Arctic residents live on or near coastlines, and many derive their livelihood from terrestrial and nearshore marine resources (Forbes 2011).

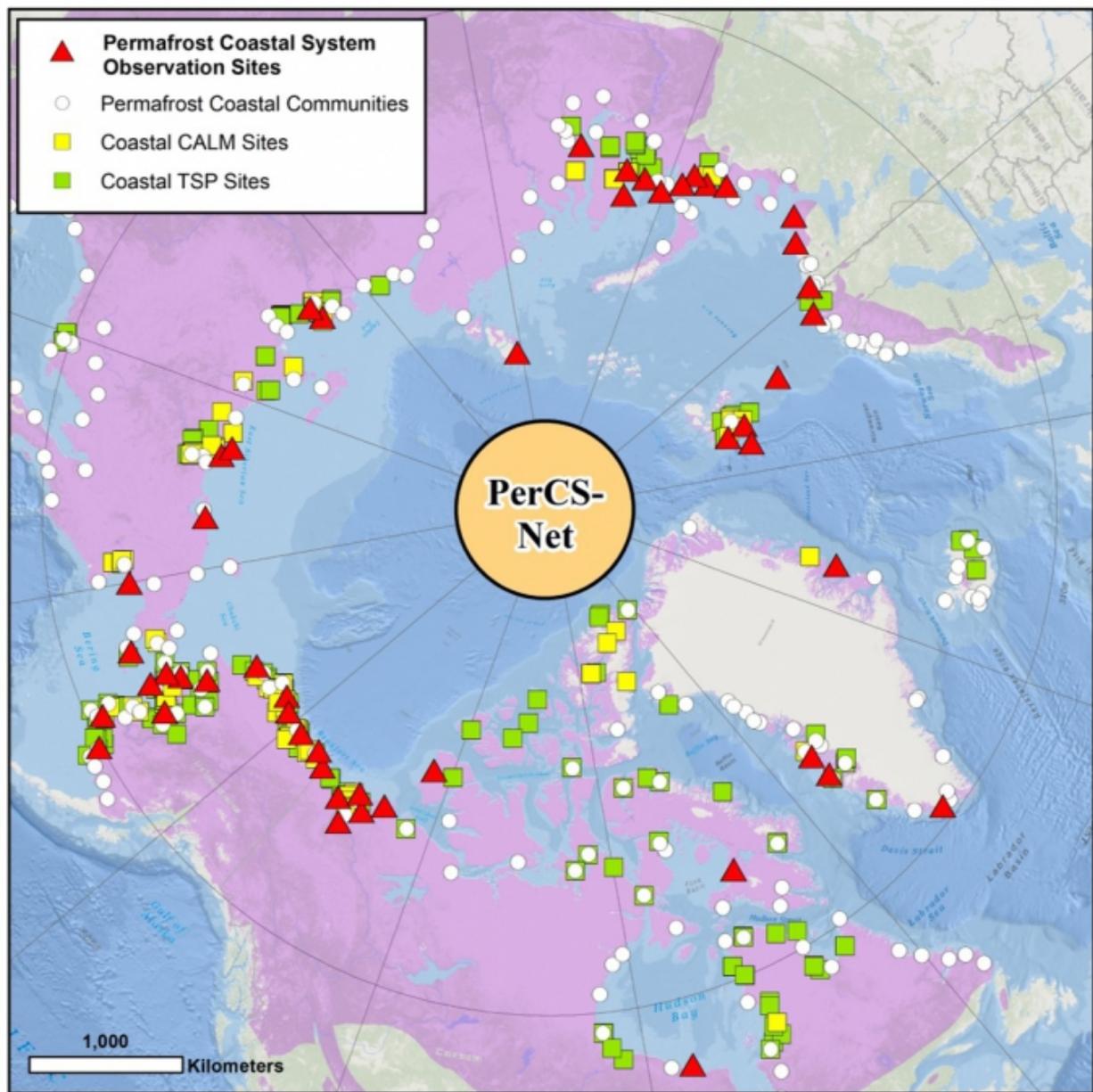


Figure 1. Circumpolar map of northern hemisphere permafrost region (purple area) and existing permafrost coastal system observation sites, permafrost coastal communities, and coastal CALM/TSP/GTN-P sites that will contribute to PerCS-Net. A range of other networks and research sites are also partnered to PerCS-NET but are not shown at this scale. Image courtesy of PerCS-Net.



Figure 2. Permafrost coastal erosion, storm surge flooding, and coastal permafrost thaw impacts: (a) coastal erosion results in the loss of a subsistence fishing cabin in 2005 (photo: Benjamin M. Jones) and (b) cultural sites along the Beaufort Sea coast in Alaska in 2007 (photo: Benjamin M. Jones); (c) housing and infrastructure at Utqiagvik are lost during a storm surge in 1963 (photo source: NARL Archive); and (d) coastal erosion and permafrost degradation impacts a legacy oil exploration well head along the Beaufort Sea coast in 2004. Photo courtesy of the Bureau of Land Management.

The National Science Foundation's AccelNet and Arctic System Sciences Programs recently awarded a collaborative grant to the University of Alaska Fairbanks (UAF), University of Texas El Paso (UTEP), and Penn State University (PSU), funding the Permafrost Coastal Systems Network (PerCS-Net; Jones and Lantuit 2019). PerCS-Net focuses on leveraging resources from existing national and international networks that have a common vision of better understanding permafrost coastal system dynamics and emerging transdisciplinary science, engineering, and societal issues in order to amplify the broader impacts by each individual network. PerCS-Net strengthens linkages between existing networks based in Germany, Russia, Norway, Denmark, Poland, and Canada with the activities of several active NSF-funded networks (PCE-RCN, Arctic COAST RCN, the Permafrost Discovery Gateway, the CALM program, and TSP program) as well as several local, state, and federally funded US-based networks. PerCS-Net benefits from the legacy of previous international permafrost coastal system efforts by leveraging these existing linkages that have been in place, in some instances, for 20-plus years.



*Figure 3. Members of the Permafrost Coastal Erosion RCN and Permafrost Coastal Systems Network during a visit to Utqiagvik in October 2018.
Photo courtesy of Ming Xiao.*

PerCS-Net will benefit the U.S. and international research communities by: (1) developing internationally recognized protocols for quantifying the multitude of changes and impacts occurring in Arctic coastal permafrost systems; (2) sustaining long-term observations from representative coastal key sites; (3) unifying annual and decadal-scale observations of circum-Arctic permafrost-influenced coasts; (4) refining a circum-Arctic coastal mapping classification system and web-based delivery of geospatial information for management planning purposes and readily accessible information exchange for vulnerability assessments; (5) engaging local communities and observers to capture impacts on subsistence and traditional livelihoods; and (6) promoting synergy across networks to foster the next generation of students, postdoctoral scholars, and early-career researchers faced with the known and unknown challenges of the future Arctic system.



Figure 4. Photo from Utqiagvik showing erosion mitigation measures being utilized to mitigate impacts of erosion to permafrost coastal bluffs and houses that sit atop the bluffs. Photo courtesy of Anne Jensen.

Future permafrost coastal system dynamics will challenge conventional wisdom as the system enters a new state, impacting human decision-making and adaptation planning, impacts on cultural heritage resources, and likely resulting in unforeseen national security challenges. Thus, it is critical to foster the development of innovative approaches to education and outreach in a transdisciplinary international network that will enhance professional growth and encourage strategic collaborations with stakeholders from local, state, federal, and national laboratory entities. PerCS-Net will provide graduate students and early career researchers valuable networking opportunities with international collaborators and stakeholders through in-person meetings and workshops, quarterly newsletters, monthly webinars, research exchanges, data and information sharing, and the chance to work collaboratively on transdisciplinary research topics of broad societal significance. Integration of PerCS-Net with remote permafrost coastal communities will foster observation activities and programs from the circum-Arctic that will both inform pressing scientific and engineering issues, and provide a forum to connect K–12 students from the countries representing the study region through a data visualization and information exchange tool.



Figure 5. Photo from Utqiagvik, Alaska in early August 2019 during a strong westerly storm that caused flooding and closure of Eben Hopson Street one of the primary roads in the community. Photo courtesy of Benjamin Jones.

Ultimately, PerCS-Net will develop a circumpolar alliance for Arctic coastal community information exchange among stake-, rights- and knowledge-holders, scientists, and land managers. There is increasingly diverse interest in permafrost coastal system issues and currently no unified source of information on the past, present, and potential future state of permafrost coastal systems that provide the level of detail needed to make decisions at scales relevant for Indigenous communities across the Arctic. Such new engagement will inform intergovernmental agencies and international research and outreach programs in making science-based decisions and policies to adapt to changing permafrost coastal system dynamics. PerCS-Net will build a network of networks to assess risks posed by permafrost coastal system changes to local and global economies and well-being, and facilitate knowledge transfer that will lead to circum-Arctic adaptation strategies.



Figure 6. UTEP's Aliuq research vessel and PI's and students from UTEP and UTMSI conducting research in Elson Lagoon as part of the BLE-LTER. Photo courtesy of Craig Tweedie.

Funding for PerCS-Net provided by US NSF grant OISE 1927553, 1927137, 1927373, co-funded by the Arctic System Science Program in the Office of Polar Programs. For more information, please consider joining PerCS-Net to keep informed about upcoming activities and new products – permafrostcoasts.org

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About the Authors



Benjamin M. Jones (UAF) – Benjamin M. Jones is a Research Professor in the Institute of Northern Engineering, Water and Environmental Research Center at the University of Alaska Fairbanks. He is leading the Permafrost Coastal Systems Network project and collaborates on numerous other NSF-funded projects focused on changing permafrost landscapes in the Arctic.



Louise Farquharson (UAF) – Dr. Louise Farquharson is a geomorphologist and Quaternary geologist who explores Arctic landscape change and permafrost affected coastal dynamics. Louise is a postdoctoral researcher at the University of Alaska Fairbanks Geophysical Institute Permafrost Laboratory.



Chris Maio (UAF) – Dr. Maio is an Associate Professor of Coastal Geography and the director of the Arctic Coastal Geoscience Lab at the University of Alaska Fairbanks. Dr. Maio has developed effective partnerships with local and regional tribal and governmental organizations. Through these partnerships, community-based erosion monitoring sites have been established in 12 Alaska Native coastal villages leading to citizen-scientist training, the collection of new baseline datasets allowing for the mapping of coastal hazards, and incorporation of new datasets in adaptation and mitigation plans.



Andrey Petrov (UNI) – Dr. Andrey N. Petrov is the President of the International Arctic Social Sciences Association (IASSA) and Director of the ARCTICenter and Associate Professor of Geography at the University of Northern Iowa, USA. He leads US flagship science cooperation initiatives in the Arctic Social Sciences: Arctic-FROST and Arctic-COAST.



Craig Tweedie (UTEP) - Dr. Craig Tweedie is a Professor with the Department of Biology and Directs the Environmental Science and Engineering Program at The University of Texas at El Paso (UTEP). Nationally and internationally, he works with multiple research focused institutions, national labs, and not-for-profit organizations.



Ming Xiao (PSU) – Dr. Ming Xiao is an Associate Professor of Civil Engineering at the Pennsylvania State University. He currently leads an RCN project, "Convergence NNA: Coordinate a transdisciplinary research network to identify challenges of and solutions to permafrost coastal erosion and its socioecological impacts in the Arctic" and a project, "NNA Track 1: Collaborative Research: Resilience and adaptation to the effects of permafrost degradation induced coastal erosion."



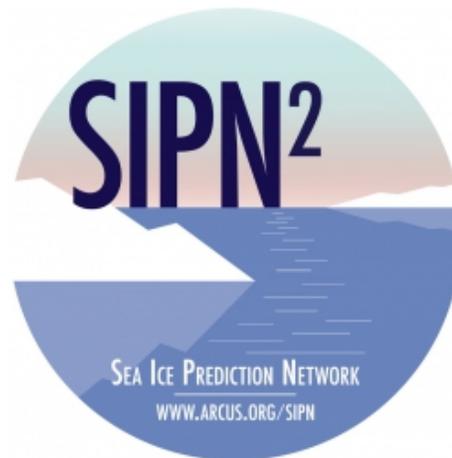
Anne M. Jensen (UAF) – Dr. Jensen is an Affiliate Research Assistant Professor in the Department of Anthropology and a Research Affiliate at the Museum of the North, both at University of Alaska Fairbanks, as well as a Research Associate in the Department of Anthropology at Bryn Mawr College. She has spent 36 years doing archaeological and ethnographic research at sites throughout Alaska, including serving as Principal Investigator for projects at Pingusugruk, Ukkuqsi, Ipiutaq, Nuvuk, and Walakpa, all of which are significant eroding coastal sites on the North Slope. She is currently a PI or co-PI on several NSF-funded projects.



Vladimir Romanovsky (UAF) - Vladimir Romanovsky, UAF professor of geophysics and head of the UAF Geophysical Institute Permafrost Laboratory.

Sea Ice Prediction Network–Phase 2 (SIPN2), 2018—2022

The Sea Ice Prediction Network–Phase 2 (SIPN2) (<https://www.arcus.org/sipn>) is a network of U.S. and international members working to advance research on the processes driving sea ice predictability, prediction products, and the communication of findings to interested stakeholders. SIPN2 is funded by NSF-Arctic Sciences Section and the UK Natural Environment Research Council (NERC) (<https://nerc.ukri.org/>), with several collaborators and partners (<https://www.arcus.org/sipn/project-team>).



Sea Ice Outlook Reports

The [Sea Ice Outlook \(SIO\)](https://www.arcus.org/sipn/sea-ice-outlook) (<https://www.arcus.org/sipn/sea-ice-outlook>) provides an open process for those interested in Arctic sea ice to share ideas and predictions for Arctic ice extent, sea-ice probability, ice-free date, and other variables. The 2019 Sea Ice Outlook season included monthly reports in [June](https://www.arcus.org/sipn/sea-ice-outlook/2019/june) (<https://www.arcus.org/sipn/sea-ice-outlook/2019/june>), [July](https://www.arcus.org/sipn/sea-ice-outlook/2019/july) (<https://www.arcus.org/sipn/sea-ice-outlook/2019/july>), and [August](https://www.arcus.org/sipn/sea-ice-outlook/2019/august) (<https://www.arcus.org/sipn/sea-ice-outlook/2019/august>), and an [interim post-season report](https://www.arcus.org/sipn/sea-ice-outlook/2019/interim) (<https://www.arcus.org/sipn/sea-ice-outlook/2019/interim>) in October.

Based on the National Snow and Ice Data Center's (NSIDC) [Sea Ice Index](https://nsidc.org/data/seaice_index) (https://nsidc.org/data/seaice_index), the 2019 September average sea ice extent was 4.32 million square kilometers, the third lowest in the satellite record that began in 1979. The medians of the Outlook contributions for June, July, and August were 4.40, 4.28, and 4.22 million square kilometers, respectively, with the July SIO coming closest to the observed September extent. The interquartile range of the projections from June (4.2 to 4.8 million square kilometers), July (4.0 to 4.6 million square kilometers), and August (4.0 to 4.4 million square kilometers) all bracketed the observed September extent.

A full post-season report, with a more in-depth analysis of the sea ice season and an evaluation of the accuracy of the Outlook predictions, will be published in February 2020.

SIPN2 Webinars

The last SIPN2 webinar was held in September, featuring a talk by Pablo Ortega, Barcelona Supercomputing Center, on the European-Union-funded project [APPLICATE](https://applicate.eu/) (<https://applicate.eu/>). The webinar series will continue in 2020, with 2–3 webinars per year. All past webinars are archived [here](https://www.arcus.org/sipn/meetings/webinars) (<https://www.arcus.org/sipn/meetings/webinars>), and future webinars are announced via the [SIPN2 mailing list](https://www.arcus.org/sipn/mailling-list) (<https://www.arcus.org/sipn/mailling-list>).

SIPN2 at AGU

SIPN2 will convene a sea-ice community open meeting on Tuesday, 10 December from 12:30–1:30 p.m. PT during the 2019 American Geophysical Union (AGU) Fall Meeting in San Francisco, California (Hotel Nikki, Monterrey I Room). This meeting will promote knowledge exchange and collaboration among members of the sea ice research community. A brief overview of the 2019 Arctic sea ice/Sea Ice Outlook season will also be provided, and discussion will focus on regional sea ice predictions. More information about the meeting is available [here](https://www.arcus.org/sipn/meetings/2019/agu) (<https://www.arcus.org/sipn/meetings/2019/agu>).

More Information on SIPN2

More information about SIPN2 is available through the SIPN2 website and through the SIPN mailing list, or by contacting Betsy Turner-Bogren, ARCUS (betsy@arcus.org).

About the Author



Betsy Turner-Bogren is a Project Manager at ARCUS who provides staff support to the SIPN2 project and its team members. She also manages the NSF-supported publications *Witness the Arctic* and *Witness Community Highlights*.

Collaborating Cross-culturally to Improve Alaska Native Health and Well-being

By: Jean E. Balestrery, PhD, MA, MSW, LICSW, MAC, Scholar-Practitioner in health equity; Hampton Faculty Fellow, Spirit of Eagles Program, Mayo Clinic

Dementia is on the rise around the world, and health organizations in Canada and the United States are responding to the urgent need—voiced by communities and practitioners—for guidance on how best to address memory loss in Indigenous communities. Eliminating associated health disparities in Alaska's Indigenous populations is a related priority. These disparities are typically addressed through Alaska's conventional health and social service organizations, whose health care delivery system can create cultural disjuncture based on rhetorical ruptures—gaps between the rhetoric of care service provided and Alaska Native cultural communication practices. Collaborating across cultural differences is key to eliminating these disparities.

An example of effective collaboration between two women from different worlds is illustrated in the teaching story, "A Fecund Frontier: We listen...in between talk... We listen...", that highlights "story-telling as medicine" (Hulko, Balestrery & Wilson 2019) in the book *Indigenous Peoples and Dementia: Memory Loss and Memory Care* published by UBC Press earlier this year (2019). Collaborating across the urban-rural divide in Alaska, these women show that listening can be transformative and healing.



Collaborators Sophie "Eqeelana Tungwenuk" Nothstine (left) and Jean E. Balestrery (right). Photo courtesy of Jean Balestrery.

The basis for this teaching story extended over many years between an Alaska Native Iñupiat Elder, originally from Cape Prince of Wales, a remote rural Alaska village, and a woman (Balestrery) among the lesbian, gay, bisexual, transgender, two-spirit, queer (LGBTQ) community from the Lower-48 with childhood roots in São Paulo, Brazil. These women met as social workers and later continued together in research based on extensive ethnography, older adult participatory action research, community engaged research, and relational research approaches. The Iñupiat Elder participated as an Elder cultural consultant and received compensation as a co-researcher through research study funding sources. During an anthropology and gerontology academic conference, an attendee noted that researchers were very impressed with this cross-cultural collaboration, explaining, "It is the exact opposite of helicopter research and what we are all striving to work toward as a model—but we wonder how it could ever be replicated?" The Iñupiat Elder responded, "Well, why not? We're doing it, aren't we?"

She also said, "I think what's happening here is really great. When I was growing up, I never heard about this dementia. We didn't have a word for it in my Inupiaq language. It's a problem, though, so we need to deal with it, but just like everything else, we need to do it slowly, otherwise it will be retraumatizing."

Jean E. Balestrery previously conducted her dissertation study, "A Multi-sited Ethnographic Study in Alaska: Examining the Culture-communication Nexus Salient to Alaska Native Elders and Conventional Health and Social Services" from 2011–2014, following many years of pre-dissertation research, clinical social work practice, and university teaching experience. It was funded by the John A. Hartford Foundation, The Reed Foundation, and University of Michigan Joint PhD Program in Social Work and Anthropology. This study examined communication practices that are critical to health and social service delivery processes relevant to Alaska Native peoples in Alaska. In doing so, the study brought awareness to communication as a cultural system and service delivery as culturally contextualized. Study findings evidenced a cultural disjuncture, which is based on rhetorical ruptures—"gaps between the rhetoric of care service provided and Alaska Native cultural communication practices" (Balestrery 2014). Notably, rhetorical ruptures contribute to "culturally charged spaces" (Balestrery 2016) in Alaska's conventional health and social service settings, which are culturally pluralistic and will continue to be that way. Alaska Native Elders describe these "culturally charged spaces" as "generational curses-a pain, prejudice on both sides-wounded, value-systems clash-fighting" (Balestrery 2016). Study recommendations include that collective accountability and responsibility are necessary to reduce intercultural anxieties and Alaska Native health disparities (Balestrery 2014). In addition, study recommendations include, promoting a paradigm of intercultural care whereby colonial histories connect to contemporary healing, cultural ideologies to communication codes, and rhetorical ruptures to violations of Indigenous human rights (Balestrery 2014, 2015). Balestrery disseminated study findings to multiple community-based stakeholders including direct service providers in social work and allied health professions, local community members, and tribal leaders throughout Alaska, in addition to peer-reviewed journal articles. As a result of these activities, Balestrery was invited to join the Cultural Committee in Northwest Alaska, which "is revitalizing Alaska Native traditional values and cultural practices in the region in its efforts to connect treatment to tradition" (Cultural Committee 2017).

Further information is available via a National Association of Social Workers Social Work Talks Podcast, [Indigenous Peoples and Dementia](https://www.socialworkers.org/News/Social-Work-Talks-Podcast/EP39-Indigenous-Peoples-and-Dementia) (<https://www.socialworkers.org/News/Social-Work-Talks-Podcast/EP39-Indigenous-Peoples-and-Dementia>)

For additional information, contact Jean E. Balestrery by email (jbalestrery@gmail.com) or by phone: 612-308-4234.

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About the Author



Jean E. Balestrery, PhD, MA, MSW, LICSW, is an interdisciplinary scholar whose research aims to improve health and social service outcomes particularly for marginalized communities. She earned a Ph.D. degree in social work and anthropology from University of Michigan, an MA in anthropology from University of Michigan, an MSW from University of Washington and a BA from Brown University. She is co-editor and author of "Indigenous Peoples and Dementia: New Understandings of Memory Loss and Memory Care" (UBC Press).

Building Dog Sledges in Tiilerilaaq, Greenland as a School Project

By: Kamilla Oliver, teacher at Diilerilaami Alivarpi, and Max Audibert, headmaster at Diilerilaami Alivarpi.

Greenland has the Arctic's largest remaining sled dog population and a globally unique sled dog culture that is more than 4,000 years old. There is concern in Greenland about the decline in the number of dogs recorded in the past decades and how to pass on the cultural skills and knowledge of traditional dog sledging. The sled dog is disappearing with the ever more common use of snowmobiles and other changes; dogs have been moved outside of town so their noise doesn't disturb the sleep of people who have full-time jobs, making it harder on dog owners to tend and feed them.

Tiilerilaaq is a traditional Inuit settlement where fishing and hunting are practiced in summer, and dog sledging is practiced in the winter. Tiilerilaaq is positioned well into the Sermilik fjord in East Greenland and has about 70 inhabitants. Its closest neighbor, Tasiilaq—the main town of East Greenland—lies about 40 kilometers away and can be reached with a helicopter, boat, or dog sledge in winter.

The school in Tiilerilaaq provides education for children in grades 1–7. The idea of an educational project to build sledges the traditional way, with pupils' participation, was put forward by the headmaster Max Audibert. Apart from various educational benefits of such a project, our wish was to organize a dog sledging trip for pupils as part of the school's winter camp educational activity.



Figure 1. Bending the wood (from the left: Gr 7 pupils Ajaattoq Kristiansen, Sivert Kristiansen and teacher Max Audibert). Photo courtesy of Kamilla Oliver.



Figure 2. Cutting the wood (Grade 6 pupil Kamilla Korneliussen and teacher Kamilla Oliver). Photo courtesy of Kamilla Oliver.

Work on the project started in early January 2019 and was almost exclusively done outside the teaching hours. Five pupils, in grades six and seven, were involved in the project. Initially two teachers were involved (the authors) and the work took place once to twice a week. The work proceeded from the design, to cutting and bending of wood, to working with tools, painting the sledges, and learning the skills necessary for dog sledging. For these students it was the first time in their life to work on such a long-term project, from its conception to the finished new sledges.

It was also the first time they had an opportunity to try, under supervision, woodworking tools such as saws, chisels, hammers, drills, and electric screwdrivers.



Figure 3. Progress, but more work on sledges still needs to be done. Photo courtesy of Kamilla Oliver.

Apart from learning the art of making a sledge from scratch, the main educational value of the project was also to instill in the young generation the value of consistent orderly work, as well as team work. Since we were building five sledges at the same time, we often had to work together on one sledge and try to keep the progress of all sledges at the same stage of completion. To help the children stay motivated, we involved local hunters in the project, who helped in various stages with the woodwork. They also recounted many interesting stories about their life and dog sledging. The sledges were finished in March and the pupils painted them in bright colors of their choice. To celebrate the successful completion of the project, we invited their parents for the occasion and each pupil received a special diploma.



Figure 4. "Now let's go." Trying the sleds with dogs near the school. Photo courtesy of Kamilla Oliver.

The final phase of the project was using the sleds for a school trip to a hut about 10 km away, stay there overnight, and return to the village. Pupils used their new sleds, each as a musher with one or two dogs. Those children whose parents didn't own any dogs could borrow the dogs of the headmaster. For this part of the project, it was essential to teach the pupils how to put a harness on the dog and how to behave when dog sledging.



Figure 5. On the way to the hut. Photo courtesy of Kamilla Oliver.

The round trip to the hut was a success. Everybody enjoyed the trip and it was a lot of fun, despite some surprises in weather. We also used this project to emphasize the importance of good care for the sled dogs in our village and to encourage in our pupils pride about their heritage and culture. The fate of the Greenlandic sled dog will ultimately be in the power of children of today.

The project was funded by the Kommune Sermersooq, which supported a portion of the teaching costs. Marion Löcker of the "Robin Hood" Animal Welfare Society in Austria generously donated funds that were used to cover the cost of materials and a small monetary incentive for the local hunters.

It is our desire to facilitate similar projects in other schools in Greenland, for example, by making a brochure detailing the process of sledge making. Of paramount importance to the success of this undertaking is adequate funding, as well as involvement of dedicated teachers. Traditional knowledge in communities is on the decline, so it is encouraging to see pupils working with their hands to make something tangible that they can use.

For more information, please see Kamilli Olivier's website, [Shades of Snow](http://shadesofsnow.com) (<http://shadesofsnow.com/outreach/>) or visit her on [Instagram](https://www.instagram.com) (<https://www.instagram.com>)

/shadesofsnow/). Or, for questions, contact the authors by email, Kamilla Oliver (olikamilla@gmail.com) and Max Audibert (maxitinit@gmail.com).

About the Authors



Kamilla Oliver - teacher at Diilerilaami Alivarpi. Born in Poland, she completed a PhD in physics and worked in academia as a lecturer and researcher for ten years, and later in nuclear industry as physicist published in peer-reviewed journals. Since 2016, she has been working as freelancer in adventure.



Max Audibert – headmaster at Diilerilaami Alivarpi. Originally from France, he moved to East Greenland at the age of twenty and became a hunter. He was a hunter for ten years and afterwards worked in tourism. After completing teacher's education in Nuuk in 2008, he returned to Tiilerilaaq as the school's headmaster.

Polar Technology Conference returns in March 2020



The Polar Technology Conference (PTC) (<https://polartech.datatransport.org/>) was a small, but impactful meeting held annually from 2005–2016, which created space for polar scientists, technology developers, and technology users to share technology needs and discoveries. The absence of this opportunity for polar people to connect has resulted in reduced connectivity and collaboration within the broader polar science community. The National Science Foundation’s Office of Polar Programs has responded to this need with support to resume the PTC as a biennial meeting.

Planning for the next PTC is underway in partnership with ARCUS and a ten-member, multidisciplinary Organizing Committee. The 2020 meeting will be held in Boulder, Colorado during 10–12 March at the University of Colorado’s Sustainability, Energy and Environment Community (SEEC) (<https://seec.colorado.edu/>) building. This interdisciplinary conference is

intended to provide an opportunity for technical and theoretical exchange on challenges impeding polar research and field operations. Community input is crucial to ensure that technological infrastructure investments are efficient, satisfy science drivers, and meet field requirements. The conference will address approaches to working and studying in the polar regions, including: terrestrial, marine, atmospheric, and social science disciplines; autonomous instrumentation; observation platforms; and all levels of logistical support.

The goal of the meeting is to link experts in polar science and technology development to discuss current technological resources for polar research and identify barriers to research and application of technology for problems unique to polar regions. The conference aims to: (1) identify and define priorities using bottom-up community feedback to enhance polar science through technological advances; (2) scope out areas where research and development (R&D) projects could deliver new technology to meet scientific or logistical user needs and identify where new technology would benefit from field trial; (3) increase awareness of current funding calls appropriate for technical or R&D projects and provide input to funding agencies on effective support of technology-related projects for polar research; and (4) build on past PTCs to create a community of practice for future dialogue between the users, manufacturers, and developers of technology used in polar research. Science topics are anticipated to include science drivers, power systems, instrumentation, communications, data access and sharing, and overarching integrative technology.

A call for abstracts and registration information is forthcoming. For more information on the conference, please visit <https://www.arcus.org/logistics/2020-polar-technology>. For any questions regarding the conference, please contact Lisa Sheffield Guy at lisa@arcus.org or 907-474-1600.

Improving Information Retrieval: The Arctic Data Center Unveils New Semantic Search Product

By: Cézanna Semnacher, Arctic Data Center Community Engagement and Outreach Coordinator; and Steven Chong, Metadata Analyst at University of California, Berkeley

Improving Search Across Concepts

The Arctic Data Center is a repository for all National Science Foundation-funded Arctic research data. The wide range of Arctic research communities represented in the repository often leads to a lack of cohesion in semantics: how terminology is used and defined. To address this challenge, the Arctic Data Center released a refined semantic search interface in September 2019 as part of their [data discovery platform](https://arcticdata.io/catalog) (<https://arcticdata.io/catalog>).

"In ecology, as well as other environmental and social sciences, there is little standardization in how variables are named, the methods used to gather them, and indeed, clarity about what was actually measured. So that is why there is a semantic challenge--to better understand the contents and implications of the data." - Mark Schildhauer, Co-Investigator at the Arctic Data Center

Archiving data for different disciplines often entails managing diverse formats and descriptions of data. The new approach of using semantic annotation to data files offers a way to standardize the descriptions of data by attachment of terms from controlled vocabularies, thereby providing definitions of concepts and showing the relationships between different terminology. So, why is it important to have archived data and to be able to search through it anyway?

"The primary reason to archive data is so that other scientists can use that data - (they) can get a better understanding historically, or synthesize them with other data that are complementary, and gain new scientific insights."
-Mark Schildhauer

As Matt Jones, a Principal Investigator at the Arctic Data Center puts it, "We are here to build on the work that came before us, so that we can 'stand on the shoulders of giants.'"

We search so that we can discover. Let's dig into what is happening behind the scenes in the search browser:

When a user enters a term (or a string of characters), in the general search box, the search engine uses the inputted character string to scour the metadata (documentation that describes the data) for matches. This generally does not provide comprehensive, nor "semantically-relevant", results. In contrast, the improved annotation field in the left-hand panel of search options allows users to search across concepts—based on defined terms from controlled vocabularies—rather than solely the character strings found in the metadata, leading to an increase in relevant results (Figure 1).

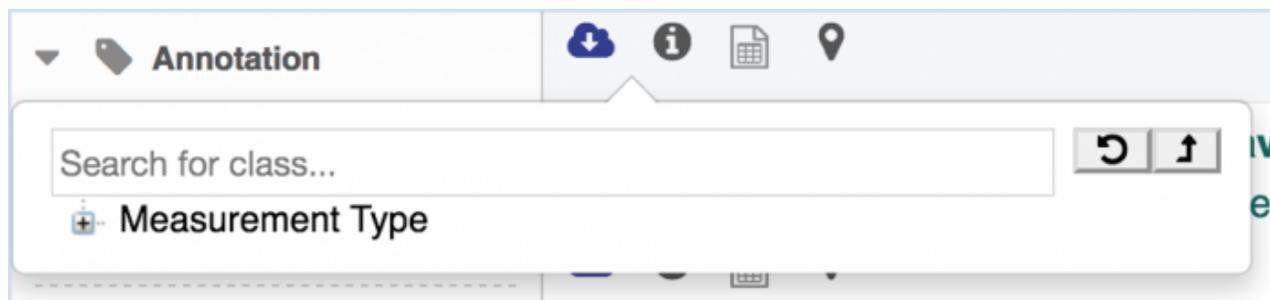


Figure 1. An image of the Arctic Data Center's new annotation search feature.

During the initial stages of building this semantically based search improvement, the semantics team at the Arctic Data Center has focused on constructing a controlled vocabulary and annotating the datasets related to carbon measurements. For example, if you were to search for the character string, "carbon dioxide flux", in the general search box, not all relevant results will be shown due to varying vocabulary conventions across disciplines—only datasets containing the exact words, "carbon dioxide flux", are returned (see Figure 2). However, if you search for the concept of "carbon dioxide flux" under the annotation search feature instead, additional data packages will show up, such as this one [here](https://arcticdata.io/catalog/view/doi:10.18739/A2D21RJ45) (https://arcticdata.io/catalog/view/doi:10.18739/A2D21RJ45) (see Figure 3). Notice that the string "carbon dioxide flux" does not appear anywhere in that package's metadata.

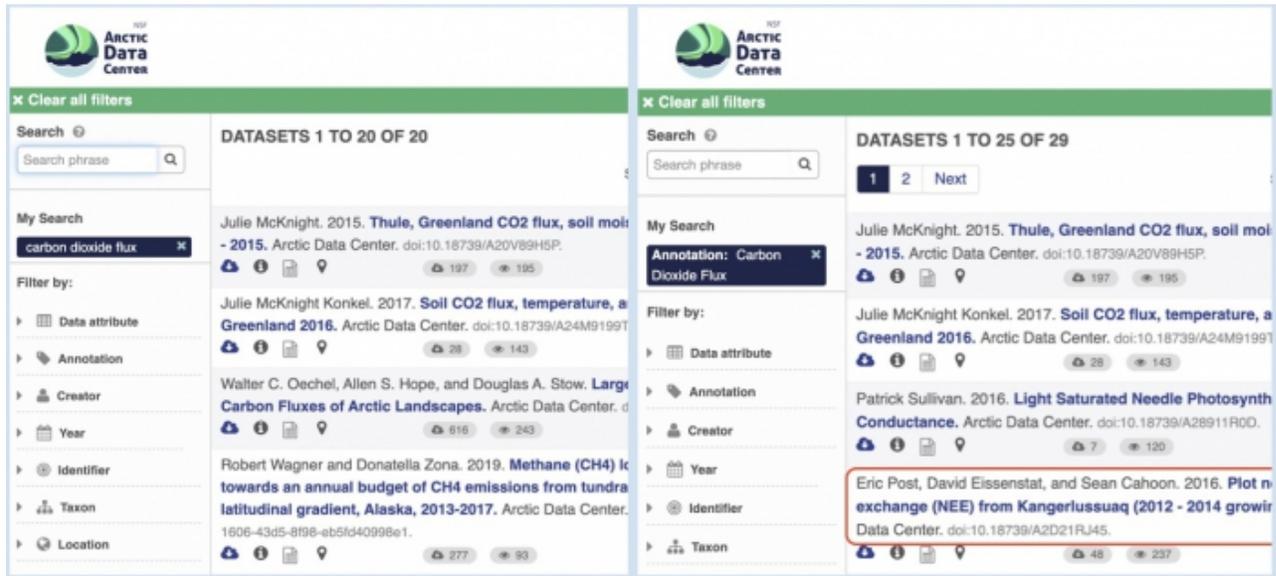


Figure 2. (left) Demonstrates a typical search for "carbon dioxide flux", yielding 20 datasets. Figure 3. (right) Illustrates an annotated search for "carbon dioxide flux", yielding 29 datasets.

(Note that if you were to interact with the site and explore the results of Figure 2, the **dataset in red** (<https://arcticdata.io/catalog/view/doi:10.18739/A2D21RJ45>) of Figure 3 will not appear in the typical search for "carbon dioxide flux.")

Why do the results differ?

Using the annotation search feature to search for "carbon dioxide flux" expands the search to include kinds of carbon dioxide fluxes, such as "carbon dioxide diffusion flux" and "stomatal conductance", as illustrated in Figure 4 below.

Explore Further with Semantic Search Features

There are two different components to the semantic annotation search feature: (1) semantic annotation browsing, where users can navigate through the term hierarchy and select a term to search (see Figure 4); and (2) the semantic annotation search box, where users type in a search term and then select a term of interest (see Figure 5).

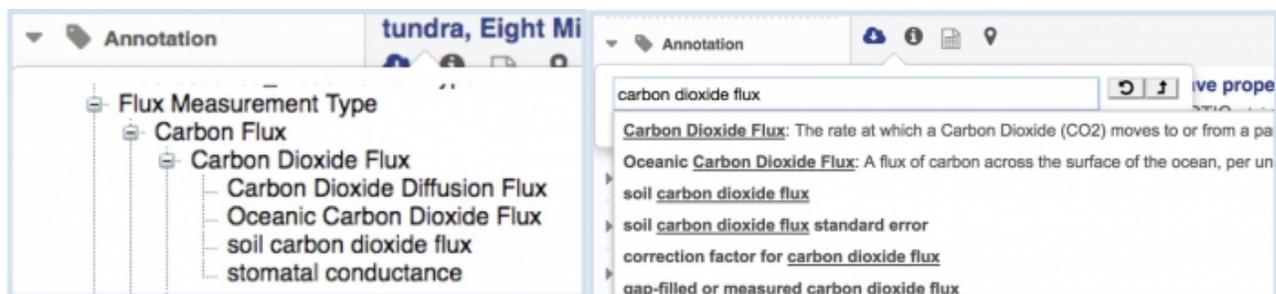


Figure 4. (left) Exhibits example of semantic annotation browsing interface. Figure 5. (right) Demonstrates semantic annotation search by typing search terms.

With the improved annotation interface, synonymous terms are displayed as well as subclasses of a term which are automatically searched and included in the results. For example, if "carbon dioxide" is searched, the results will also reveal data annotated with the synonymous term "CO2." With respect to subclasses, if a user searches "carbon flux", the interface will additionally display datasets that are tagged with "carbon dioxide flux" because the latter is a subclass of the former.

Moving Forward

As mentioned above, the semantics team has initially focused on datasets related to measurements of carbon. With continued activity the team expects to annotate all of the data in the Arctic Data Center, however this also depends on the existence of well-constructed controlled vocabularies, or "ontologies" as they are called in the semantic web community. To support this effort, we encourage all principal investigators (PIs), data submitters, and users to explore the search interface and provide feedback to the development team by email to:

support@arcticdata.io. Because the Arctic Data Center has already annotated a number of datasets, we encourage PIs to review their own datasets for annotation accuracy. Eventually, annotations will be allowed at the data submission stage—stay tuned for updates

If you are curious to explore hundreds of thousands of Arctic data files using refined semantics in the annotation browser, please visit the [Arctic Data Center](https://arcticdata.io/) (<https://arcticdata.io/>).

Additionally, Arctic Data Center staff are Exhibit Hall at the 2019 AGU Fall Meetings held in San Francisco, California.

About the Authors



Cézanna Semnacher works to curate science communication through art and conversation. She currently fills a role as Community Engagement and Outreach for the Arctic Data Center. Formerly, Cézanna was field safety staff and science communication faculty for the Juneau Icefield Research Program.



Steven Chong is a Metadata Analyst at UC Berkeley Library. He was formerly a Projects Data Technician and Postdoctoral Researcher at the Arctic Data Center working on data semantics.

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STEM at the Poles! PolarTREC in the News

By: Judy Fahnestock, PolarTREC (Teachers and Researchers Exploring and Collaborating) Project Coordinator at ARCUS.

It's been a busy season for the NSF-funded program [STEM at the Poles! Research Experiences for Formal and Informal Educators in the Polar Regions](https://www.nsf.gov/awardsearch/showAward?AWD_ID=1918637&HistoricalAwards=false) (https://www.nsf.gov/awardsearch/showAward?AWD_ID=1918637&HistoricalAwards=false).

In September, STEM at the Poles! (PolarTREC) sent educator Katie Gavenus on the Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) (<https://www.mosaic-expedition.org/>) expedition. MOSAiC is an expedition aboard the German research icebreaker *Polarstern*, in which hundreds of scientists from 19 countries will spend a year drifting through the Arctic Ocean—trapped in ice. The goal of the expedition is to intensely study the Arctic to gain fundamental insights that will help us better understand the Arctic ecosystem and the interconnectedness with global climate change. You can learn more about what Katie learned while drifting for six weeks in the Arctic Ocean [here](https://www.polartrec.com/expeditions/mosaic) (<https://www.polartrec.com/expeditions/mosaic>).

Recently, three PolarTREC educators each found themselves at McMurdo Field Station in Antarctica at the same time! Teachers Bridget Ward (Massachusetts), Denise Hardoy (California), and educator Amy Osborne (California) all were working on different NSF-funded projects with overlapping field seasons. Bridget Ward ([Weddell Seals: Growing Up on Ice](https://www.polartrec.com/expeditions/weddell-seals-growing-up-on-ice)) (<https://www.polartrec.com/expeditions/weddell-seals-growing-up-on-ice>) worked with a team studying Weddell seal pups on the ice, while Amy Osborne ([Thermal Sensitivity of Embryos and Larvae of Antarctic Marine Ectotherms](https://www.polartrec.com/expeditions/thermal-sensitivity-of-embryos-and-larvae-of-antarctic-marine-ectotherms)) (<https://www.polartrec.com/expeditions/thermal-sensitivity-of-embryos-and-larvae-of-antarctic-marine-ectotherms>) and Denise Hardoy ([Antarctic Fish Development Under Future Ocean Conditions](https://www.polartrec.com/expeditions/antarctic-fish-development-under-future-ocean-conditions)) (<https://www.polartrec.com/expeditions/antarctic-fish-development-under-future-ocean-conditions>) are both working on projects in the cold ocean waters of Antarctica.



McMurdo Station, Antarctica - 2019 PolarTREC Teachers Denise Hardoy, Bridgette Ward, and Amy Osborne. Photo courtesy of Denise Hardoy, ARCUS.

Right before Thanksgiving 2019, PolarTREC will send Jocelyn Argueta (also known as [Jargie the Science Girl](https://www.indiegogo.com/projects/jargie-the-science-girl-national-tour#/)) to the South Pole to work with the IceCube and the Askaryan Radio Array 2019 research team. Jocelyn is a performer-scientist who works with a theater group to create "Jargie the Science Girl", an educational science show that tours to venues nationwide. Jocelyn is looking forward to showcasing Antarctic research (and beauty!) in curriculum used for future performances.

A big congratulations to two PolarTREC teachers who each won Presidential Awards for Excellence in Mathematics and Science Teaching ([PAEMST](https://www.paemst.org/home/view)) this year. The [PAEMST](https://www.paemst.org/about/view) Award is the highest recognition that a kindergarten through 12th grade science, technology, engineering, mathematics, and/or computer science teacher may receive for outstanding teaching in the United States. The PolarTREC recipients were Svea Anderson from Arizona ([2018, Shrubs, Snow and Nitrogen in the Arctic](https://www.polartrec.com/expeditions/shrubs-snow-and-nitrogen-in-the-arctic)) and Dolores (Lollie) Garay from Texas ([Nitrogen in the Arctic Ocean Ecosystem 2011](https://www.polartrec.com/expeditions/nitrogen-in-the-arctic-ocean-ecosystem)), and [Oden Antarctic Expedition 2007](https://www.polartrec.com/expeditions/oden-antarctic-expedition-07)). Both teachers have credited the PolarTREC program with advancing their skills as teachers, and as an important program that helped give rise to the award-winning teachers that

they are today. Congratulations Svea and Lollie!

About the Author



Judy Fahnestock is a Project Coordinator for ARCUS' PolarTREC (Teachers and Researchers Exploring and Collaborating) program. Including time worked with PolarTREC, she has worked over a decade for ARCUS as support staff for programs such as SEARCH, The Arctic in the Classroom, Sea Ice for Walrus Outlook, and Arctic Visiting Speakers Program.

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The U.S. GEOTRACES "Float Your Boat" Outreach Project

By: David Kadko, 2015 Expedition Chief Scientist, Professor and Associate Director Applied Research Center, Florida International University; William Landing, Co-Chief Scientist, Professor Florida State University; Ignatius Rigor, Applied Physics Laboratory (APL); Wendy Ermold, APL; Bill Schmoker, PolarTREC teacher; David Forcucci, U.S. Coast Guard Science Coordinator.

In 2015 a team of environmental scientists boarded the [U.S. Coast Guard Cutter Healy](https://www.pacificarea.uscg.mil/Our-Organization/Cutters/cgcHealy/) (<https://www.pacificarea.uscg.mil/Our-Organization/Cutters/cgcHealy/>) and sailed north into the Arctic Ocean to take part in an international [GEOTRACES](http://www.geotraces.org/) (<http://www.geotraces.org/>) program investigating the cycling of trace elements and their isotopes, an important indicator for ocean health and contamination. During this voyage, the U.S. Arctic GEOTRACES program participated in a novel outreach project, "Float Your Boat", to involve students and the public with an Arctic research expedition. The program was coordinated with Dave Forcucci, U.S. Coast Guard Marine Science Coordinator.

With funding from the National Science Foundation, over 1,000 8-inch (20-cm) long cedar boats were commissioned from the [Center for Wooden Boats](https://www.cwb.org/) (<https://www.cwb.org/>) in Seattle, Washington and distributed to school groups, scout troops, and science open house events around the country. Students personalized their boats with bright colors and upon return to Seattle, the surface of each boat was stamped prominently with the program's website before being packed into the hold of the USCGC Healy for the journey to the North Pole. During the GEOTRACES cruise, the small boats, packed in cardboard boxes, were deployed on ice floes between 87.5N and 80N on the 150W meridian. After drifting with the Arctic ice, it was hoped that the boats would eventually be freed from its grasp, the cardboard boxes would disintegrate, and the small boats would float to a distant shore to be discovered and reported. This project has a Facebook page and is described by our PolarTREC supported teacher-at-sea, Bill Schmoker in his [journal](https://www.polartrec.com/expeditions/us-arctic-geotraces) (<https://www.polartrec.com/expeditions/us-arctic-geotraces>).

Each floe was tagged with a satellite buoy deployed for the University of Washington Applied Physics Laboratory for their real-time tracking of ice movement by the [International Arctic Buoy Programme](http://iabp.apl.washington.edu/maps_daily_table.html) (http://iabp.apl.washington.edu/maps_daily_table.html). As it turned out, the iridium satellite-linked buoys provided an opportunistic chance for understanding the movement of the boats for about a year and a half. This provided an unexpected synergy between educational

outreach and scientific investigation.

In October 2018, three years after deployment, one of the small wooden boats was found by Bolli Thor, a gentleman in Iceland. He wrote, "These are the coordinates 63.962285, -22.734055 where I found one of your little wooden boats, near the small town called Sandgerði in Iceland where I live. I found it at my favorite spot, where I usually walk with my dog called Tyra." The recovered weathered boat is shown in Figures 1 and 2. Remarkably, we identified the pre-deployment picture, the student, and school.



Figure 1. Left and middle: The first boat, recovered in October 2018, showing the effects of three years of weathering. Right: the boat in its original condition. Photos left and middle courtesy of Bolli Thor; photo right courtesy of the GEOTRACES Project.



Figure 2. Mr. Bolli Thor with the boat, in Iceland. Photo courtesy of Bolli Thor.

Later, on 16 April 2019, another boat was found by Guðmundur Örn Benediktsson, who wrote, "Greetings from Kópasker, Iceland. Hello! One of your floatboats was found at Harðbaksvík, NE Iceland, April the 16th 2019; co-ordinates very close to 66.5150 N and 15.994040 W." (Figure 3). He is a teacher in Kópasker and involved in collecting plastics on his native shore as a means of bringing attention to this worldwide pollution problem.



Figure 3. The second floatboat found at Harðbaksvík. Photo courtesy of Guðmundur Örn Benediktsson.

These discoveries prompted us to investigate how these small boats could have gotten to Iceland from their point of deployment. The satellite drift track data from the US Arctic GEOTRACES small boat deployments stopped in February 2017 (Figure 4). Four groups of boats (boxes 3, 4, 5, and 6) were on floes that ran aground in northern Canada, while two groups (boxes 1 and 2) that were deployed near the North Pole were entrained in the [Arctic Ocean's Transpolar Drift](http://psc.apl.washington.edu/northpole/Buoys.html) (<http://psc.apl.washington.edu/northpole/Buoys.html>), which exits the Arctic Basin by its only deep-water channel through Fram Strait and traveled into the East Greenland Current (a buoy deployed in April near the North Pole has a high probability of following that general route to reach the central Greenland Sea by the following mid-winter).



Figure 4. The map shows drift tracks of our small boat deployments. Boxes 3,4,5, and 6 ran aground in northern Canada in February 2017. Boxes 1 and 2 were entrained in the Transpolar drift and went towards Fram Strait between Greenland and Svalbard. The boats discovered in Iceland were in that group. Image courtesy of the GEOTRACES project.

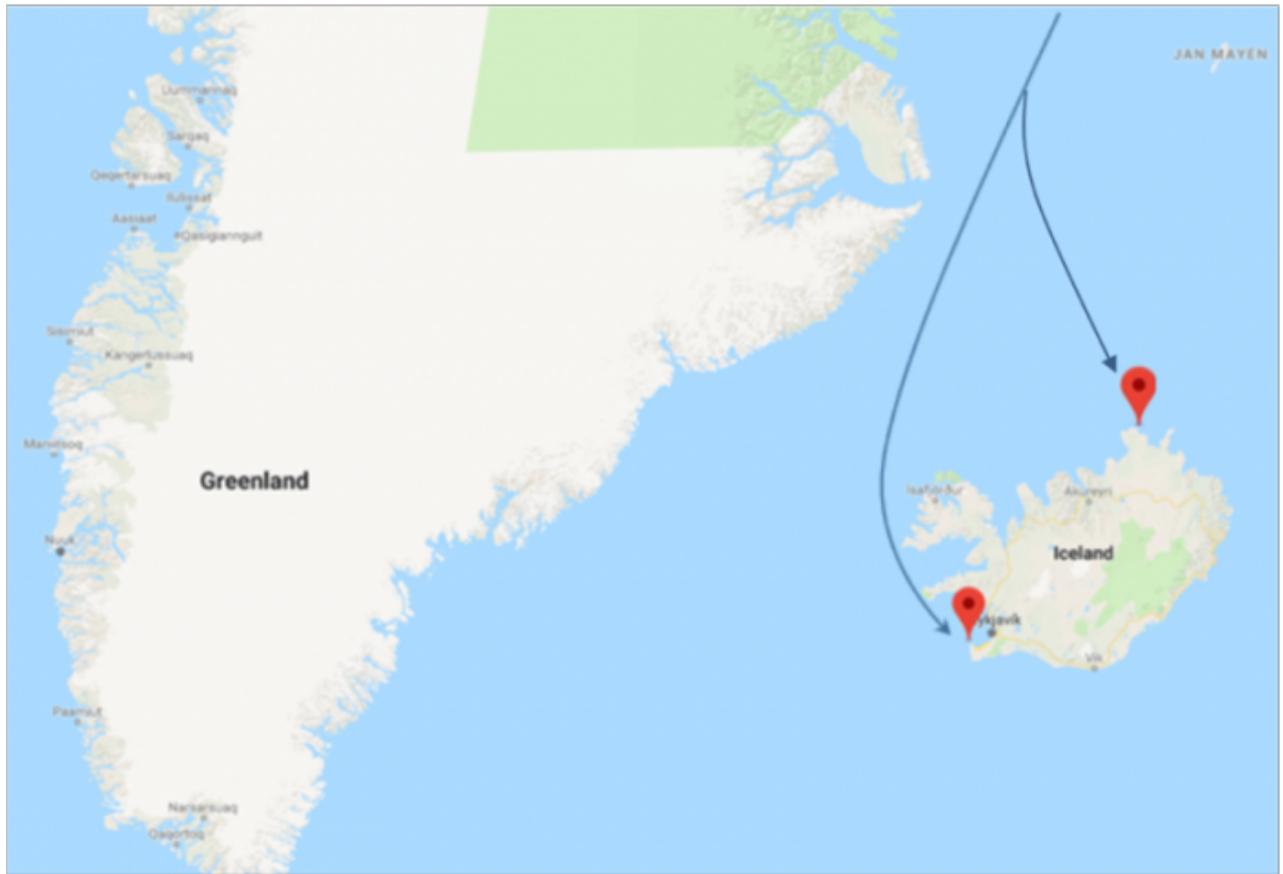


Figure 5. The locations, Sandgerði in southwest Iceland, and Kópasker in northwest Iceland, where the small boats were recovered. Image courtesy of the GEOTRACES project.

The dual purposes of the "Float Your Boat" project, a happy marriage of science outreach and investigation, allowed researchers to simultaneously generate excitement for their work and study the Arctic using unorthodox tools. Furthermore, the project transcended international boundaries, its success relying ultimately upon actions of interested citizens of Iceland.

William Landing (Co-Chief Scientist) said these kind of projects—and the astonishing, serendipitous stories they produce—are crucial in cultivating broad enthusiasm about science among the general public, especially at a time when scientific literacy will be an important tool in addressing the looming specter of environmental catastrophe.

"The 'Float Your Boat' program engaged not only the students who decorated their boats, but also the teachers, scout leaders, and parents who were involved," he said. "There is always a need to reach out to the public and help them understand the value of scientific research, especially these days when humans are having such a large impact on the environment."

For further information, please see the [Float Your Boat Project](http://www.geotraces.org/news-50/news/116-news/1588-float-your-boat) (<http://www.geotraces.org/news-50/news/116-news/1588-float-your-boat>) and "[The U.S. Arctic GEOTRACES Expedition Set to Embark in 2015](https://www.arcus.org/witness-the-arctic/2015/2/article/23166)" (<https://www.arcus.org/witness-the-arctic/2015/2/article/23166>) in the spring 2015 issue of *Witness the Arctic*. Dr. Peter Morton (Florida State University) and Dr. Tim Kenna (Columbia University) contributed to the success of this effort.

About the Authors



David C. Kadko, PhD is a professor and Associate Director of the Applied Research Center at Florida International University. His research interests lie in utilizing naturally occurring radioactivity for tracing the pathways and discovering the rates of various oceanic processes. Because naturally occurring radioisotopes have half-lives ranging from seconds to many years, it is possible to study processes that encompass a great variety of temporal and spatial scales.



William M. Landing, PhD is a professor in the Department of Earth, Ocean, and Atmospheric Science at Florida State University. His research interests include the biogeochemistry of trace elements in marine and fresh waters, the chemistry and deposition of atmospheric aerosols, and mercury cycling in the atmospheric and in aquatic environments.



Ignatius Rigor, PhD is a climatologist at the Polar Science Center, Applied Physics Laboratory (APL), and an Affiliate Assistant Professor in the School of Oceanography at the University of Washington (UW) in Seattle. Dr. Rigor studies sea ice, and how it interacts with the atmosphere and ocean. His primary tools for research are observations from drifting buoys and satellites.



Wendy Ermold is a scientific programmer and field technician for the Polar Science Center (Applied Physics Laboratory, University of Washington). She joined the Polar Science team in 1998.



Bill Schmoker is an Earth Science teacher at Centennial Middle School in Boulder, Colorado where he has taught for over 20 years. Mr. Schmoker was a PolarTREC teacher in 2010 and 2015 and a National Geographic Grosvenor Teacher Fellow in 2013. He is passionate about birding and has photographed over 640 species of North American birds.

His photos appear internationally in numerous books, magazines, web sites, and interpretive signage.



David Forcucci has coordinated marine science for the USCGC Healy for almost two decades. He has a MS degree in Marine Biology. Dave enjoys the sea in his free time and is an underwater photographer with the ability to free dive to 40 meters.

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Long-term Marine Ecosystem Habitat Protective Measures are Needed for Bristol Bay

By: Helen M. Aderman, Marine Mammal Program Manager, Bristol Bay Native Association & 2019 ARCUS Arctic Indigenous Scholar

The recommendation of the Bristol Bay Marine Mammal Council and Qayassiq Walrus Commission to federal and state agencies is to work together on establishing a permanent marine mammal habitat corridor in the Togiak Bay, Alaska area to protect the marine mammals, their habitat, and other species from the seasonal northern Bristol Bay yellowfin sole trawl fishery; and to have access on these waters every year from 1 April—15 August.

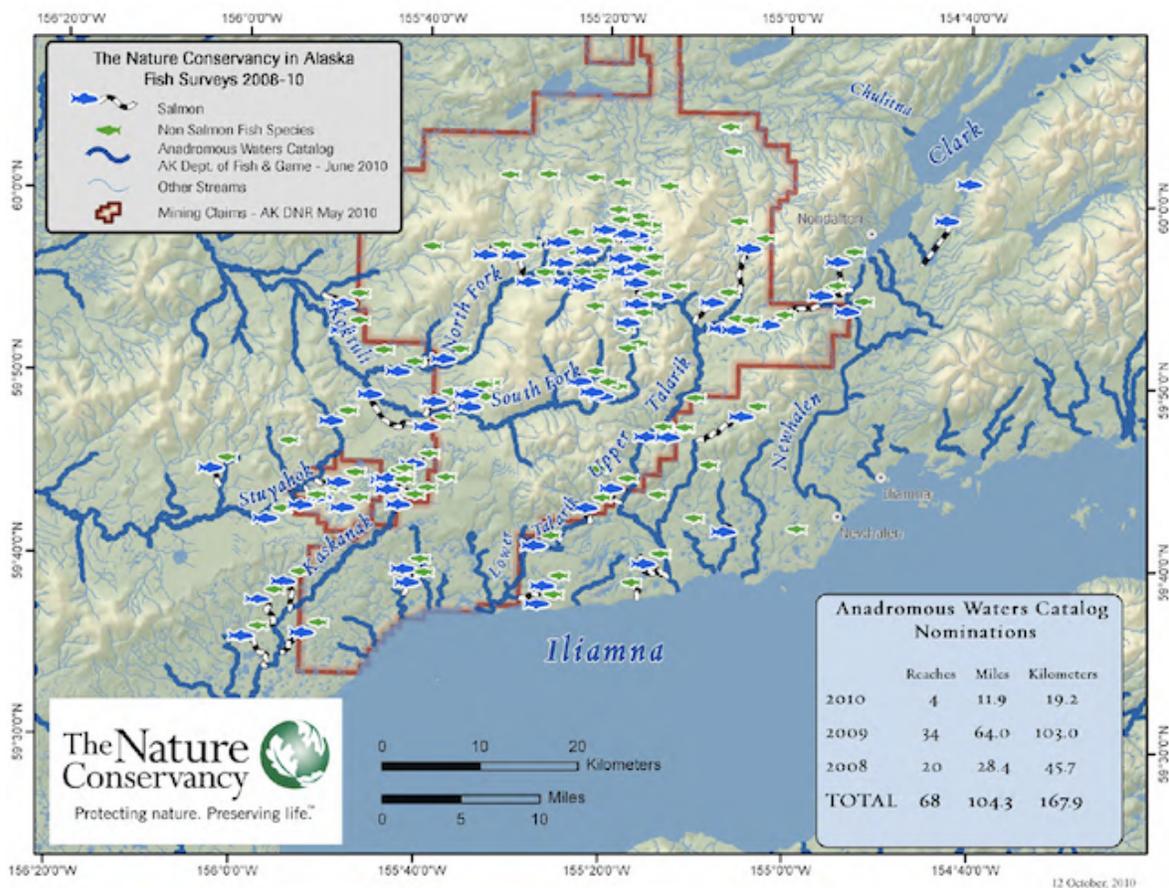


Figure 1. Map of streams near Iliamna with and without salmon. Image courtesy of The Nature Conservancy.

The proposed Pebble Mine is a threat to one of Bristol Bay tribal members' main staple—all salmon species in the freshwater watershed areas in the Iliamna Lake communities extending to the Bristol Bay oceans. Every spring, the juvenile smolts start their out-migration from their

freshwater habitats into the ocean waters. There is a transition period, for one to two weeks, when the smolts go out to the Bay's ocean water's edge to get acclimated to the colder ocean waters, and go back into the freshwater system until they are fully prepared to live in the ocean waters for one to two years. After a few years in the ocean environment, they travel back up through rivers, creeks, and streams into the freshwater lake systems to where they were born to spawn out. After the salmon have laid their eggs in stream and creek beds, the cycle of life starts again with new birth and new life.



Figure 2. Lake Aleknagik sunset. Photo by Helen Aderman.



Figure 3. Chythlook and Aderman family fish rack at Lake Aleknagik.

If there are heavy early spring and late fall rainfalls, the streams and creeks become at least 2–4 feet wider. This results in an increased flow downstream, which affects the salmon egg habitat, as well as the newly born juvenile salmon species. From Talarik and Kuktuli creeks, the heavy current flowing from the proposed Pebble Mine toxic tailings can result in destroying the fragile fish and waterfowl habitat areas, including tundra forage foods for large land animals and fur bearing animals.

For years, the Qayassiq Walrus Commission (QWC) and the Bristol Bay Marine Mammal Council have worked with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service in establishing long-term marine mammal corridor boundaries of the shared marine subsistence food resources shared in Togiak Bay by all other Bristol Bay tribes. The U.S. Fish and Wildlife Service determined that there was no noise disturbance to establish long-term Round Island Protection corridor, but that the 3-mile no fly zone established by the North Pacific

Fishery Management Council was sufficient to protect the walrus haulout at Round Island (Qayassiq). Since Walrus Islands is a State Game Sanctuary, the agencies claim the State owns the Walrus Islands, but our Yup'ik Eskimo Ancestors have always lived and hunted in the Togiak Bay area. This is a jurisdictional issue that needs to be resolved by all parties.

Not having a long-term inter-tribal relationship with the federal and state agencies has resulted in giving the seasonal yellowfin trawl fisheries more access on the Walrus Islands, except for the 3-mile Round Island walrus haulout protection zone. Since 1995, the seasonal yellowfin sole trawl fishery has impacted the traditional subsistence food harvests of Pacific walrus, clams, and bearded seals' habitat. It is a traditional known fact that there is a spring and fall migration of the marine mammals, and the seasonal yellowfin sole trawl fishery has diverted the spring migration of male Pacific walrus from the northern Bering sea to their historic Bristol Bay walrus haulouts: Round Island, Hagemester Island, Cape Peirce, and Cape Seniavin. For the past three years, new walrus haulouts have emerged as a result of human disturbance of walrus in the Northern Alaska Peninsula in Cape Craig and in Meshik Bay, Alaska.

Recommendations in Establishing a Marine Mammal Protection Corridor

- Tribal consultation with the State of Alaska, National Marine Fisheries Service, and the U.S. Fish and Wildlife Service needs to occur to establish Togiak Bay Marine Mammal Protection Corridor so the Pacific walrus can return to their respective historical habitats, and the bearded seals, as well. Our Tribes were taught to conserve their traditional food resources for long-term food security purposes.
- Agencies who claim to water rights ownership need to take a second look and make some conclusions that there is Tribal Jurisdiction in Tribal waters due to historic access to their Ancestral Home communities: traditional subsistence resource camps and sacred Alaska Native historical places that will continue to provide safe, reliable access to their traditional marine ecosystem resources without fear of being arrested for "trespassing" on their own inherent Ancestral hunting grounds, lands, and waters.

Major Gap Analysis Need

We all recognize there are changes in our environment, including climate change, which is affecting our tribal food security year-round cycle of harvesting our traditional species resources and their habitat areas. There is a gap in the statewide Alaska Native Organization (ANO) Marine Mammal Management, Research, and Monitor funding. Not all ANOs receive marine mammal co-management funding, although we have the infrastructure and full capacity to manage our own region's resources with respective tribal members. We need full funding for staff salaries, travel, board meetings, and marine mammal tribal capacity to build integrated research projects and long-term marine mammal monitoring projects, including: (1) Consensus building among Bristol Bay tribes; (2) Collaborative research and management of marine mammals; (3) Mentoring of a student intern to learn marine mammal management processes; (4) Develop tribal ordinances in managing tribal multi-species resources for the five Bristol Bay sub-regional communities; (5) Develop tribal regional marine multi-species conservation plans in Perryville, Igiugig, Manokotak, Naknek, and Newhalen; and (6) Develop a regional marine Mammal Multi-Species Management Plan and Research Plan.

About the Author



Helen Kegginarrluk Aderman is Yup'ik born in Togiak, Alaska, from Aleknagik, Alaska. She is the Bristol Bay Native Association's Marine Mammal Manager, based in Dillingham, and the Executive Director of the Qayassiq Walrus Commission and Bristol Bay Marine Mammal Council. She holds a B.A. in Rural Development from University of Alaska Fairbanks. Helen is working to address impacts on marine mammal habitat use areas and to ensure future Alaska Native generations will have continued access to their traditional marine foods for harvest.

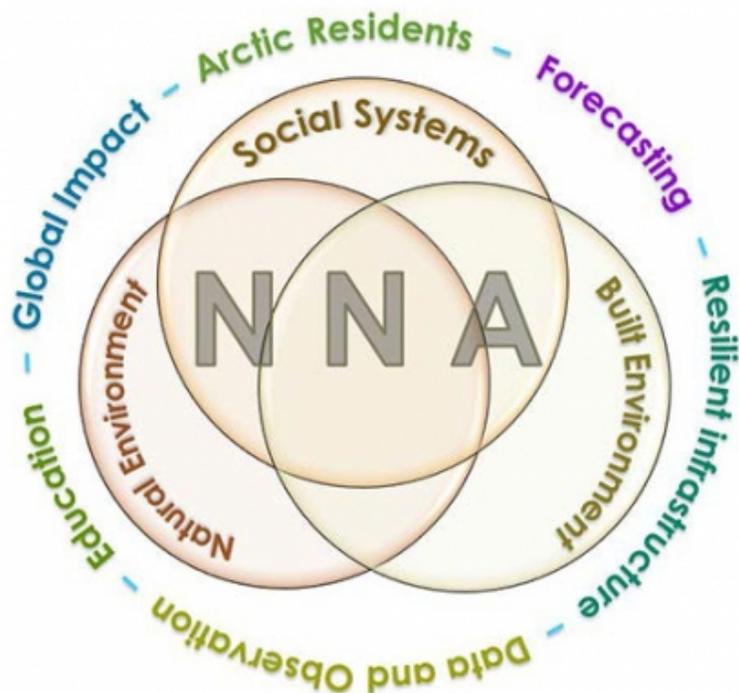
NSF's Navigating the New Arctic (NNA) — FY 2020 Program Solicitation

By: Roberto Delgado Program Director, Arctic Observing Network, Section for Arctic Sciences, Office of Polar Programs, National Science Foundation

The FY 2020 solicitation for the National Science Foundation's Big Idea, Navigating the New Arctic (NNA) (<https://www.nsf.gov/geo/opp/arctic/nna/index.jsp>), is informed by the FY 2019 competition and other feedback from the research community. For FY 2020, the NNA solicitation ([NSF 20-514](https://www.nsf.gov/pubs/2020/nsf20514/nsf20514.htm)) (<https://www.nsf.gov/pubs/2020/nsf20514/nsf20514.htm>) has several significant revisions:

NNA's major goals have been expanded; the research foci for Track 1 have been revised and expanded; guidance for Track 2 proposals has been simplified and clarified; the solicitation includes a new section titled, "Special Considerations for Collaborations with Arctic Communities in NNA Proposals" that provides additional guidance, when appropriate, related to co-production of knowledge, community engagement, and guidelines for NNA research sites near Arctic residents; the deadline date has been changed to 11 February 2020; there is a new limit of three (3) proposals that include any one individual as Principal Investigator (PI), co-PI, or Senior Personnel; the section on Budget Preparation Instructions gives more explicit guidance on budgeting for participation in the NNA PI meetings; and the Additional Solicitation-specific Review Criteria have been refined.

NNA's goals for FY 2020 include:



- Improved understanding of Arctic change and its local and global effects that capitalize on innovative and optimized observation infrastructure, advances in understanding of fundamental processes, and new approaches to modeling interactions among the natural environment, built environment, and social systems;
- New and enhanced research communities that are diverse, integrative, and well-positioned to carry out productive research on the interactions or connections between natural and built environments and social systems and how these connections inform our understanding of Arctic change and its local and global effects;
- Research outcomes that inform national security, economic development, and societal well-being, and enable resilient, sustainable Arctic communities; and
- Enhanced efforts in formal and informal education that focus on the social, built, and natural impacts of Arctic change on multiple scales and broadly disseminate research outcomes.

NNA requests proposals that fall within two tracks. Track 1: Research Grants must have a budget of no more than \$3,000,000 and a maximum duration of five years. Track 2: Planning Grants must have a total budget of no more than \$250,000 and a maximum duration of 24 months.

Track 1 proposals must address at least one, and preferably more than one, of the following five research focus areas (For more guidance, see: [solicitation](https://www.nsf.gov/pubs/2020/nsf20514/nsf20514.htm) (<https://www.nsf.gov/pubs/2020/nsf20514/nsf20514.htm>) and [FAQs](https://www.nsf.gov/pubs/2020/nsf20022/nsf20022.jsp) (<https://www.nsf.gov/pubs/2020/nsf20022/nsf20022.jsp>)):

- Arctic Residents
- Data and Observation
- Education
- Forecasting
- Global Impact
- Resilient Infrastructure

Under Track 2, NNA calls for proposals to support planning activities leading to convergence research team formation and capacity-building within the research community to address the important challenges of the changing Arctic, its global impact, and advancing Arctic science and engineering through education. Proposals should show clear potential to develop novel, leading-edge research ideas and approaches that integrate natural, social, and built environments to target significant societal challenges, build meaningful educational opportunities, and/or engage internationally and with local and Indigenous communities, when appropriate.

For more information, please participate in virtual office hours with NNA Program Officers:

[NNA Office Hours Information and How to Join](https://www.nsf.gov/geo/opp/arctic/nna/index.jsp) (<https://www.nsf.gov/geo/opp/arctic/nna/index.jsp>)

The deadline for proposal submission is Tuesday, 11 February 2020. For further questions, please review carefully the [Frequently Asked Questions](<https://www.nsf.gov/pubs/2020/nsf20022/nsf20022.jsp>). If you still have questions after reviewing the FAQs, then you may reach the NNA Working Group by sending an email to NNA@nsf.gov.

About the Author



Roberto Delgado is the program director for the Arctic Observing Network (AON) (https://www.nsf.gov/news/news_summ.jsp?cntn_id=109687) in NSF's Office of Polar Programs (OPP). He was previously with the National Institutes of Health, where he served as a Program Chief; co-led the Interagency Arctic Research Policy Committee (IARPC) Health and Wellbeing Collaboration Team; coordinated the Arctic Council's RISING SUN initiative; and managed research grants focused on resilience and well-being among rural, global, Arctic, and American Indian and Alaska Native communities. He earned his doctorate in biological anthropology and anatomy (now evolutionary anthropology) from Duke University, with expertise in evolutionary ecology, terrestrial ecosystems, and wildlife biology. He also previously held research faculty positions at Hunter College of the City University of New York and the University of Southern California. In addition to directing AON, he is a Co-Chair of the interagency U.S. Arctic Observing Network (US AON) (<https://www.arctic.noaa.gov/Arctic-News/ArtMID/5556/ArticleID/386/United-States-Arctic-Observing-Network>), one of the US national representatives for the Sustaining Arctic Observing Networks (SAON) (<https://www.arcticobserving.org/>) initiative, and a member of NSF's Navigating the New Arctic Working Group. He may be reached at his office at 703-292-2397 or via email at robdelga@nsf.gov.

IARPC Launches Development of the next Five-Year Arctic Research Plan

By: IARPC Secretariat Executive Secretary Sara Bowden, Web Manager and Communications Officer Jessica Rohde, and Project Analyst Meredith LaValley

The Interagency Arctic Research Policy Committee ([IARPC](https://www.iarpcollaborations.org/about.html))

(<https://www.iarpcollaborations.org/about.html>)

has begun development of the next Arctic

Research Plan as called for in the [Arctic Research Policy Act \(ARPA\) of 1984](https://www.nsf.gov/geo/opp/arctic/iarpc/arc_res_pol_act.jsp) (https://www.nsf.gov/geo/opp/arctic/iarpc/arc_res_pol_act.jsp) (15

U.S.C. § 4108). The Plan will aim to strengthen

interagency communication, coordination, and

collaboration of the fourteen federal agencies,

departments, and offices that make up IARPC. When released at the end of 2021, the Plan will

identify those areas where research in the Arctic can be improved by interagency collaboration. As called for in ARPA, IARPC will consult with collaborators in the State of Alaska, local communities, Indigenous organizations, nongovernmental organizations, and the academic community to ensure that the interests and needs of all stakeholders are addressed appropriately in this research plan. Input is sought from any interested individuals and organizations, and IARPC is committed to an open and equitable consultation process. These consultations will extend throughout the Plan development process.

The Arctic environment is undergoing a rapid transition as sea and land ice diminish, with tremendous implications for natural environments, human well-being, national security, transportation, and economic development. The United States and the other Arctic nations require strong, coordinated research efforts to understand and forecast changes in the Arctic. The new Arctic Research Plan will provide a blueprint for effective Federal coordination of Arctic research for the next half-decade and positions the United States to remain a global leader in Arctic stewardship for many years to come.



Development of
**Arctic
Research
Plan**
2022-2026

How to contribute to Plan development

IARPC is looking for broad input on the goals and objectives of the Plan, ideas on how the Plan should be structured, and suggestions on ways to ensure all interested parties have opportunities to contribute.

Current opportunities to contribute

- Submit your thoughts through this [online form](https://docs.google.com/forms/d/e/1FAIpQLSd1h-z_IIEBSFty4mjJBV81ySRmx62KUaklC8PTMrAQGD-1hg/viewform) (https://docs.google.com/forms/d/e/1FAIpQLSd1h-z_IIEBSFty4mjJBV81ySRmx62KUaklC8PTMrAQGD-1hg/viewform).
- Comment or direct message us on the [IARPC Collaborations Facebook page](https://www.facebook.com/iarpccollaborations/) (<https://www.facebook.com/iarpccollaborations/>).
- Participate in public webinars (dates TBA). Join our [Diversity & Inclusion Team](https://www.iarpccollaborations.org/members/people/teams/3862) (<https://www.iarpccollaborations.org/members/people/teams/3862>) to receive updates.
- If you would like us to come to a conference or meeting in your community or would like to receive physical materials contact Meredith (mlavalley@arcus.org or 940 733 5675)

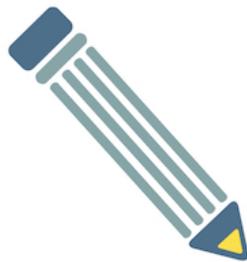
Development of Arctic Research Plan 2022-2026 ("the Plan")

U.S. INTERAGENCY ARCTIC RESEARCH POLICY COMMITTEE (IARPC)



DEVELOPMENT FEBRUARY 2020- SEPTEMBER 2020

- Planning Workshop(s)
- Develop Policy Drivers & Research Goals
- **Federal Register Request for Input**
- **Implement Engagement Strategy**
- Principal approval of drivers and goals
- Form drafting teams

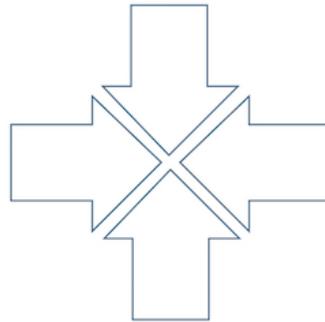


CLEARANCE + RELEASE MAY 2021- DECEMBER 2021

- **Federal Register Review**

REVIEW + PLANNING SEPTEMBER 2019- JANUARY 2020

- Seek approval of IARPC Principals
- Consider past Arctic Research Plans
- **Develop Engagement Strategy**
- Identify Plan Development Team
- Designate Subject Matter Expert to guide Plan development



DRAFTING OCTOBER 2020- APRIL 2021

- Write chapters + supplementary material
- Get concurrence from agencies
- Synchronize and edit
- Write Executive Summary

Four Arctic Indigenous Scholars Visit Washington, D.C. in May 2019

By: Lisa Sheffield Guy, Helen Aderman, Beth Leonard, and Tonia Osborne

The Arctic Indigenous Scholars Program, led by the Arctic Research Consortium of the U.S. (ARCUS) and the Inuit Circumpolar Council (ICC) Alaska, and supported by the National Science Foundation's Division of Arctic Sciences, aims to create a space for Indigenous scholars to educate and inform policy- and decision-makers engaged in Arctic issues in Washington, D.C. The program defines a scholar as an expert within their own knowledge system.

During 2019—the second year of the program—a five-member volunteer selection committee composed of Arctic Indigenous leaders selected four scholars for the opportunity. The 2019 scholars included Helen Aderman (Yup'ik), with interests in marine ecosystems and subsistence; Beth Leonard (Athabaskan), with a focus on higher education for Alaskan Native students; Tonia Osborne (Inupiaq), with focus on marine science, climate change, and incorporating Indigenous knowledge into science; and Mark Miklahook (St. Lawrence Island Yupik), with interest in language and cultural resources for St. Lawrence Island. Please see our [webpage](https://www.arcus.org/indigenous-scholars) (<https://www.arcus.org/indigenous-scholars>) for more information on each scholar and a recording of Helen Aderman's seminar. The scholars met with a variety of organizations and leaders in the capital, specific to their interests. ARCUS would like to thank the following organizations for hosting the scholars in Washington, D.C.: U.S. Global Change Research Program, Interagency Arctic Research Policy Committee (IARPC), Office of Science and Technology Policy, Smithsonian Arctic Studies Center, The Arctic Institute, National Oceanographic and Atmospheric Administration (NOAA), National Science Foundation (NSF), Senator Lisa Murkowski, Senator Dan Sullivan, U.S. Department of Education, U.S. Bureau of Indian Education, National Congress of American Indians (NCAI), and National Council for Science and the Environment.

Below, three of the 2019 Arctic Indigenous Scholars share their experiences.

Helen Aderman

Helen Kegginarrluk Aderman is Yup'ik born in Togiak, Alaska, from Aleknagik, Alaska. She is the Bristol Bay Native Association's Marine Mammal Manager, based in Dillingham, and the Executive Director of the Qayassiq Walrus Commission and Bristol Bay Marine Mammal

Council. She holds a B.A. in Rural Development from University of Alaska Fairbanks.

Helen was the first of the four 2019 scholars to travel to Washington, D.C. during 5–9 May. She met with federal stakeholders to make them aware of Bristol Bay Native issues, including the need to establish long-term marine ecosystem habitat protective measures. Federal and state partners have not supported the recommendations of both Qayassiq Walrus Commission and Bristol Bay Marine Mammal Council. The recommendation to the federal and state agencies is to work together on establishing a permanent marine mammal habitat corridor in the Togiak Bay, Alaska area that would protect the marine mammals, their habitat, and other multi-species from impacts of the seasonal Northern Bristol Bay yellowfin sole trawl fishery; and to have access on these waters every year from 1 April–15 August.

Helen presented an ARCUS webinar titled, "Impacts on Marine Mammal Habitat Use Areas to Ensure Future of Subsistence Resource Use Areas Including Multi-Species Habitats in Bristol Bay, Alaska", which can be viewed [here](https://youtu.be/MP1b-yeZfLw) (<https://youtu.be/MP1b-yeZfLw>).

Beth Leonard

Beth Ginonidoy Leonard is Deg Xit'an Athabascan and member of the Shageluk Tribe of interior Alaska. She is professor of Alaska Native Studies at the University of Alaska Anchorage. She holds a PhD in Cross-Cultural Studies from the University of Alaska Fairbanks.

Beth traveled to Washington, D.C. with Mark Miklahook and Tonia Osborne in May 2019. During this visit she met with education and Arctic Social Sciences staff from the National Science Foundation, NCAI, and the Bureau of Indian Education to learn about recent initiatives and potential funding opportunities to promote Alaska Native student success in higher education.

Tonia Osborne

Tonia Qanannaq Osborne is Inupiaq from the Norton Sound Region. She grew up in White Mountain and Nome. She is graduating from the University of Alaska Southeast this December 2019 with her Bachelor's in Marine Biology.

Tonia has been doing research on marine mammals and how we can incorporate traditional and Indigenous knowledge into western science. It is important that we respect the needs and cultural values of Indigenous communities when conducting research on their home land. These collaborations are necessary to understand the effects of climate change on the Arctic marine ecosystem. Climate change in the Arctic is more rapid than any other biome in the world—with sea ice melting, rising sea levels, changes in snow cover, and ocean acidification affecting polar

waters. These environmental changes are fundamentally influencing Arctic and sub-Arctic marine food webs. Many people in the Arctic, particularly Indigenous people, depend on the ocean as a source of food. Indigenous communities depend on marine mammals and are woven into Arctic Indigenous culture through food, spirituality, medicine, and social ties. It is so vital to incorporate traditional knowledge from elders, hunters and gatherers, and villagers in scientific research. Environmental disruptions will ultimately have detrimental effects on Arctic Indigenous communities. It is important to incorporate funds in Arctic research towards training scientists and researchers on Arctic Indigenous culture and how to properly retain data from traditional knowledge.

In D.C., Tonia spoke to scientists and researchers, policy makers, and professionals about the importance of traditional knowledge. She went to various organizations like NOAA, NSF, NCAI, and others. She sought advice on what she can do as a young scientist pursuing this field, as well as what steps she can take as a graduating senior.

We hope to include a contribution from 2019 Arctic Indigenous Scholar, Mark Miklahook, in a future issue of Witness the Arctic.

The Arctic Indigenous Scholars Program will continue in 2020 with support from the National Science Foundation. The application period will open in winter 2019/2020, with scholars traveling in late spring. Application information will be announced on the [Arctic Indigenous Scholars webpage](https://www.arcus.org/indigenous-scholars) (<https://www.arcus.org/indigenous-scholars>) and circulated through ARCUS' communication channels.



Left to right, Tonia Osborne, Beth Leonard, and Mark Miklahook visit the National Science Foundation office during May 2019. Photo by Joed Polly, ARCUS.

About the Authors



Lisa joined ARCUS in 2015. She works on a variety of projects, including the Sea Ice for Walrus Outlook, Arctic Indigenous Scholars, and The Arctic in the Classroom, among others. Lisa has been working in Alaskan ecosystems since 2002 and earned BS and MS degrees in Wildlife Science from Oregon State University where she studied seabirds as indicators of climate change on St. Lawrence Island, AK. Her professional interests include the impact of changing climate on ecosystems and communities, science communication, and equitable inclusion of Indigenous Knowledge in science and policy. Lisa lives with her husband and wildling sons near Pescadero, CA. Outside of work, Lisa is usually obsessing over her herb garden, looking for interesting snakes, boating, camping, fussing over chickens, and working on restoring the lovely patch of oak woodland where she lives.

Helen Kegginarrluk Aderman is Yup'ik born in Togiak, Alaska, from Aleknagik, Alaska. She is the Bristol Bay Native Association's Marine Mammal Manager, based in Dillingham, and the Executive Director of the Qayassiq Walrus Commission and Bristol Bay Marine Mammal Council. She holds a B.A. in Rural Development from University of Alaska Fairbanks. Helen is working to address impacts on marine mammal habitat use areas and to ensure future Alaska Native generations will have continued access to their traditional marine foods for harvest.



Beth Ginondidoy Leonard is professor and director of the Alaska Native Studies Program at the University of Alaska Anchorage. She is Deg Xit'an (Athabascan) and member of the Shageluk Tribe of interior Alaska; her parents are James, and the late Jean Dementi. In 2014, she was awarded a Fulbright U.S. Core Scholarship and spent five months at Te Kawa a Māui – School of Māori Studies at Victoria University of Wellington (VUW). During that time, she taught a joint University of Alaska-VUW videoconference with Dr. Ocean Mercier, and researched Māori student recruitment, retention, and mentoring. Beth is a member of the Alaska Native Studies Council, and UArctic Indigenous Issues Committee. Her current research investigates the confluences of Indigenous methodologies, knowledges, and pedagogies in shaping Indigenous spaces in higher education.



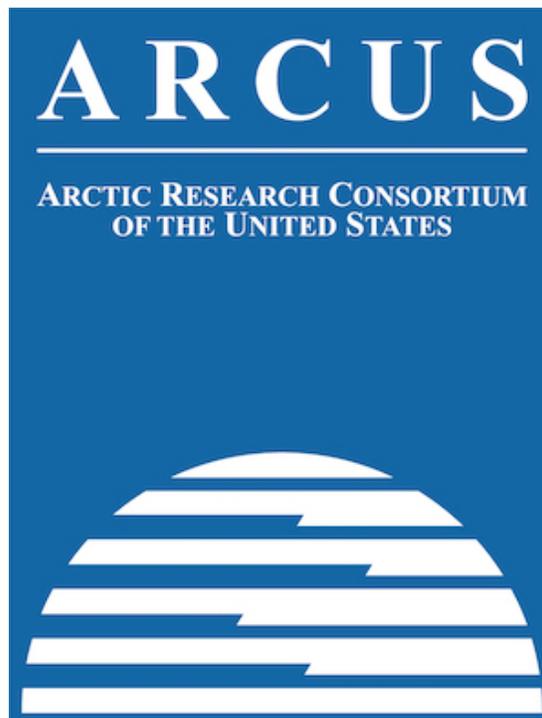
Tonia Qanannaq Osborne is Inupiaq from the village of White Mountain, Alaska but she also grew up in Nome. She is a senior at the University of Alaska Southeast in Juneau where she is studying marine biology. Tonia is an Alaska Native Science and Engineering Program (ANSEP) university success student as well as a Caleb Pungowiyi Scholar. As an undergraduate, she is very involved with research with marine mammals through an REU (Research Experience for Undergraduates) program at Mystic Aquarium. Tonia will continue to do research with her university until she graduates. She is very interested in incorporating traditional knowledge from hunters, villagers, and elders in scientific research as the Arctic is experiencing amplified effects of climate change.

ARCUS Highlights

By: Helen Wiggins, ARCUS Interim Executive Director, Director of Programs

Greetings from Alaska, where the temperatures have finally started to feel more like normal and we are looking forward to wrapping up a very successful 2019. Since the the update in the [Spring 2019 issue of Witness the Arctic](https://www.arcus.org/witness-the-arctic/2019/1) (<https://www.arcus.org/witness-the-arctic/2019/1>), ARCUS staff, Board, members, and collaborators have been working hard to advance Arctic research and education. Here are a few highlights:

- **New Cooperative Agreement:** I am delighted to announce that National Science Foundation has awarded ARCUS a 3-year cooperative agreement for "Building Community in Arctic Research: Communication, Research Support, and Multi-Knowledge System Integration" (Proposal No. OPP-1927894). The cooperative agreement supports many of ARCUS' core research community support activities —everything from our website and mailing list communications to the Arctic Community Meeting Rooms at AGU, as well as several new projects. One new activity is a travel award to support early career researchers to attend a conference for professional development and networking; volunteers are currently being sought to serve as members of the travel award selection committee. If you would like to volunteer, please send a short statement (1 paragraph) describing your interest to Brit Myers at brit@arcus.org by Friday, 6 December.
- **Engaging Rural and Alaska Native Youth in Arctic STEM (Science, Technology, Engineering, and Mathematics):** Another new project funded by NSF will include two public "listen and learn" sessions and a workshop to identify ways to increase participation of rural and Alaska Native students in STEM programs and careers. This project will be a collaborative effort with organizers from ARCUS, NOAA Fisheries Alaska Region, and the University of Alaska Fairbanks. For more information, contact Janet Warburton, ARCUS, at warburton@arcus.org.



- SEARCH Arctic Futures 2050 Conference: Several ARCUS staff were busy planning for and supporting SEARCH's Arctic Futures conference, held in September to enhance collaborations between Arctic scientists from many disciplines, diverse Indigenous knowledge holders, and policy makers from all levels of government. More information about the conference is in the [SEARCH article](https://www.arcus.org/witness-the-arctic/2019/2/article/30138) (<https://www.arcus.org/witness-the-arctic/2019/2/article/30138>) in this issue and on the [conference webpages](https://www.searcharcticscience.org/arctic-2050/conference-2019) (<https://www.searcharcticscience.org/arctic-2050/conference-2019>).
- Fall AGU Meeting: 'Tis the season for planning for the Fall AGU Meeting. As usual, ARCUS will have a strong presence this year—from hosting the [community meeting rooms](https://www.arcus.org/communitymeetings/agu/request) (<https://www.arcus.org/communitymeetings/agu/request>), organizing a [funders meet and greet](https://www.arcus.org/communitymeetings/agu/2019/research-funders-registration) (<https://www.arcus.org/communitymeetings/agu/2019/research-funders-registration>), holding our annual [Arctic Community Reception](https://www.arcus.org/annual-meetings/2019) (<https://www.arcus.org/annual-meetings/2019>), and we will have several [ARCUS sessions, talks, and posters](https://www.arcus.org/communitymeetings/agu/2019/arcus) (<https://www.arcus.org/communitymeetings/agu/2019/arcus>). We hope to see many of you there!

You can find updates on all our activities, including [PolarTREC](https://www.polartrec.com/) (<https://www.polartrec.com/>), the [Sea Ice Prediction Network](https://www.arcus.org/sipn) (<https://www.arcus.org/sipn>), the [Arctic Indigenous Scholars program](https://www.arcus.org/indigenous-scholars) (<https://www.arcus.org/indigenous-scholars>), the [Arctic Research Seminar Series](https://www.arcus.org/research-seminar-series) (<https://www.arcus.org/research-seminar-series>), and others through the [ARCUS website](https://www.arcus.org/) (<https://www.arcus.org/>) or by contacting me at helen@arcus.org. You can join the ARCUS community by becoming an individual or organizational member [here](https://www.arcus.org/arcus/member-information) (<https://www.arcus.org/arcus/member-information>). Follow us on twitter: [@ArcticResearch](https://twitter.com/ArcticResearch).

Meet the Board of Directors — Peter Webley

Peter was elected to the ARCUS Board of Directors in 2010, he fills a term that expires in 2020.

Peter works at the Geophysical Institute ([GI](https://www.gi.alaska.edu/)) (<https://www.gi.alaska.edu/>), University of Alaska Fairbanks ([UAF](https://uaf.edu/uaf/)) (<https://uaf.edu/uaf/>). He is the Associate Director of Research at the Alaska Center for Unmanned Aircraft Systems Integration ([ACUASI](https://acuasi.alaska.edu/)) (<https://acuasi.alaska.edu/>), an Associate Research Professor of Remote Sensing, and a Faculty Ambassador to UAF's Office of Intellectual Property and Commercialization ([OIPC](https://uaf.edu/oipc)) (<https://uaf.edu/oipc>). Peter has a passion for business development and technology transfer from an academic environment into the private sector. Dr. Webley's impact on the innovation practices



and entrepreneurial activities at UAF has been important for the University's growth. Peter is also a State of Alaska Innovators Hall of Fame (HOF) inductee, class of 2017 (<https://www.alaska.edu/research/research/scor/ak-innovators/2016-2017/>), and is one of five at UAF who hold a patent and are an HOF inductee. He supports and advises UAF's innovators and entrepreneurs along with their Office on providing resources, programs and initiatives to build an innovative culture at UAF. This led him to become the Vice President of [V-ADAPT](https://www.vadapt.net/) (<https://www.vadapt.net/>) (Volcanic Ash Detection, Preparedness for Transportation), a start-up company out of UAF. They provide real-time decision support tools, consultancy services to evaluate potential ash impact on day-to-day operations and advise on how to analyze remote sensing data for real-time hazard assessment.

Peter has Bachelor of Science (BSc, Hons): Geophysical Sciences and Masters of Science (MSc): Atmospheric Sciences degrees, both from the University of East Anglia ([UEA](https://www.uea.ac.uk/)) (<https://www.uea.ac.uk/>), UK. In 2003, he earned his doctoral degree (PhD) in Remote Sensing of Volcanoes from the University of [Reading](http://www.reading.ac.uk/) (<http://www.reading.ac.uk/>), UK and in 2005 moved to Alaska as a Post-doctoral researcher focused on volcanic eruptions and hazard analysis. He became a UAF Faculty member in 2009, and has since transitioned to Associate Research Professor. From 2008–2013, Peter worked at the Alaska Volcano Observatory ([AVO](https://avo.alaska.edu/)) (<https://avo.alaska.edu/>) in its remote sensing team where he often worked as the Duty Remote

Sensing Scientist with 24/7 on-call responsibilities to provide advice and observations of changes in volcanic activity. From 2008 to 2013, Peter was the Americas and Caribbean representative for the World Organization of Volcano Observatories ([WOVO](http://www.wovo.org/)) (<http://www.wovo.org/>) and recently (2018) joined the leadership team for the American Geophysical Unions Art and Science Community.

Peter's research interests include volcanic ash cloud modeling, use of unmanned aircraft systems for geoscience applications, connecting emergency managers with real-time remote sensing data, developing decision support tools, real-time monitoring of volcanic activity, and remote sensing of volcanic processes. His aim is to provide tools and products for hazard assessment and risk mitigation. Peter sees that navigating, monitoring, and observing of the new Arctic are critical components of current and future Arctic science. Remote sensing data provides an ideal tool to map the Arctic landscape to detect and track natural hazards that can affect local infrastructure and population centers. Peter is privileged to serve within ARCUS as a board of director and sees that ARCUS plays an important role in bringing together scientists from across the Arctic to advance our understanding of the region and the need for transdisciplinary research that builds on the capacity and capabilities of all those living and working in the circumpolar north.

Meet the Board of Directors – Kaare Sikuaq Erickson

Kaare Erickson was elected to the Board of Directors in 2017 and his term expires in 2020.

Kaare Sikuaq Erickson is the North Slope Science Liaison for the [Ukpeaġvik Inupiat Corporation](https://uicalaska.com/)

(<https://uicalaska.com/>) in Utqiagvik (formerly Barrow), Alaska. As liaison, Kaare represents hundreds of Arctic researchers to thousands of Arctic residents, and vice versa; he represents thousands of Arctic residents to hundreds of Arctic researchers. Day-to-day responsibilities include providing advice to Arctic research projects during all phases of their projects and facilitating outreach and engagement initiatives in communities in the Arctic. Kaare

currently leads several outreach and engagement initiatives on the North Slope, such as the annual BARC Science Fair that includes three days of family friendly events, barbeques, and evening presentations in Utqiagvik; the Soup N' Science lunchtime seminar series, which provides a positive space for Arctic residents and researchers to share time, food, and ideas; and an Arctic science outreach tour that includes a series of community meetings, field schools, and school visits in several villages in the Arctic each spring.

Both Arctic residents and Arctic researchers are alarmed by the extreme climatic and seasonal changes the Arctic is facing. The value of Arctic research has never been greater as the world needs to know the threats we are currently facing. The threats are not only serious to Arctic residents, these are threats against all humans. We need to come together, both Arctic residents and Arctic researchers, and fight together as allies against our common threats and challenges.



It is becoming clear that Arctic research is moving towards more convergence, transdisciplinary, and co-produced research that is actionable and that makes tangible and positive social impacts. Organizations such as ARCUS, who bring coordination and communication to the Arctic research community, are crucial for Arctic research to continue moving forward.

Kaare spends his free time with his beautiful wife Roxanne, and his amazing daughters Kaia Rae (12) and Chanel "Teeny Tiny" (9), and his mischief son/hunting partner Keok JD (3). Kaare and his family feel most at home when they are on the land and water hunting, fishing, gathering, travelling, and LIVING.

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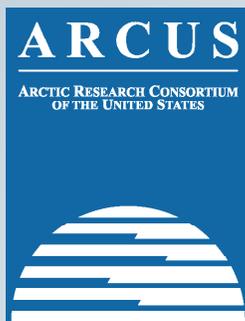
Editors: Betsy Turner-Bogren, Lisa Sheffield Guy, and Helen Wiggins

Contributors: H. Aderman, M. Audibert, J. E. Balestrery, S. Bowden, S. Chong, R. Delgado, K.S. Erickson, W. Ermold, J. Fahnestock, L. Farquharson, D. Forcucci, A. Jensen, B.M. Jones, D. Kadko, B. P. Kelly, H. Kent, W. Landing, M. LaValley, B. Leonard, C. Maio, B. Myers, K. Oliver, T. Osborne, A. Petrov, I. Rigor, J. Rohde, V. Romanovsky, B. Schmoker, C. Semnacher, L. Sheffield Guy, B. Turner-Bogren, C. Tweedie, P. Webley, H.V. Wiggins, and M. Xiao.

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Arctic Research Consortium of the
United States
3535 College Road
Suite 101
Fairbanks, AK 99709 USA
Phone: 907-474-1600
Fax: 907-474-1604
info@arcus.org