



NNA REU 2026

Mariculture in Valdez, AK

Hannah Bogdan, Naomi Krause, Sabrina Nauriaq
Dunphrey, and Tommy Sheridan
02/05/2026

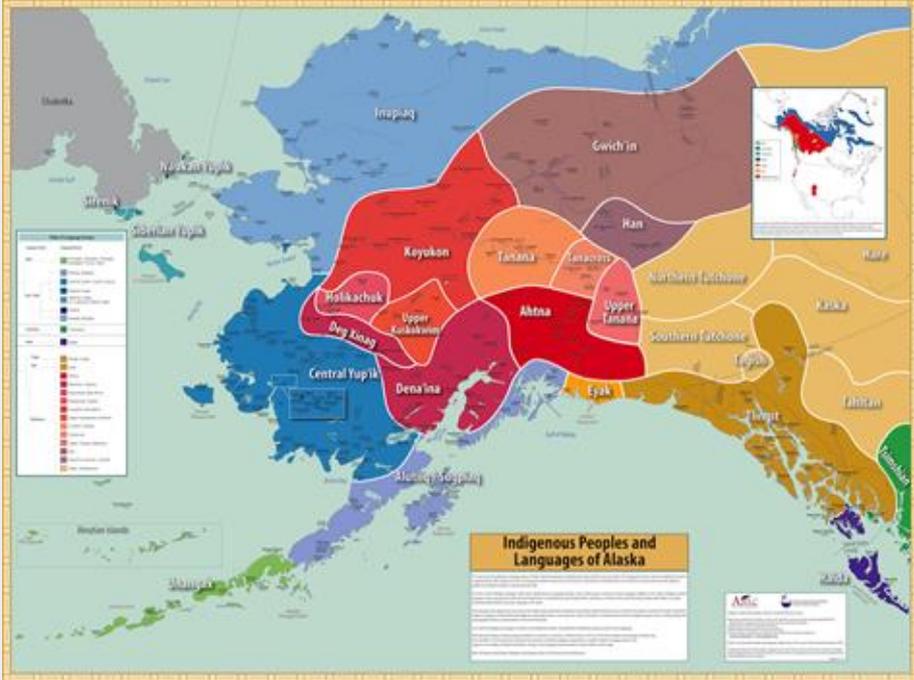


Land Acknowledgement

We acknowledge that we are presenting on the traditional lands of the Dena'ina people.

We acknowledge that we live on the traditional lands of the Dena'ina, Tlingit and Eyak.

We acknowledge that our research projects are on the traditional lands of the Alutiiq/Sugpiaq and Troth Yeddha', a traditional gathering place for the Lower Tanana Dene



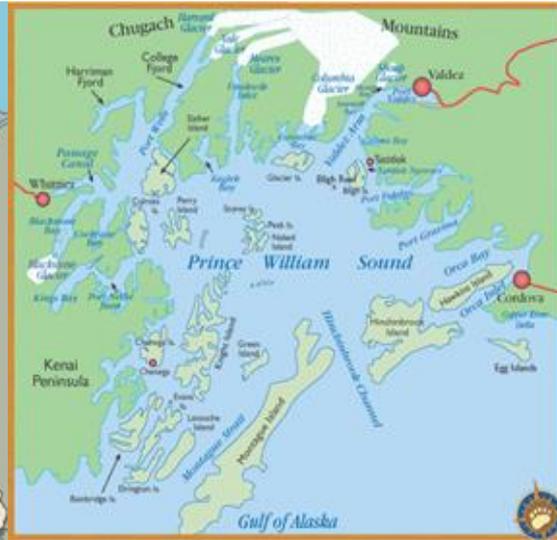
Kelp & Oyster Farming in the Prince William Sound



01

LOOKING ACROSS THE BAY HEADING OUT TO SAMPLE

Valdez, AK





SAMPLING LOCATION



POTENTIAL FARM SITE IN JACK BAY

Google Earth

- ### Test Sites:
- Port Valdez
 - Sawmill Bay
 - Jack Bay
 - Galena Bay



Tommy holding the Site Assignment Toolkit



Getting ready to sample, Tommy and Amanda

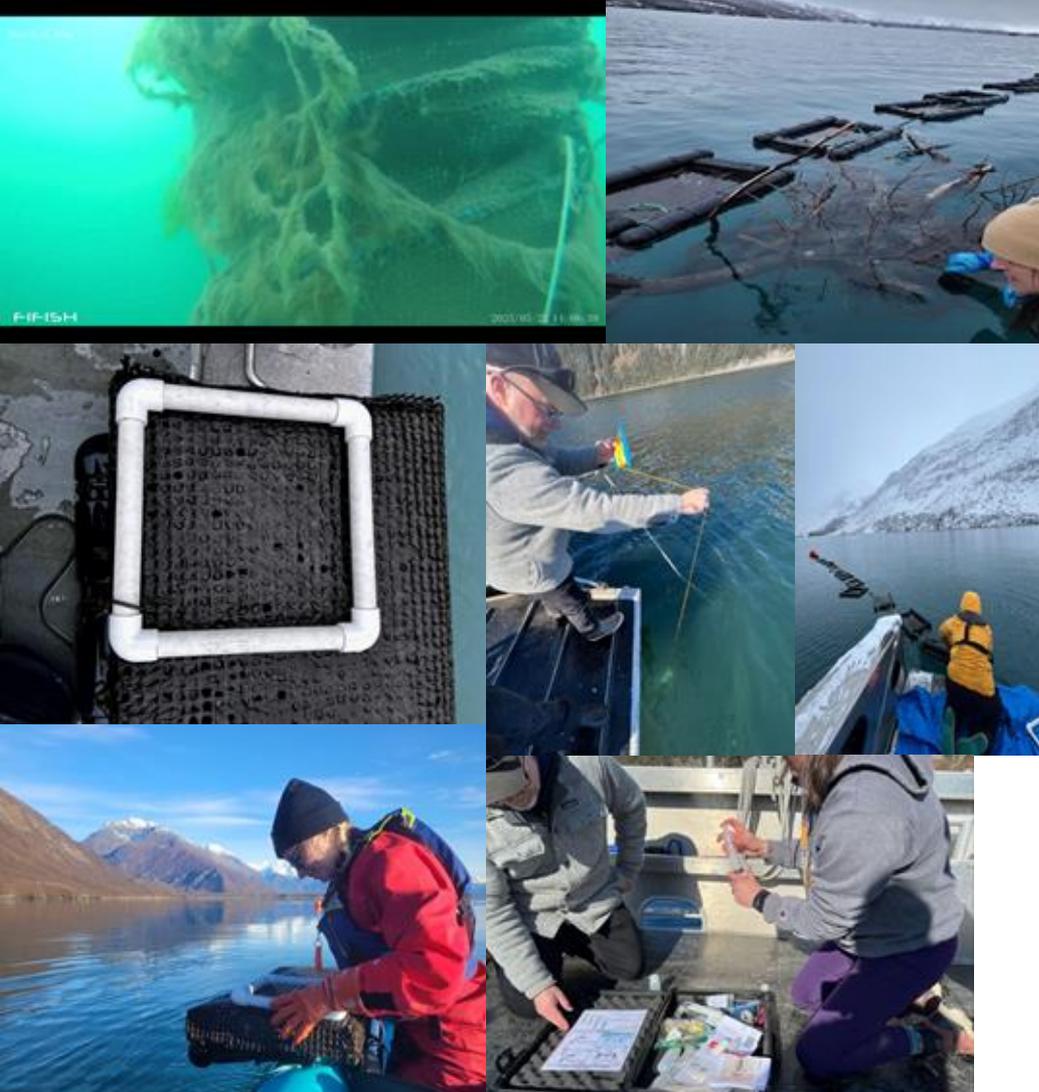


Hannah collecting water samples for UAF OARC

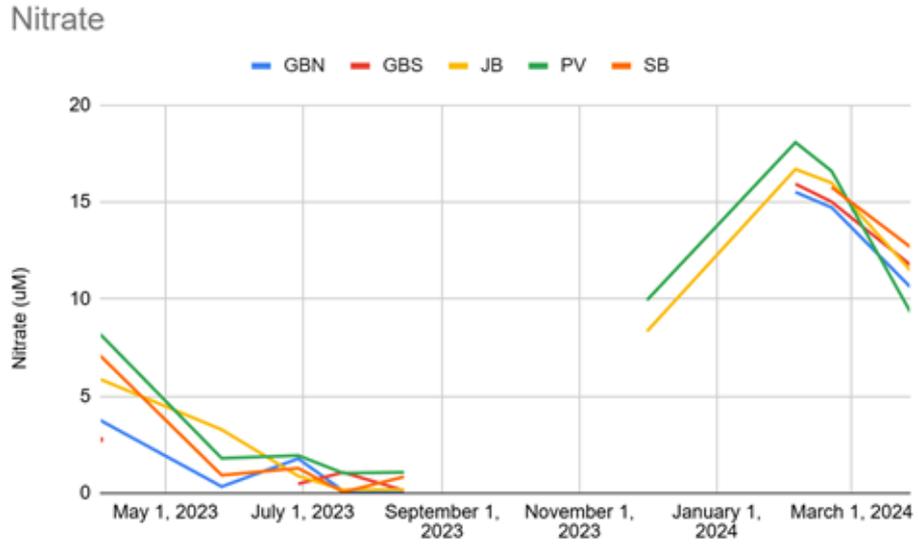


What Goes into Picking a Site?

- Gas cost
- Mileage
- Ease to get to year round
- Water sampling data
- Depth
- Biofouling
- How busy the area is
- Environmental conditions
- Possible Hazards
- Regulations
- Historical significance
- Educational Opportunities



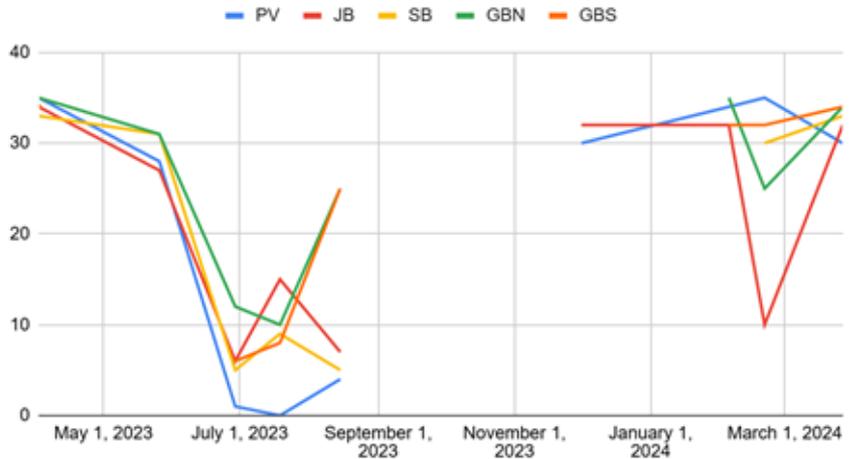
Site Selection Data



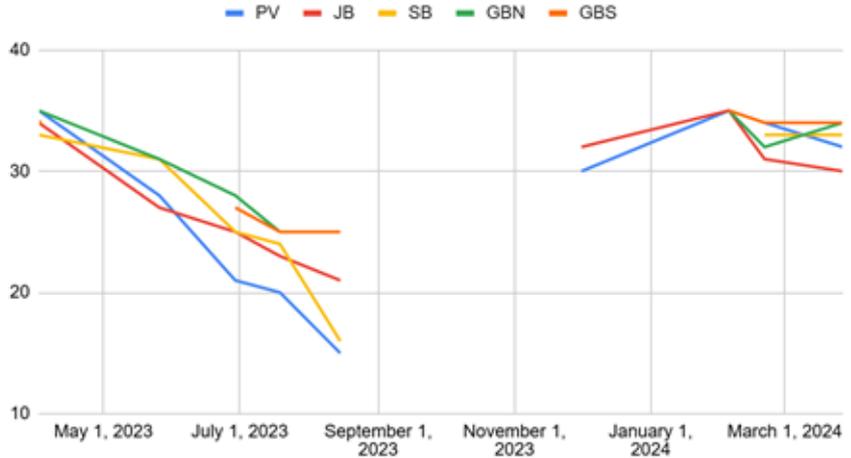
- Water Sampling: Nitrate, Nitrite, Phosphate, Silicate, Ammonium, Temperature, Salinity, Turbidity, Flow Velocity, Flow Direction, and Weather.
- The data varies as there was a time we were unable to get out on the water
- High Nitrate levels fuels HAB (16ppm or lower)
- Site selection was chosen with Valdez Native Tribe



Salinity at surface



Salinity at 3 m



Site Selection Data Pt. 2

- Salinity between 14-28 ppt is optimal for oysters
- Testing salinity at different depths can show freshwater input, density, stratification, circulation, etc.
- Freshwater lens
- Kelp and Oysters need lots of nutrients to grow
- Jack Bay was chosen due to historical significance, proximity, and conducive mariculture production water quality parameters.



Depth: 2.91m

How will our kelp be utilized?



Partnership with the Automated Construction and Advanced Materials Lab (ACAM) at UAF

ACAM

- Using local materials in construction
- Kelp as a construction material

My ACAM Contact–Jessica McKay

Want to manufacture kelp building materials such as tiles, drywall, bricks and insulation? - jismckay@alaska.edu



ARCTIC INFRASTRUCTURE
Development Center
INSTITUTE OF MARITIME TECHNOLOGIES

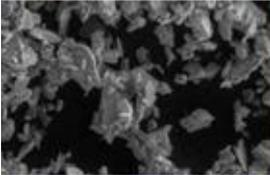
FIND US ONLINE
aide.uaf.edu





Feasibility of Glacial Rock Flour (GRF) as an alternative cementitious binder through Alkali Activation (AA) and Mariculture ByProducts (MBP) for use as a Viscosity Modifying Agent (VMA)

Jessica McKay, Civil Infrastructure Graduate Student
Supervisor: Nima Farzadnia, PhD, Director of the Automated Construction and Advanced Materials Lab



SEM image of the raw Looe River (Yaluk, AK) GRF sample

In Situ Resource Utilization: Glacial Till as a Portland Cement Replacement

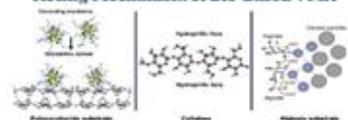
Fine local sediments, such as glacial till, are promising primary materials for developing alternative cements through alkali activation. These sediments can form geopolymeric binders with characteristics equivalent to—or even superior to—those of Portland cement. Such geopolymers have a wide range of applications, including soil stabilization, pavement construction, manufactured aggregates, and other infrastructure and construction uses.

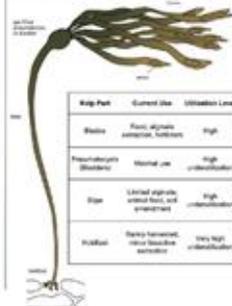
In Situ Resource Utilization: Alaskan Kelp for Alaskan Building Products

The Alaska Mariculture Industry produces hundreds of thousands of pounds of kelp each year. The key challenge within this industry, currently, is finding large scale uses for the kelp that is being grown. Kelp has been used (and is being used) in building products such as roof thatching, insulation, and as partial replacements for Portland cement. Leveraging existing methodologies and developing new ones for use with Alaskan kelp byproducts has high potential across the construction industry, particularly in cementitious composite materials and concrete 3-D printing.

Kelp components utilization level vs. potential use for Bio-VMA

Acting Mechanism of Bio-Based VMA





Kelp Part	Current Use	Utilization Level	Potential for Bio-VMA
Blade	Food, wildlife attraction, feedlots	High	Substrate for algae cultivation, CO2 sequestration
Phenanthrene (Bladder)	Normal use	High	Material - brick production and screens
Stipe	Animal agriculture waste feed, soil enrichment	High	Strong - roof insulation, polycondensation reactions by alkali activation
Holdfast	Sticky treatment, other livestock feed	Very High	Material - cementitious composite materials and exterior plaster

The content of this presentation is based on the research supported by the Alaska Sea Grant, funded by the National Science Foundation, and the University of Alaska, Fairbanks. The information contained herein is for informational purposes only and does not constitute an offer of any financial product or service.

Partnership with the Automated Construction and Advanced Materials Lab (ACAM) at UAF

Cement replacement

- Locally sourced glacial flour, coal fly ash, kelp, and **imported calcium oxide (lime)**

Can Alaska manufacture our own lime?



ARCTIC INFRASTRUCTURE
Development Center
UNIVERSITY OF ALASKA
INSTITUTE OF MARITIME TECHNOLOGIES

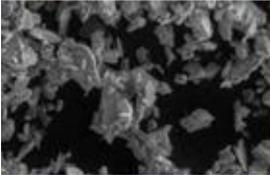
FIND US ONLINE
aids.uaf.edu





Feasibility of Glacial Rock Flour (GRF) as an alternative cementitious binder through Alkali Activation (AA) and Mariculture ByProducts (MBP) for use as a Viscosity Modifying Agent (VMA)

Jessica McKay, Civil Infrastructure Graduate Student
Supervisor: Nima Farzadnia, PhD, Director of the Automated Construction and Advanced Materials Lab



SEM image of the raw Looe River (Yaluk, AK) GRF sample

In Situ Resource Utilization: Glacial Till as a Portland Cement Replacement

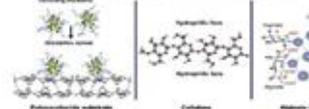
Fine local sediments, such as glacial till, are promising primary materials for developing alternative cements through alkali activation. These sediments can form geopolymeric binders with characteristics equivalent to—or even superior to—those of Portland cement. Such geopolymers have a wide range of applications, including soil stabilization, pavement construction, manufactured aggregates, and other infrastructure and construction uses.

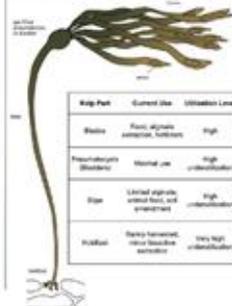
In Situ Resource Utilization: Alaskan Kelp for Alaskan Building Products

The Alaska Mariculture Industry produces hundreds of thousands of pounds of kelp each year. The key challenge within this industry, currently, is finding large scale uses for the kelp that is being grown. Kelp has been used (and is being used) in building products such as roof thatching, insulation, and as partial replacements for Portland cement. Leveraging existing methodologies and developing new ones for use with Alaskan kelp byproducts has high potential across the construction industry, particularly in cementitious composite materials and concrete 3-D printing.

Kelp components utilization level vs. potential use for Bio-VMA

Acting Mechanism of Bio-Based VMA



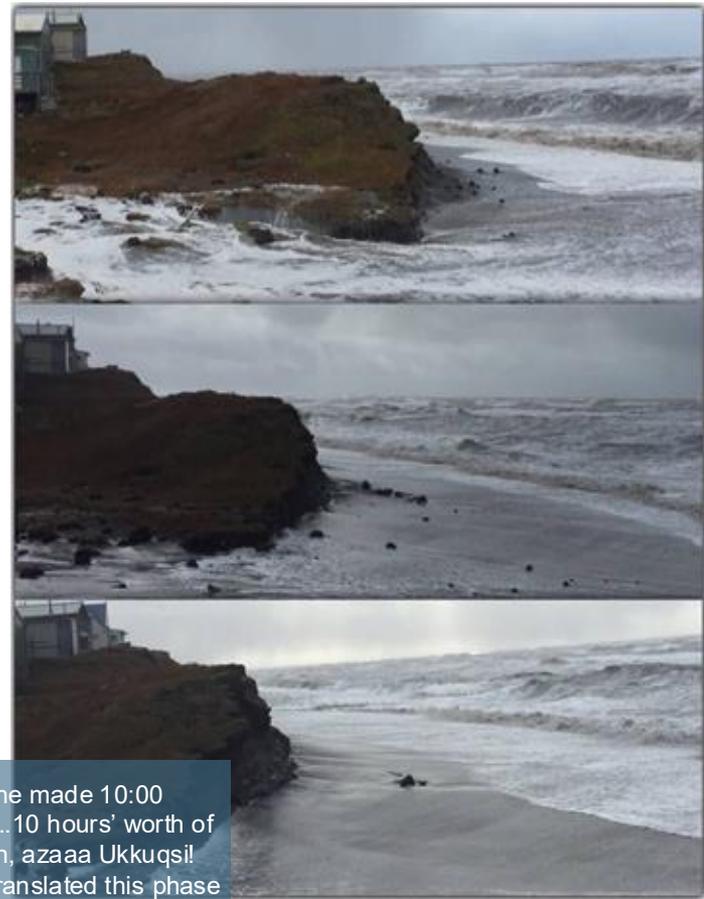


Kelp Part	Current Use	Utilization Level	Potential for Bio-VMA
Blade	Food, wildlife attraction, feedlots	High	Medium - low potential after high-level utilization (20% or higher)
Pseudostem (Stipeless)	Wood, jam	High	Medium - low potential after high-level utilization
Stipe	Animal agriculture feed, soil enrichment	High	Strong - high potential after high-level utilization
Holdfast	Slack, fertilizer, other livestock feed	Very High	Medium - strong potential after high-level utilization

The content of this presentation is based on research supported by the Alaska Department of Natural Resources and the University of Alaska Fairbanks. The content is not intended to be used for any other purpose without the permission of the University of Alaska Fairbanks.

Why would Alaska want to manufacture our own lime?

- Climate change is causing **usteq**
 - Requires imported cement to adapt
 - high cost and high CO₂ emissions
 - Lime is important in construction and cement



This one made 10:00 news.... 10 hours' worth of erosion, azaaa Ukkuqsil (Billy translated this phase as "OMG!") (Billy Adams AAOXH, 2015)
Location: Utqiagvik



Photo: Hump Island Ketchikan oysters

How do we manufacture lime?

Simplified Process:

Calcination



(Thermal decomposition of calcium carbonate to produce **calcium oxide (lime)**)

What are local CaCO_3 sources?

- Oyster shells
- Bones
- Limestone

Manufacturing Lime from Oyster Shells

Simplified Process:



- Oyster shells are 95% or greater CaCO_3
- Reduction of CO_2 emissions
- Economic diversification
- Shorten supply chains

Considerations and Challenges Moving Forward

Facility location:

- Near calcium-rich waste sources and energy source
- Informed community consent to facility placement

Oyster shell recycling:

- Develop strategies
- Do we have enough?

Community involvement:

- Increase awareness of where building materials come from
- How can we positively involve Native Alaskan communities?



Na'en ch'ghednu' (We are working outdoors)

Working with Alaska Native communities and people in a good way

03

Introductions & Background

Introductions

- My introduction
- Why are introductions important?
 - Relationship building
 - Accountability

How does Mariculture tie into Alaska Native communities?

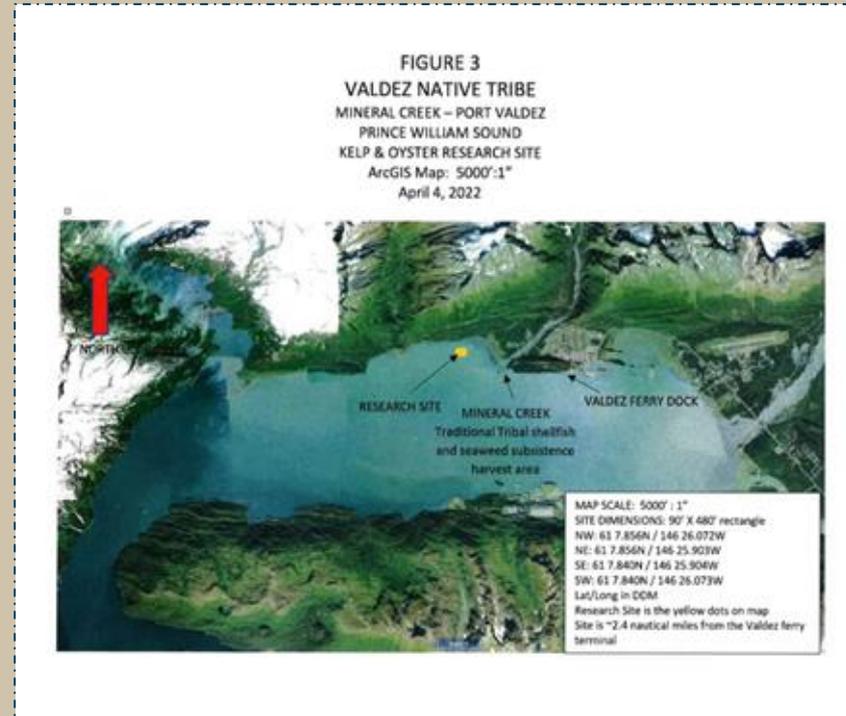
- People in the Mariculture industry want to work with Alaska Native communities in a good way

Kelp & Oyster Farming in the Prince William Sound

- Previously worked with Valdez Native Tribe, would like to continue working with Valdez Native Tribe in the future

Automated Construction and Advanced Materials Lab (ACAM)

- Lots of experience working with Alaska Native rural communities and is committed to continuing to work with them in the future



A framework for co-production of knowledge in the context of Arctic research



The outer ring: Tools for undertaking research that build equity

The action circle (inner ring): Represents different parts of the research process

“Our Indigenous communities contain incredible knowledge. They are of their lands and waters. Their existence is an expression of the interconnectedness of all things. Reciprocity, humility, and respect for beings we coexist with and rely on are at the center of our Way of Life. Customary laws and unwritten protocols exist in each community around the sharing of knowledge. Relationship building and recognition of parallel and equal knowledge systems is critical.”

Lisa Navraq Ellanna

(Katirvik Cultural Center Director; King Island Inupiaq)

“Learning Together”: Braiding Indigenous and Western Knowledge Systems to Understand Freshwater Mussel Health in the Lower Athabasca Region of Alberta, Canada



Final guiding framework (Bald eagle—protector; sweetgrass or sage braid and tobacco—ceremonial protocols [smudging, offering]; field notes—qualitative tools; field water quality probe—quantitative tools)

Free, Prior & Informed
Consent

Respect

Ethical

Common Themes



Reciprocity

Relationship

Sovereignty

Challenges & Solutions

Challenge: Lack of knowledge about Native and remote/rural communities

Solutions:

- Education
- Building relationships

Challenge: Understanding how Tribes work

Solutions:

- Education
- Respecting tribal sovereignty

Challenge: Innovation fatigue

Solutions:

- Understanding communities' histories
- Building relationships



Here is a picture of Hannah taking percent cover at the VNT oyster farm

Conclusions and future direction

- Our why, revisited
- Honored past work (PWSC, VNT)
- Made new connections (ACAM)
- Established framework for 2027
- ...and beyond!



CHIN'AN/QUYANA/ THANK YOU!

Interested in knowing more??
Reach out to Tommy
Sheridan!
Email:
tmsheridan@alaska.edu



Works Cited Page

