INTERLABORATORY VALIDATION OF AN ENZYME LINKED IMMUNOSORBENT ASSAY FOR DOMOIC ACID IN BLUE MUSSELS (*Mytilus edulis*) AT THE ALUTIIQ PRIDE MARINE INSTITUTE

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ABSTRACT

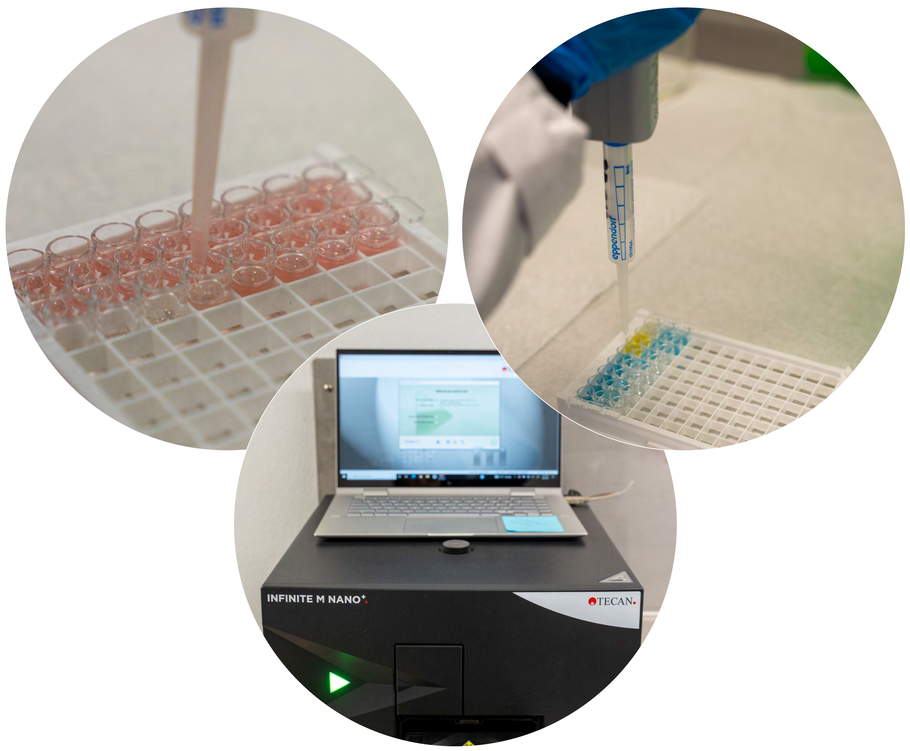
Amnesic shellfish poisoning (ASP) is a potentially fatal syndrome caused by domoic acid (DA), which is produced by diatoms in the genius *Pseudo-nitzschia*. Currently, there is not a state run harmful algal bloom (HAB) monitoring program for subsistence and recreational harvesters in Alaska, putting users at great risk of illness and even death. Regional Tribal networks are taking the initiative to collect critical phytoplankton and shellfish toxin data that can be used to inform subsistence harvesters of real-time toxin risk levels at key shellfish harvest sites. The Chugach Regional Resources Commission (CRRC) is a Tribal consortium representing the seven Tribes in the Prince William Sound, Lower Cook Inlet, and Lower Copper River regions of Alaska. CRRC operates the Alutiiq Pride Marine Institute (APMI) in Seward; as part of its Chugach Regional Ocean Monitoring (CROM) program, APMI has worked to validate the commercially available enzyme-linked immunosorbent assay (ELISA) [Eurofins] for detection of DA in blue mussels (*Mytilus edulis*). Samples were collected from Afognak Beach in Seward after a *Pseudo-nitzschia* bloom. Through collaboration with the University of Alaska Fairbanks (UAF) College of Fisheries and Ocean Sciences (CFOS), DA was extracted from *M. edulis* tissue and toxin levels were measured in both CRRC and UAF CFOS laboratories, outputs were then tested for accuracy and parallelism, which both met adequate requirements for validation. APMI plans to use this assay for both regular monitoring of shellfish toxins and future research applications.

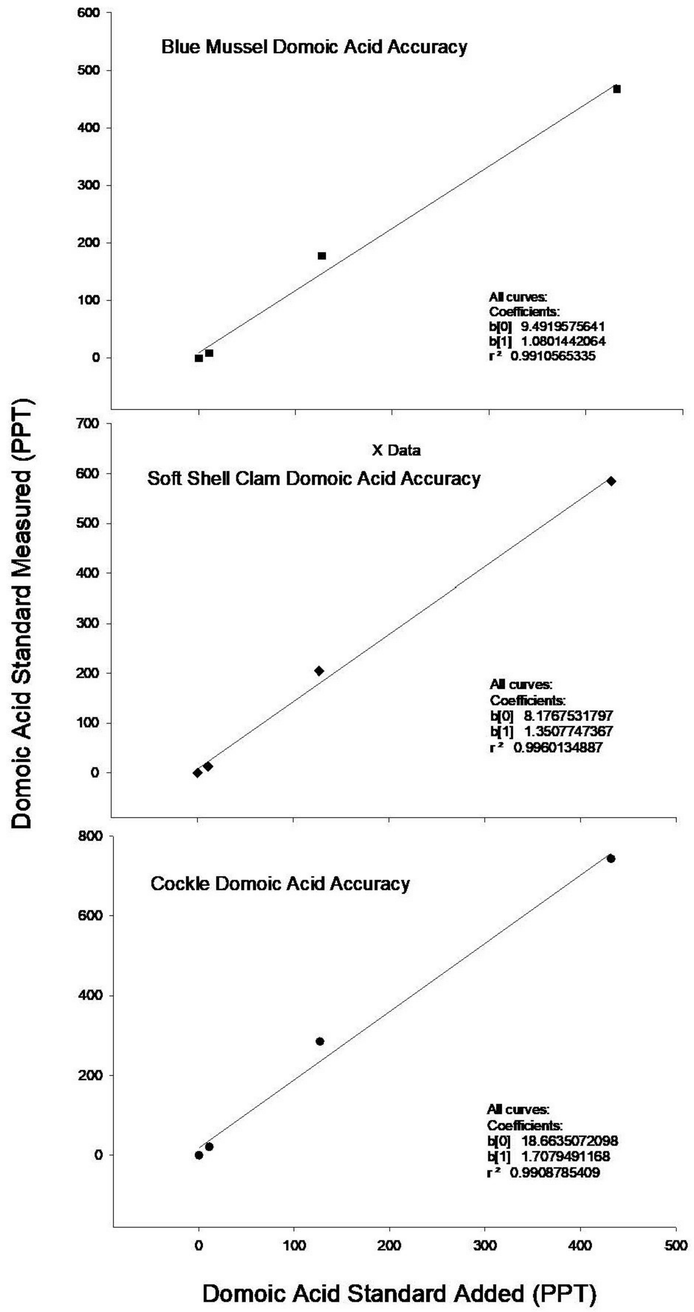
METHODS

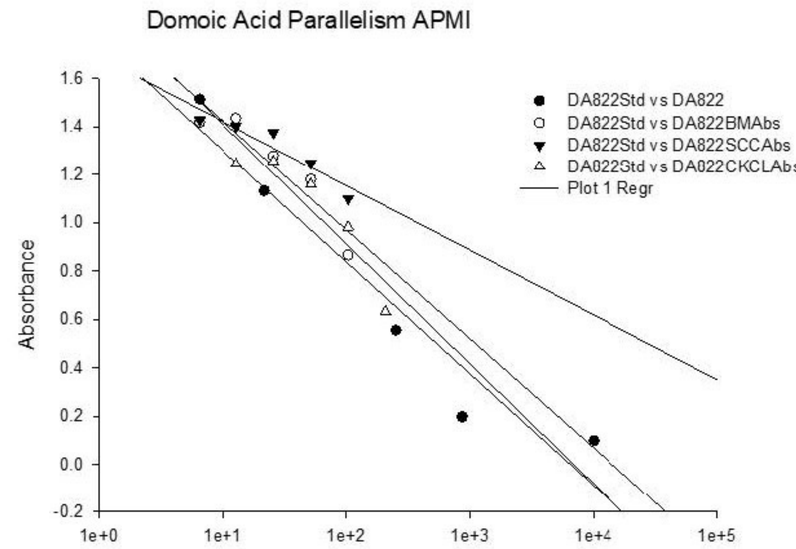
Extraction
- DA was extracted from sample homogenate using 50% methanol.

Parallelism
- Serial dilutions
  - 4:1, 2:1, 1:1, 1:2, 1:4
- Compared slopes of:
  - Absorbance vs. relative dose
  - Known-concentration standards

Accuracy
- Standard curve spiked with a [4:1] DA extract
- spiked standards were assayed next to their respective standard curve
- Curves of biotoxin concentration vs known standard were assessed for slope and coefficient of determination
- Measured samples were plotted as total concentration vs. known standards







Domoic Acid Standard Curve Absorbance
Coefficients:
b[0] 1.7642787149
b[1] -0.4634824242
r² 0.9306095729

Blue Mussels Absorbance:
Coefficients:
b[0] 1.8741257929
b[1] -0.4517157823
r² 0.8615359088

Soft Shell Clams Absorbace
Coefficients:
b[0] 1.6889114765
b[1] -0.2680131587
r² 0.8785173288

Cockle Absorbance:
Coefficients:
b[0] 1.906996839
b[1] -0.4973922936

RESULTS

Parallelism: Results for *M. edulis* were plotted as the absorbance vs. log of the standard mass. Parallelism results met validation requirements for detecting DA; serially diluted extractions produced slopes that were parallel with the standard curve and had variation below 10% between all slopes.

Accuracy: assessments for *M. edulis* met the requirements to validate the detection of DA; All extractions plotted as total concentration vs. known standard concentration produced slopes within the acceptable range of 0.7 -1.3, and all linear regression resulted coefficients of determination between 0.98 and 0.99, indicating that the sample matrix did not significantly impact the percent recovery.

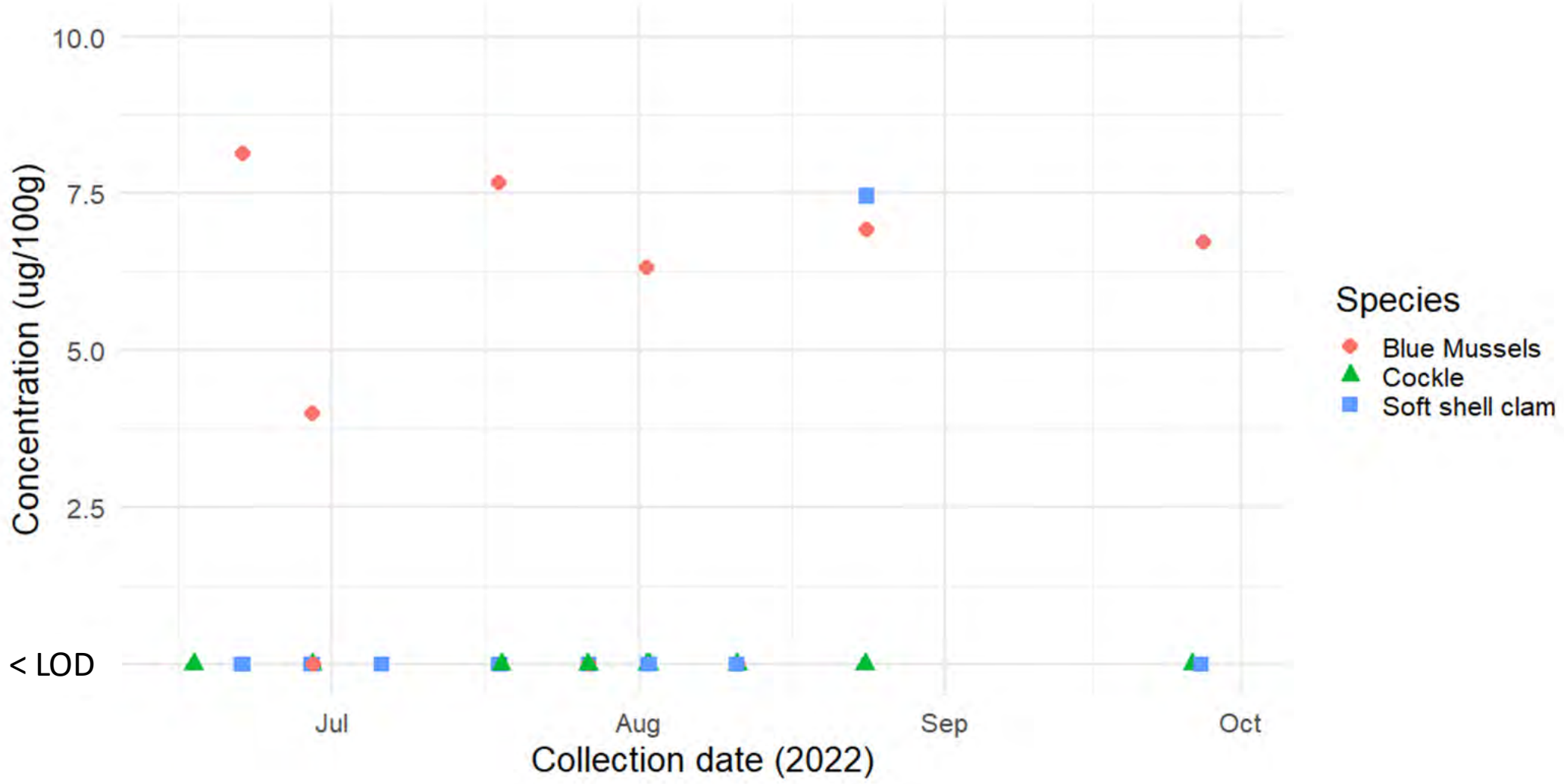
ACKNOWLEDGEMENTS

This Project was funded under awards from the USGS Climate Adaptation Science Center and the Exxon Valdez Oil Spill Trustee Council.

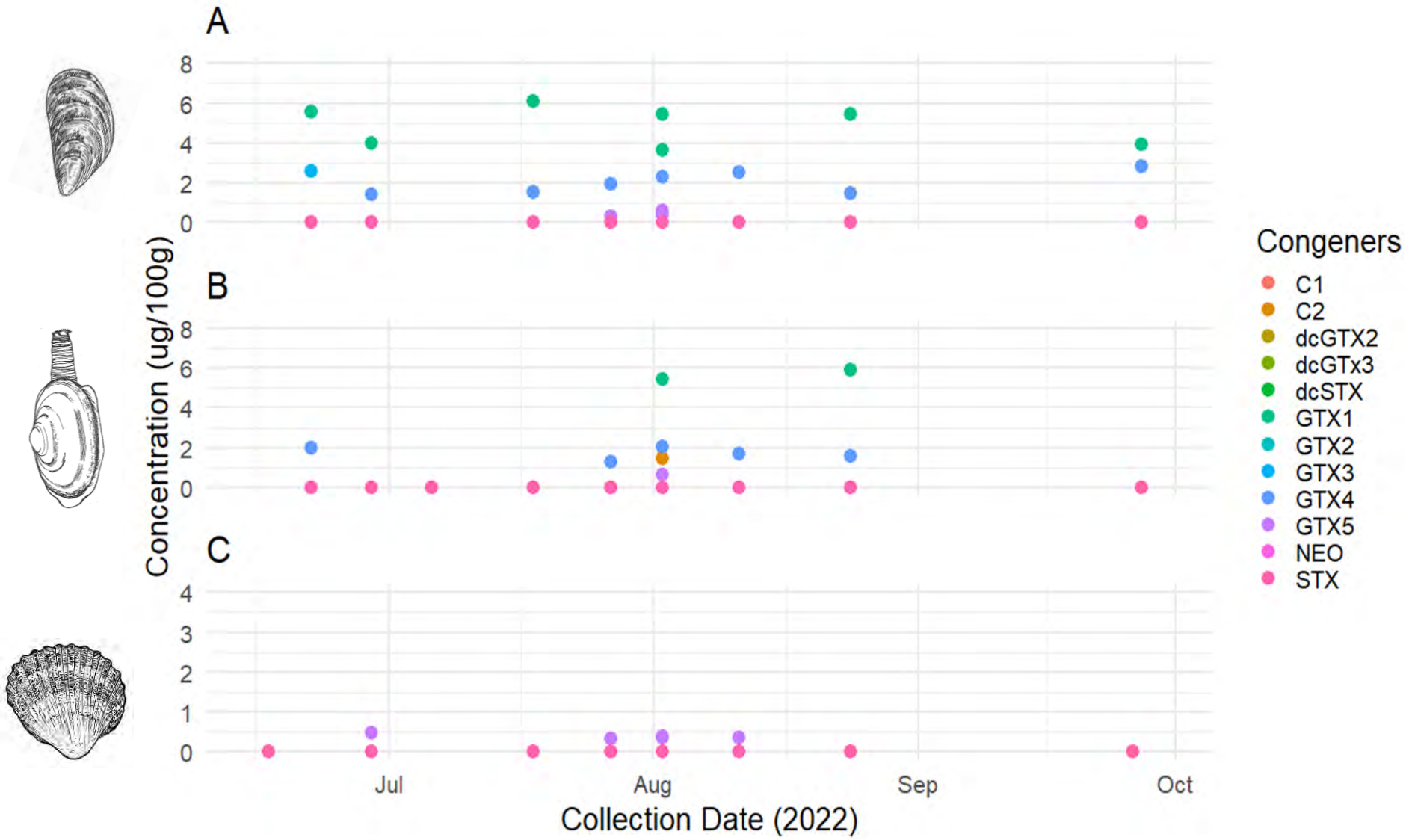
Annette Jarosz

Evaluation of Paralytic Shellfish Toxin Congeners in Resurrection Bay Bivalves

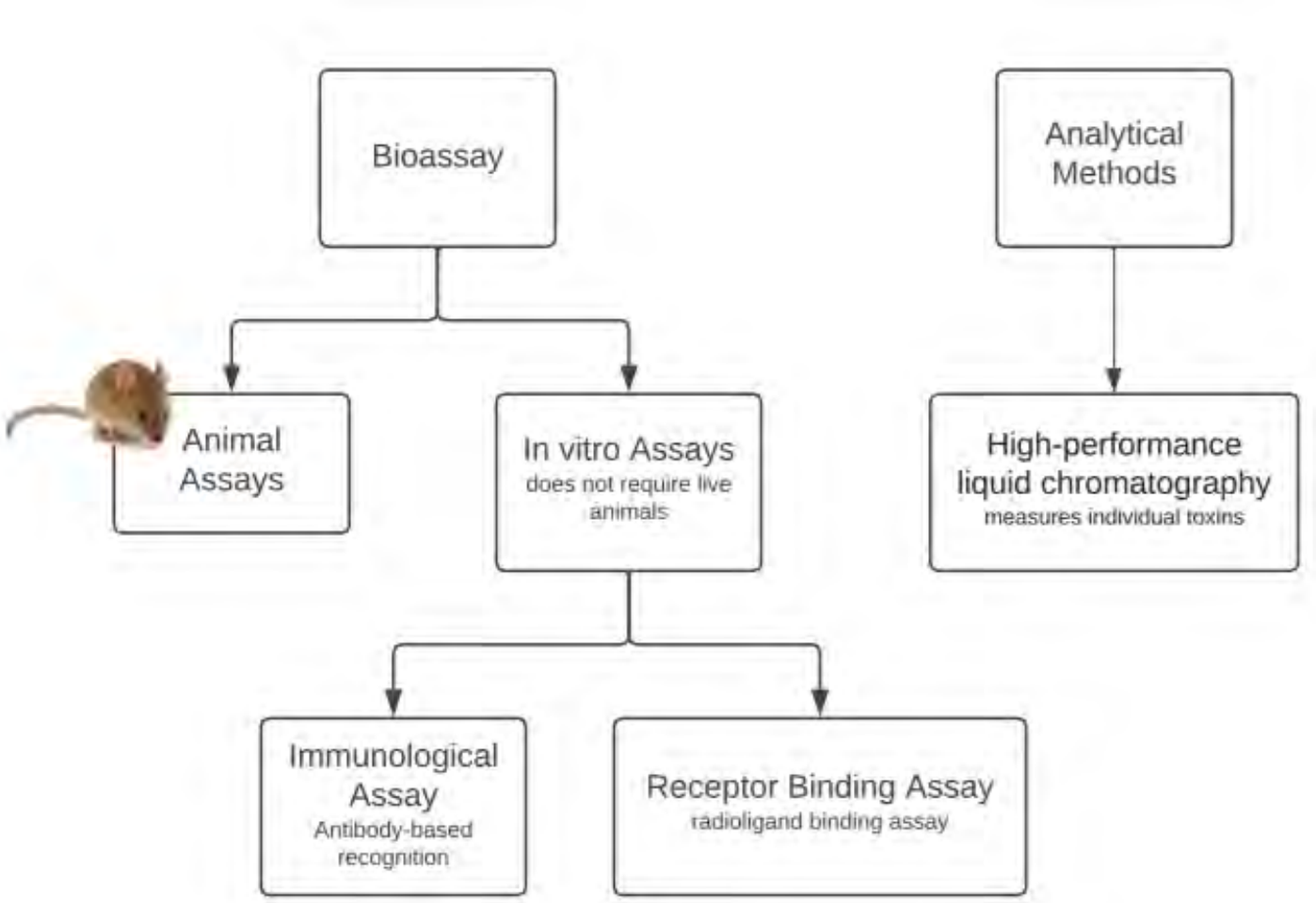
Total toxicity



The congener toxin profile



Why is this important?



<u>HPLC</u>

Pro: can identify 12 congeners and total toxicity*

Con: expensive, takes over a month to get results, must ship to anchorage, lower sensitivity

<u>RBA</u>

Pro: open source, cheaper than HPLC, can do in-house, measures total toxicity

Con: open source, radioactive, does not ID congeners

<u>ELISA</u>

Pro: PSP kits, cheaper than HPLC, can do in-house

Con: only sensitive to STX, does not measure total toxicity

Next steps

• Use Receptor Binding Assays (RBAs) to identify how size relates to total toxicity in butter clams (*Saxidomus gigantea*).

• Use the same homogenate from HPLC experiment and run it using Enzyme-linked Immunosorbent Assay and RBA to compare methods.

Evaluation of Paralytic Shellfish Toxin Congeners in Resurrection Bay Bivalves

Annette Jarosz[1], Emily Mailman[1], Shannon Atkinson[2], Maile Branson[1]

1. Chugach Regional Resources Commission
2. University of Alaska Fairbanks

Abstract

- From April to September of 2021 and 2022, three different bivalve species: blue mussels (*Mytilus edulis*), soft-shell clams (*Mya arenaria*), and cockles (*Clinocardium nuttallii*) (n = 83) were collected from Resurrection Bay.
- Samples were analyzed by the Alaska Department of Environmental Conservation using high-pressure liquid chromatography (HPLC).
- This method can identify 12 different paralytic shellfish toxin congeners.
- Understanding which congeners are most abundant in the local ecosystem can help evaluate risk level of shellfish harvest.

Preliminary Results

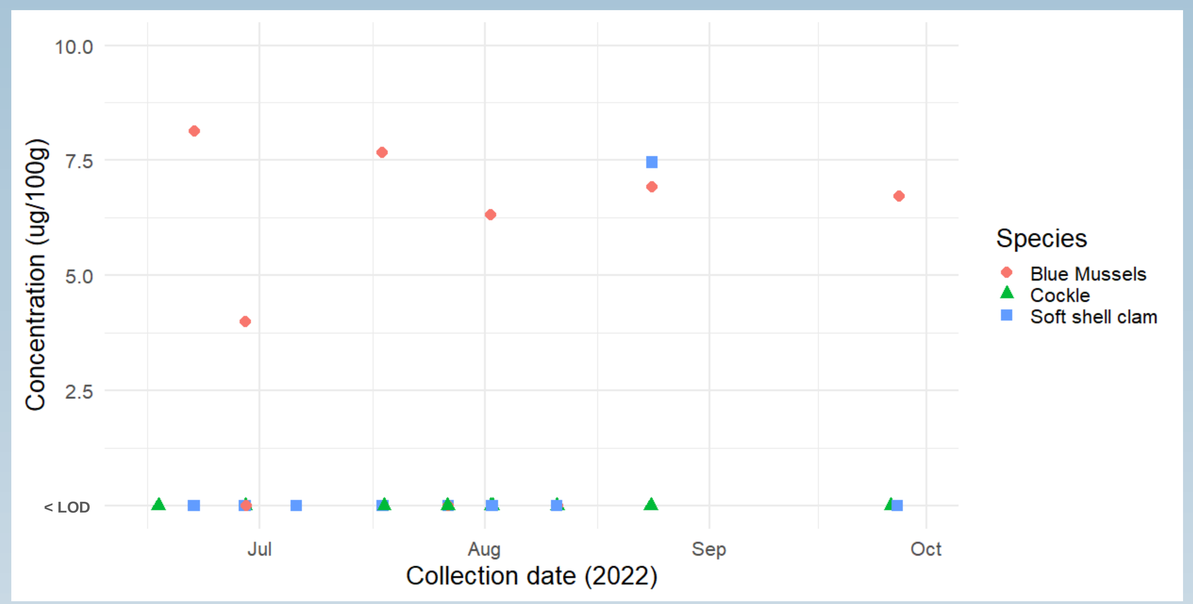


Figure 1: The total paralytic shellfish toxin concentration in blue mussels, cockles and softshell clams.

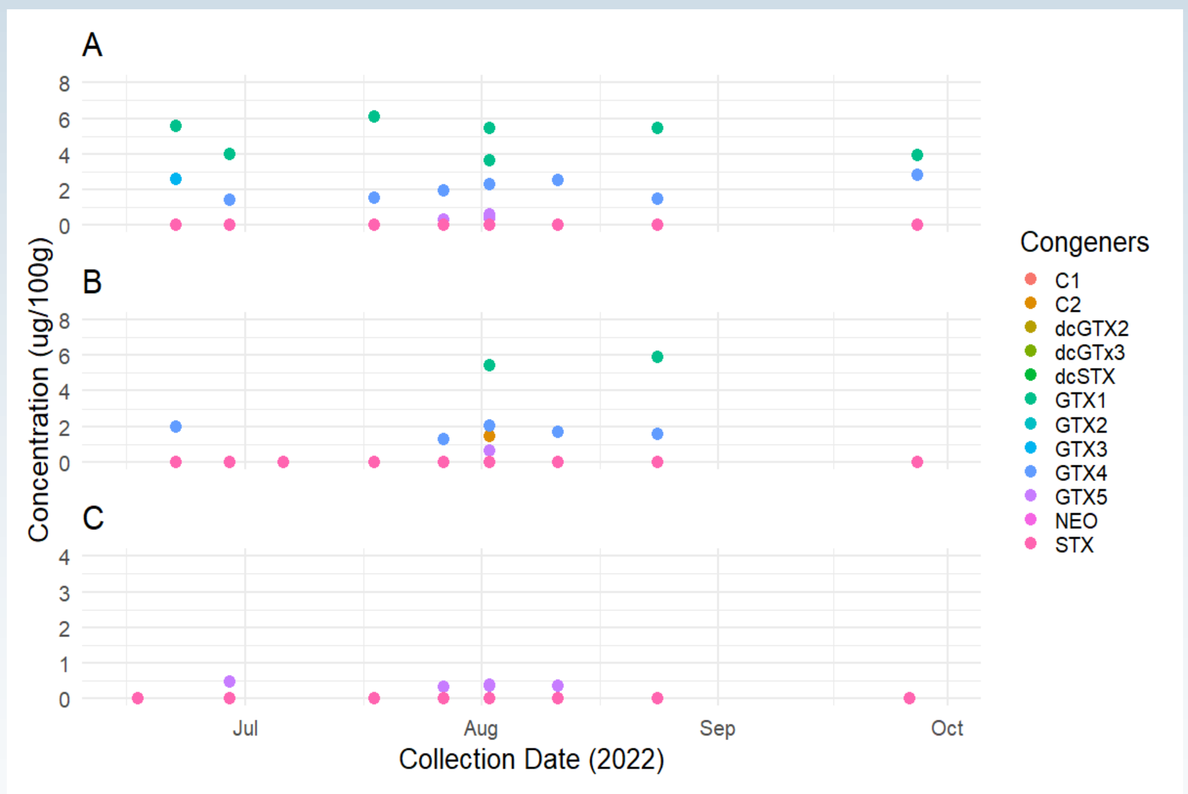


Figure 2: The congener toxin profile of (A) blue mussels, (B) softshell clams and (C) cockles.

Future research

- Use Receptor Binding Assays (RBAs) to identify how size relates to total toxicity in butter clams (*Saxidomus gigantea*).
- Use environmental data to identify relationships between toxicity, salinity, and temperature.
- Use the same homogenate from HPLC experiment and run it using Enzyme-linked Immunosorbent Assay and RBA to compare methods.

Acknowledgments

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Intra-laboratory and Inter-laboratory Validations for Saxitoxin Detection using ELISA

Annette Jarosz[2], Alison Carl[1], Dustin Carl[1], Shannon Atkinson[3], Kendall Marshburn[3], Maile Branson[2]

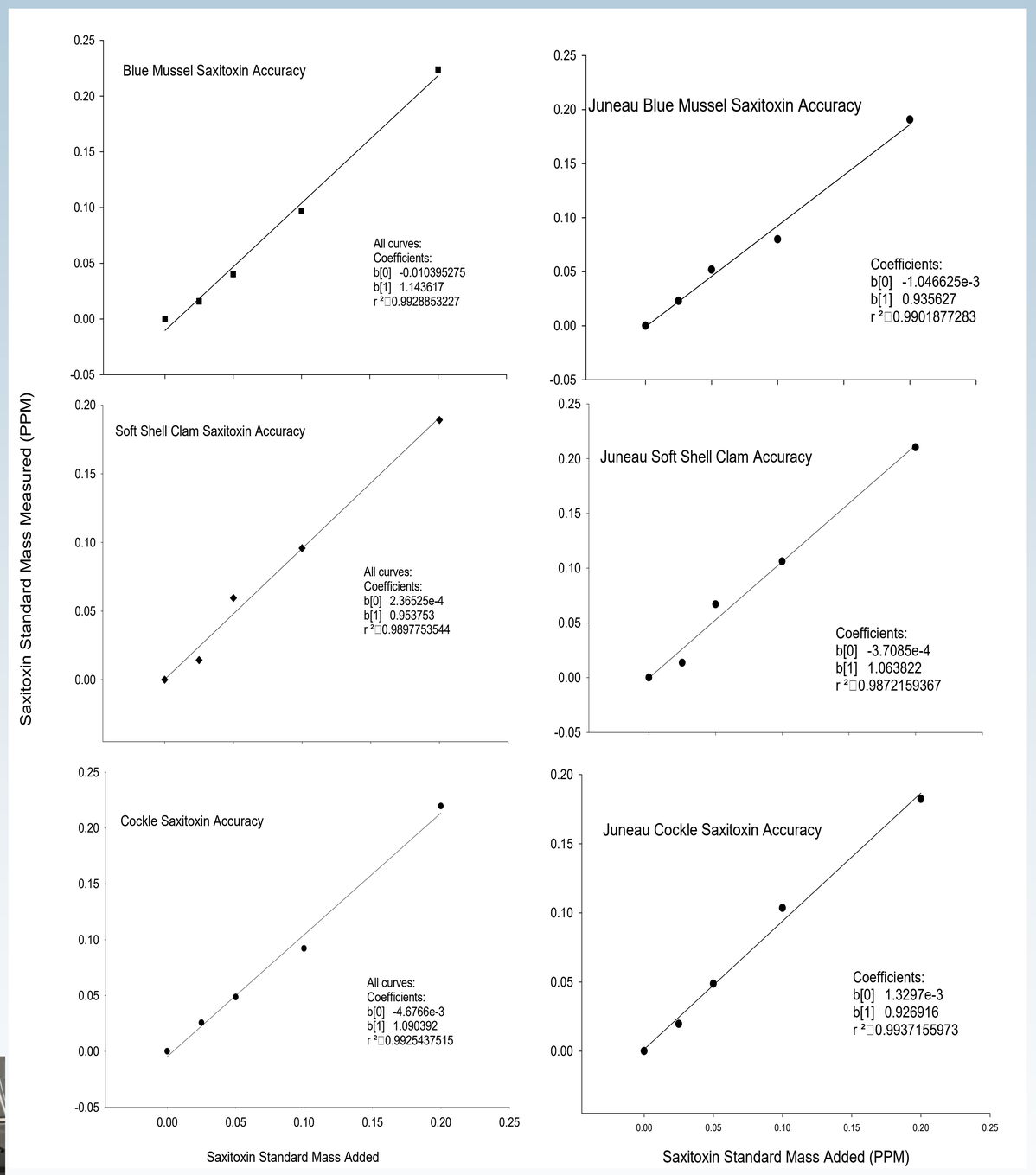
1. Chugach Regional Resources Commission
2. Alutiiq Pride Marine Institute
3. University of Alaska Fairbanks

Abstract

- Establish a paralytic shellfish poisoning toxin detection lab using enzyme-linked immunosorbent assays as the method of detection.
- Members from the APMI lab traveled to Juneau and learned the proper ELISA technique.
- Members from the UAF Lab traveled to APMI to facilitate and oversee the accuracy and parallelism tests for three bivalve species.
- The UAF team used the same extract from the APMI validation test and ran the same test in their Juneau lab.
- The accuracy and parallelism tests in both labs were successful and demonstrated a successful intra-laboratory and inter-laboratory validation for saxitoxin detection using ELISAs.

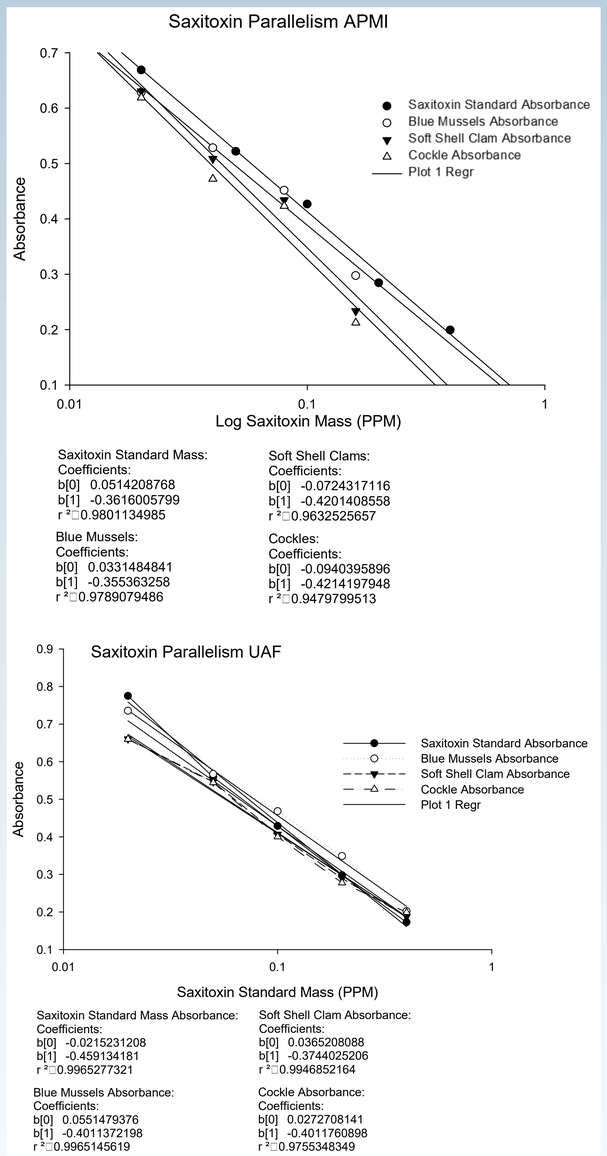
Accuracy

- Tests for potential interference within shellfish sample that are independent of specific antigen-antibody binding.
- R^2 should equal 1 +/- 0.1



Parallelism

- Serial dilutions of shellfish samples are used in conjunction with standard curve to determine precision.
- R^2 should be within +/-0.1 units of the standard absorbance



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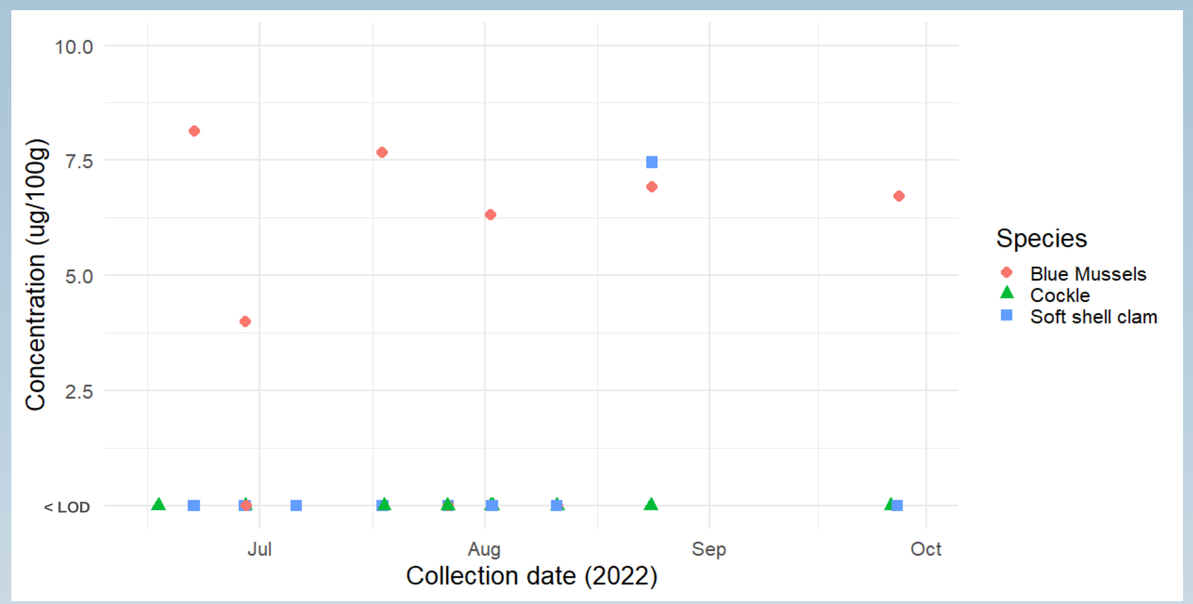

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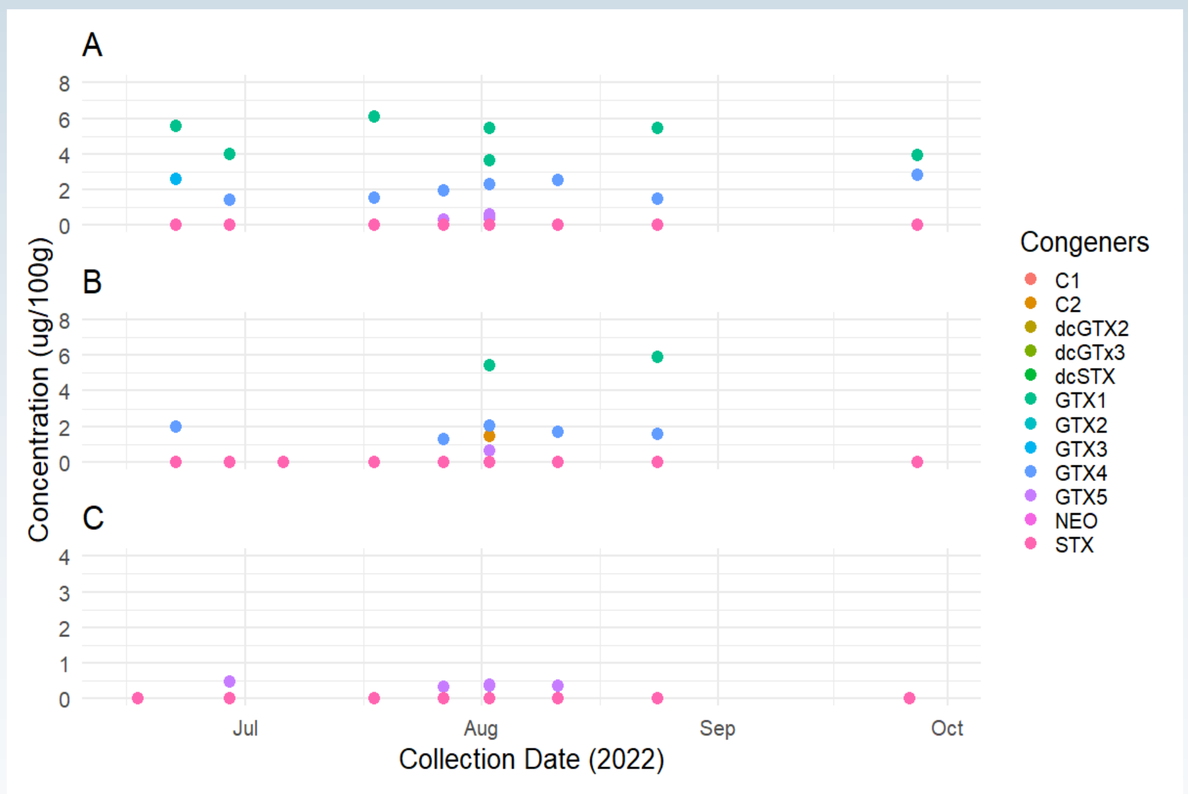

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Team Project Review and Update: Chugach Regional Resource Commission

A Tribal Organization Focusing on Natural Resource Issues affecting the Chugach Region of Alaska

Message from CRRC's Chairman of the Board and Port Graham Village Council Chief

Patrick Norman

"Our Tribes in the past have been nomadic which is an English term, but the way you explain it is exactly how our people were. We were not stuck to where we are now. We were spread out all the way from Prince William Sound to Lower Cook Inlet and other places and got drawn into being in these one places during the Russian period. Then, when the canneries came around more permanent residences were established where we are now. But even during that time, our elders were still going out and doing their traditional hunting and harvesting in the spring and summer even though they were needed in the canneries. They maintained those traditions of going where they knew the animals and sea life were. The elders were so in tune with everything they used, they knew when to move to another area to let those resources build back up over time. That type of management of the resources that we use contradicts what we must follow now with the western culture where it is based on the western model based on my experiences of dealing with it. I look at it as they feel they have a need to control what we Natives are doing the same way they do with their own western cultures. So, it is an ongoing issue on trying to get them to understand our traditional way of doing it and them not fully accepting that yeah, we did manage these resources and accept that when we make a request under their regulations to try and move our harvesting practices back to more traditional times is hard. Trying to get those things understood has been an ongoing issue for us. If they just understand that what we are asking is our observational look at the resources and try to get the best for our people."

CHUGACH REGIONAL RESOURCES COMMISSION:

7

WHO ARE WE?

- A consortium of seven Southcentral Alaskan Tribes in Prince William Sound and Lower Cook Inlet
- Established to manage natural resources and engage in both terrestrial and marine science across the region on behalf of Tribes
- Operate the Alutiiq Pride Marine Institute in Seward AK

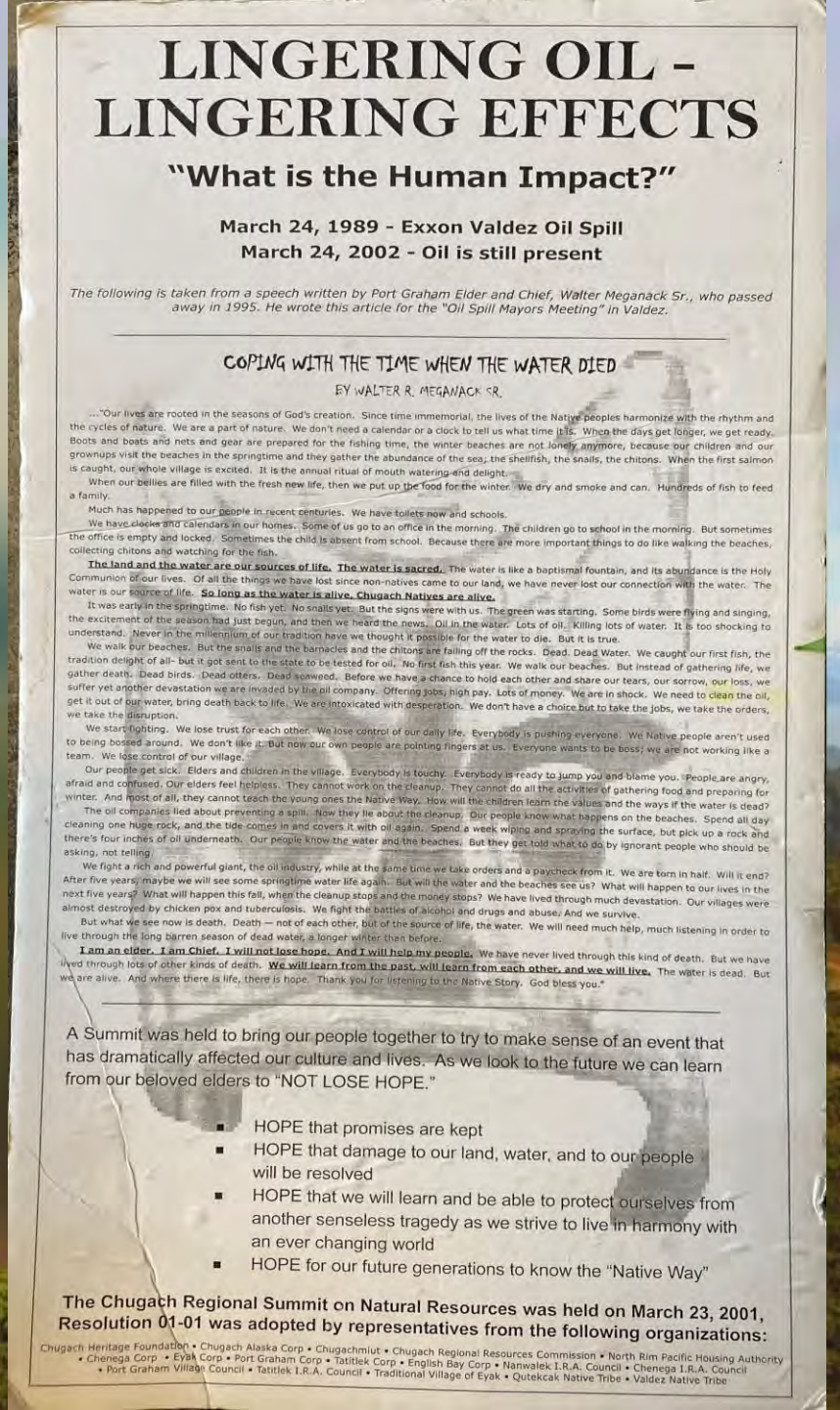

Valdez
Tatitlek
Eyak
Prince
William
Sound
Cook Inlet
Qutekcak
Chenega
Resurrection
Bay
Kachemak
Bay
Nanwalek
Port Graham
Gulf of Alaska

Project Involvement

The identity of the Chugach Region is shaped around our subsistence resources.

Subsistence will have recovered when injured resources used for subsistence are healthy and productive and exist at prespill levels, and when people are confident that the resources are safe to eat. One indication that recovery has occurred is when the cultural values provided by gathering, preparing, and sharing food are reintegrated into community life (EVOS Trustee Council 1999: 27).

There is still oil in the substrate of the shoreline (EVOS TC 2022)



LINGERING OIL - LINGERING EFFECTS

"What is the Human Impact?"

March 24, 1989 - Exxon Valdez Oil Spill
March 24, 2002 - Oil is still present

The following is taken from a speech written by Port Graham Elder and Chief, Walter Meganack Sr., who passed away in 1995. He wrote this article for the "Oil Spill Mayors Meeting" in Valdez.

COPING WITH THE TIME WHEN THE WATER DIED

BY WALTER R. MEGANACK SR.

..."Our lives are rooted in the seasons of God's creation. Since time immemorial, the lives of the Native peoples harmonize with the rhythm and the cycles of nature. We are a part of nature. We don't need a calendar or a clock to tell us what time it is. When the days get longer, we get ready. Boots and boats and nets and gear are prepared for the fishing time, the winter beaches are not lonely anymore, because our children and our grownups visit the beaches in the springtime and they gather the abundance of the sea; the shellfish, the snails, the chitons. When the first salmon is caught, our whole village is excited. It is the annual ritual of mouth watering and delight.

When our bellies are filled with the fresh new life, then we put up the food for the winter. We dry and smoke and can. Hundreds of fish to feed a family.

Much has happened to our people in recent centuries. We have toilets now and schools.

We have clocks and calendars in our homes. Some of us go to an office in the morning. The children go to school in the morning. But sometimes the office is empty and locked. Sometimes the child is absent from school. Because there are more important things to do like walking the beaches, collecting chitons and watching for the fish.

The land and the water are our sources of life. The water is sacred. The water is like a baptismal fountain, and its abundance is the Holy Communion of our lives. Of all the things we have lost since non-natives came to our land, we have never lost our connection with the water. The water is our source of life. **So long as the water is alive, Chugach Natives are alive.**

It was early in the springtime. No fish yet. No snails yet. But the signs were with us. The green was starting. Some birds were flying and singing, the excitement of the season had just begun, and then we heard the news. Oil in the water. Lots of oil. Killing lots of water. It is too shocking to understand. Never in the millennium of our tradition have we thought it possible for the water to die. But it is true.

We walk our beaches. But the snails and the barnacles and the chitons are falling off the rocks. Dead. Dead Water. We caught our first fish, the tradition delight of all- but it got sent to the state to be tested for oil. No first fish this year. We walk our beaches. But instead of gathering life, we gather death. Dead birds. Dead otters. Dead seaweed. Before we have a chance to hold each other and share our tears, our sorrow, our loss, we suffer yet another devastation we are invaded by the oil company. Offering jobs, high pay. Lots of money. We are in shock. We need to clean the oil, get it out of our water, bring death back to life. We are intoxicated with desperation. We don't have a choice but to take the jobs, we take the orders, we take the disruption.

We start fighting. We lose trust for each other. We lose control of our daily life. Everybody is pushing everyone. We Native people aren't used to being bossed around. We don't like it. But now our own people are pointing fingers at us. Everyone wants to be boss; we are not working like a team. We lose control of our village.

Our people get sick. Elders and children in the village. Everybody is touchy. Everybody is ready to jump you and blame you. People are angry, afraid and confused. Our elders feel helpless. They cannot work on the cleanup. They cannot do all the activities of gathering food and preparing for winter. And most of all, they cannot teach the young ones the Native Way. How will the children learn the values and the ways if the water is dead?

The oil companies lied about preventing a spill. Now they lie about the cleanup. Our people know what happens on the beaches. Spend all day cleaning one huge rock, and the tide comes in and covers it with oil again. Spend a week wiping and spraying the surface, but pick up a rock and there's four inches of oil underneath. Our people know the water and the beaches. But they get told what to do by ignorant people who should be asking, not telling.

We fight a rich and powerful giant, the oil industry, while at the same time we take orders and a paycheck from it. We are torn in half. Will it end? After five years, maybe we will see some springtime water life again. But will the water and the beaches see us? What will happen to our lives in the next five years? What will happen this fall, when the cleanup stops and the money stops? We have lived through much devastation. Our villages were almost destroyed by chicken pox and tuberculosis. We fight the battles of alcohol and drugs and abuse. And we survive.

But what we see now is death. Death — not of each other, but of the source of life, the water. We will need much help, much listening in order to live through the long barren season of dead water, a longer winter than before.

I am an elder. I am Chief. I will not lose hope. And I will help my people. We have never lived through this kind of death. But we have lived through lots of other kinds of death. **We will learn from the past, will learn from each other, and we will live.** The water is dead. But we are alive. And where there is life, there is hope. Thank you for listening to the Native Story. God bless you."

A Summit was held to bring our people together to try to make sense of an event that has dramatically affected our culture and lives. As we look to the future we can learn from our beloved elders to "NOT LOSE HOPE."

- HOPE that promises are kept
- HOPE that damage to our land, water, and to our people will be resolved
- HOPE that we will learn and be able to protect ourselves from another senseless tragedy as we strive to live in harmony with an ever changing world
- HOPE for our future generations to know the "Native Way"

The Chugach Regional Summit on Natural Resources was held on March 23, 2001, Resolution 01-01 was adopted by representatives from the following organizations:

Chugach Heritage Foundation • Chugach Alaska Corp • Chugachmiut • Chugach Regional Resources Commission • North Rim Pacific Housing Authority • Chenega Corp • Eyak Corp • Port Graham Corp • Tatitlek Corp • English Bay Corp • Nanwalek I.R.A. Council • Chenega I.R.A. Council • Port Graham Village Council • Tatitlek I.R.A. Council • Traditional Village of Eyak • Qutekcak Native Tribe • Valdez Native Tribe

CORaL Network Website

The identity of the Chugach Region is shaped around our subsistence resources.

- Provide information of Alaska Native research, community science activities, and outreach in the spill impacted region
- Digitize spill related missing data sources, visualizations from the Chugach region
  - i.e., Alaska Department of Fish and Game Traditional Ecological Knowledge handbook intended to assist both the EVOS researchers and community residents in working with TEK (Miraglia).
  - i.e., A Traditional Ecological Knowledge Database Reference Guide (Huntington)
  - i.e., Community Facilitator data
- Ensure the design and content of the CORaL website are optimized for the Alaska Native stakeholders
- Integrate/conect to CRRC and APMI's webpages

Community Sharing

- In close partnership with Chugachmiut Heritage Preservation, coordinate regular meetings between local Elders, community members, scientists, educators, and outreach specialists in communities
- Facilitate culturally relevant interactions for scientists to truly understand and comprehend the dimensions of the communities relevant to their field work
- Revisit, revamp, and relive then2002 EVOS Trustee Council funded WisdomKeepers Workshops (hosted in Tatitlek and Port Graham) Series for the Chugach region which promoted exchanges of information between the oil spill region's Tribes and researchers involved in GEM program projects.
  - Note: By Dr. Huntington's own assessment, "the [TEK] workshops, while useful, did not achieve their goals." (Huntington, et al. 2002:785). The workshop format may have been responsible in part. In most cases, the researchers gave formal presentations, similar to ones that might be given at a science conference. This sense of formality inhibited discussions from Tribal members during presentations. The researchers also experienced difficulties in communicating scientific information to a non-western science audience.

Cultural & Communication Competency Learning Opportunities

- Ensure increased representation of Traditional Ecological Knowledge
- Facilitate Alaska Native Relations courses for EVOS-funded project personnel

Intern Institute

- Help to increase participation in internship opportunities by local young adults
- Be available for the interns “core experiences”, i.e., provide space for learning at our Alutiiq Pride Marine Institute

Community Science & Outreach Resources

Organizational Outreach Venues and Expertise

- Annually providing one multi-day core course and four single-day short courses from their Alaska Native Relations training program.

USFWS Native American Policy and Alaska Native Relations Policy

Stephen Payton

PUBLISHED

Co-Management and Collaborative Management

Stephen Payton

PUBLISHED

Tribal Consultation

Stephen Payton

PUBLISHED

Village Protocols

Stephen Payton

PUBLISHED

Cross Cultural Communication

Stephen Payton

PUBLISHED

American Laws and Alaska Natives

Stephen Payton

PUBLISHED

Community Science & Outreach Resources

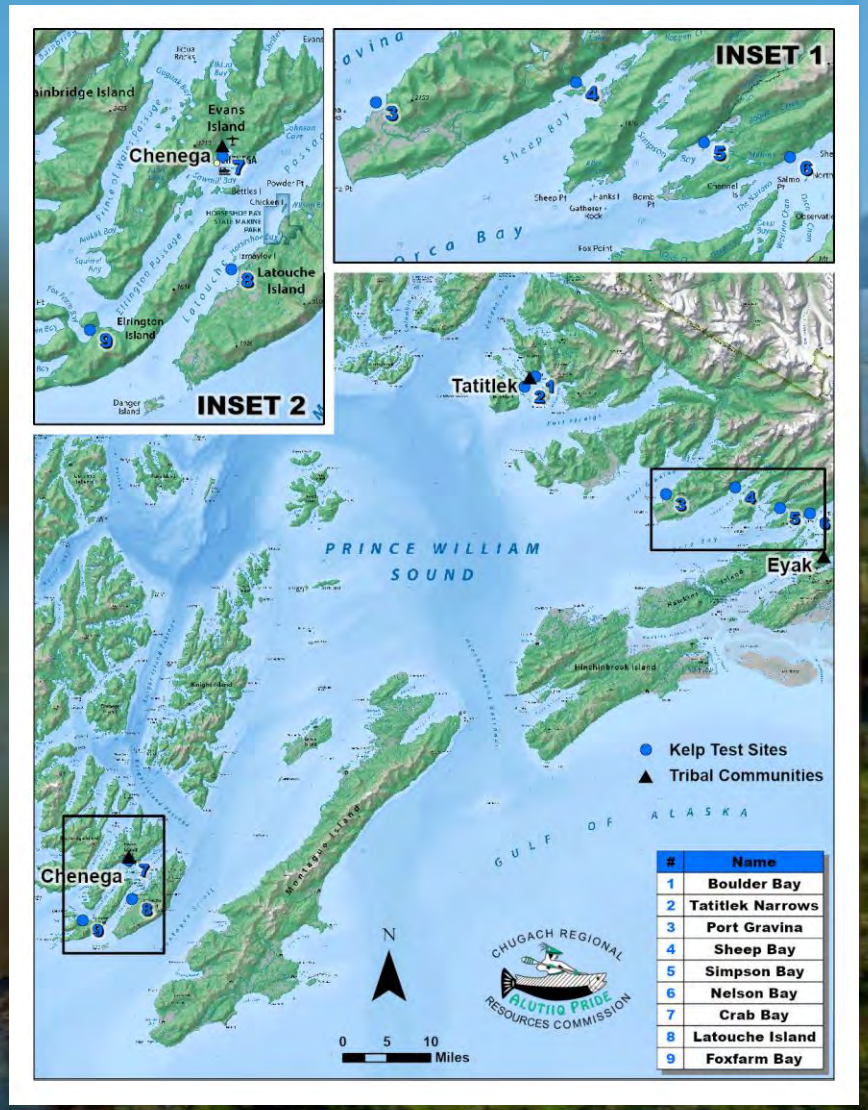
Networked Video Kiosk Stations

- Exxon Valdez Oil Spill Interviews & video development
- Photo & document scanning
- Kiosk to travel to Chugach communities and live at APMI for visitors

Community Science & Outreach Resources

Data Visualization App for Community Science

- App testing and guidance from Alaska Native kelp farmers and community member led environmental monitoring efforts into the app



Community Science & Outreach Resources

Community Pathways for Student Science [COMPASS]

- Utilize our relationships with the Cordova, Chugach, and Kenai Peninsula School Districts
- Develop curriculum, as requested
- Integrate with CRRC's Lisngaluni Gwani ("things are to be learned here") Internship Program, as applicable

History of Community Involvement - 1994

- Restoration Workshop Tribal Members made the point to the Trustees that the people who live, hunt, fish and gather in the spill area have knowledge that could provide valuable input in the efforts to better understand and restore the damage that resulted from the spill.
- Expressed the firm desire to be better informed of the Trustee Council's research and restoration efforts, and to be more involved in the decision-making process
- Community facilitators in Chenega, Tatitlek, and Port Graham, Nanwalek, Cordova, Valdez, Seward, and Seldovia, as well as additional community facilitators to represent the other two ANCSA regions within the oil spill impacted area, Kodiak Island and the Alaska Peninsula.
- Their duties included communicating Traditional Ecological Knowledge and local interests and concerns to project researchers and serving as the primary contact point between the villages and the Trustee Council on oil spill related issues.

History of Community Involvement -1996

- In 1996, the Trustee Council's invitation to submit proposals included a specific section on community involvement, which had been developed by a panel of Native community representatives in September 1995 (EVOS TC 1996a:15).
- *Create a forum for local traditional knowledge bearers and principal investigators to increase the exchange between culturally diverse groups in an effort to plan, implement and evaluate future restoration projects. Develop protocols to assist principal investigators and local communities in regard to contact with the communities and collection of traditional ecological knowledge, including methodology, data ownership, compensation, and data coordination (EVOS TC 1996b:7)*

History of Community Involvement

- As a result of this project and the Trustee Council's commitment to include TEK in EVOS related research, TEK became a buzzword for for principal investigators seeking to improve the chances of their EVOS project proposals getting funded. This situation presented a conundrum for the communities. On the one hand, community elders and other leaders found themselves overwhelmed with requests for their knowledge. On the other, it appeared to them that TEK was treated superficially, with little real inclusion for the Tribes. These interactions also raised concerns in the communities that they were giving away their traditional knowledge, thereby jeopardizing ownership and control over it, but not getting the involvement, respect, or power within the process that they were seeking.

Advocating for our Tribes

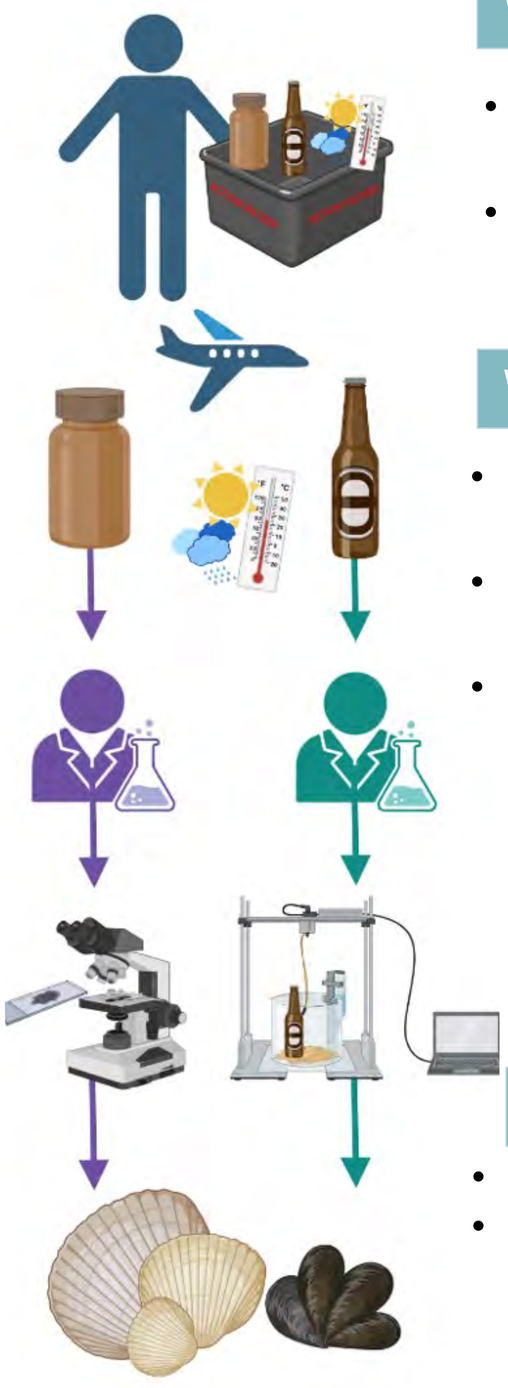
- Completion of a peer-reviewed paper titled: “Beyond Speculation: An Indigenous Alaskan People's Adaptation in the Face of an Ecological Catastrophe”

- Remembering that we are all here today because the people of the Spill Area endured a trauma we will never be able to comprehend. This project, the science, their journey - is not always going to be glamorous. It’s gun wrenching, it’s painful, the discussions will be uncomfortable but it’s a story we need to ensure is included as the civil settlement funds are spent down.

THANK YOU

Chugach Regional Ocean Monitoring Program
Tribal Capacity to Monitor for Subsistence Harvesting

Emily Mailman[1], Annette Jarosz[1], Maile Branson[1], Shannon Atkinson[2]
[1]Chugach Regional Resources Commission - Alutiiq Pride Marine Institute, [2]University of Alaska Fairbanks



What are Harmful Algal Blooms (HABs)

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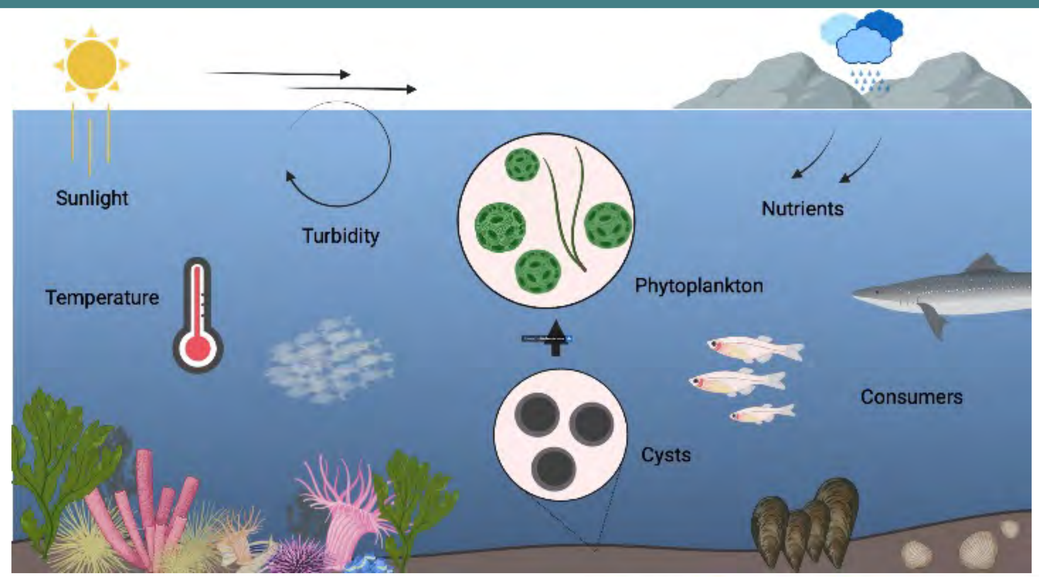
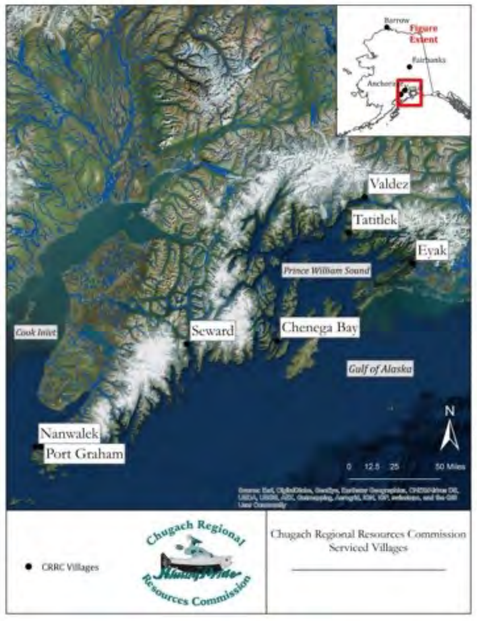


Where do HABs happen?

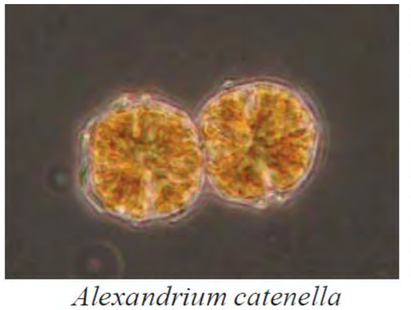
- We are monitoring HABs in the Chugach region – HABs have no geographical boundary
- HABs are expected to increase with warming ocean temperatures
- Limits resources for primary productivity and/or produces toxins such as Domoic acid and Saxitoxin

Name of Syndrome	Species and Toxin	Symptoms
Amnesic Shellfish Poisoning **(ASP)**	*Pseudo-nitzschia* **Domoic acid**	Short term memory loss
Paralytic Shellfish Poisoning **(PSP)**	*Alexandrium* Saxitoxin	Loss of motor control

Tatitlek Community Sampler Training; July 2022



Pseudo-nitzschia pungens



Alexandrium catenella

Why do we monitor them?

- HABs can cause ASP and PSP
- These are not zoonotic diseases however; these were added to the One Health Zoonotic Disease Prioritization list due to rising HAB occurrences in Alaskan coastal waters[1]
- Monitoring acts as an early detection system for communities

CRRC and APMI are not regulatory agencies and the consumption of wild shellfish in Alaska is up to consumer discretion. Commercially harvesting shellfish are regulated by the Department of Environmental Conservation and are considered safe for consumption. CRRC and APMI make no recommendations for harvest safety. If you believe you have consumed shellfish contaminated by harmful algal blooms reach out to your local health officials

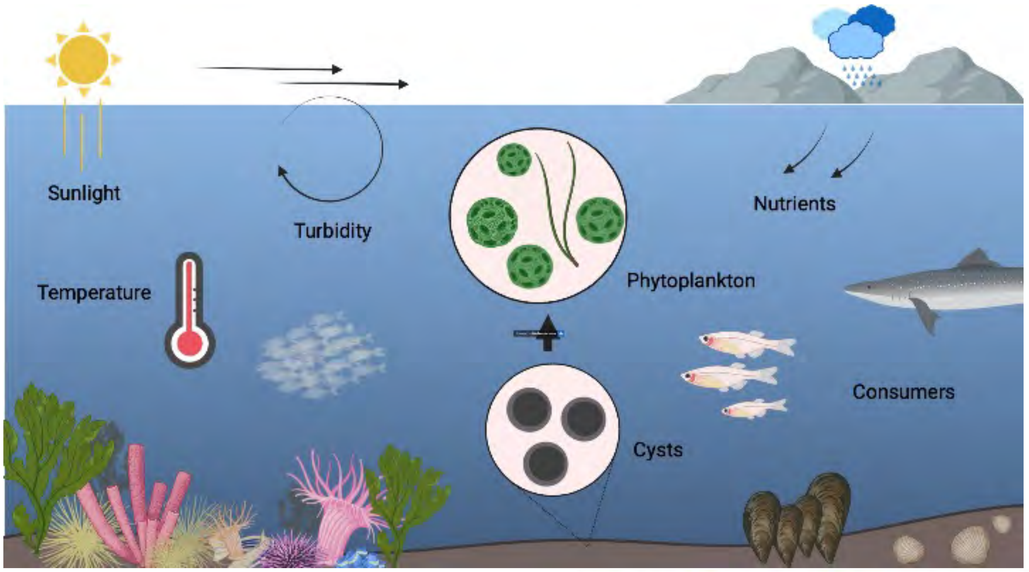
SCAN ME

This work was conducted under funding from the US Administration for Native Americans, US Geological Survey Climate Adaptations Science Center, University of Alaska Biomedical Learning and Student Training, US Environmental Protection Agency Indian General Assistance Program, and the Exxon Valdez Oil Spill Trust. Additionally, this work is supported by our tribal sampling partners.

[1]Centers for Disease Control and Prevention. (2019). *Workshop Summary: One Health Zoonotic Disease Prioritization for Multisectoral Engagement in Alaska*.

Citizen Science in Early Detection of Harmful Algal Blooms in Southcentral Alaska

Emily Mailman[1], Annette Jarosz[1], Maile Branson[1], Shannon Atkinson[2]
[1]Chugach Regional Resources Commission - Alutiiq Pride Marine Institute, [2]University of Alaska Fairbanks



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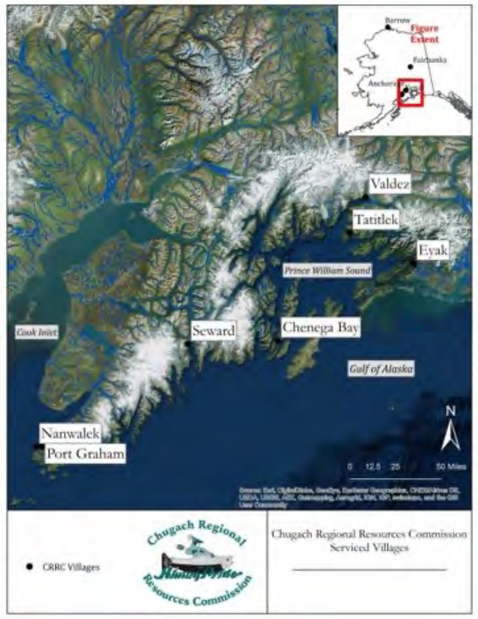

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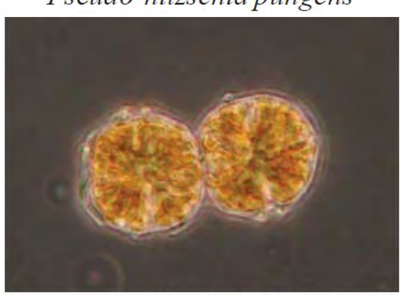

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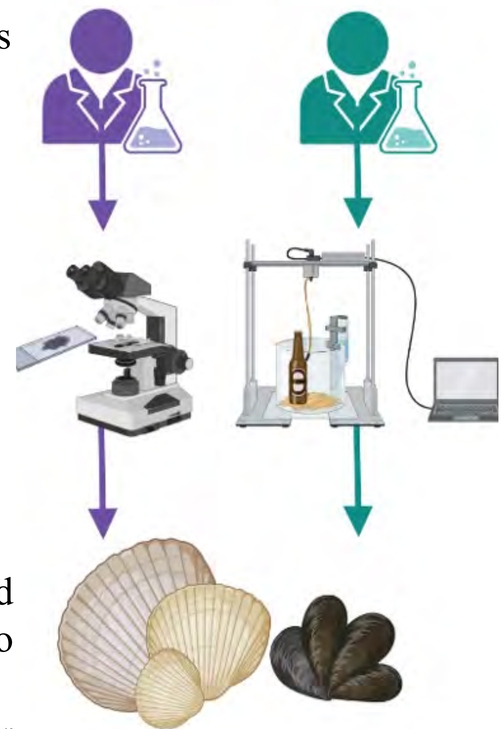

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Building tribal capacity for harmful algal bloom monitoring for safe and sustainable community harvest of traditional shellfish resources in Southcentral Alaska

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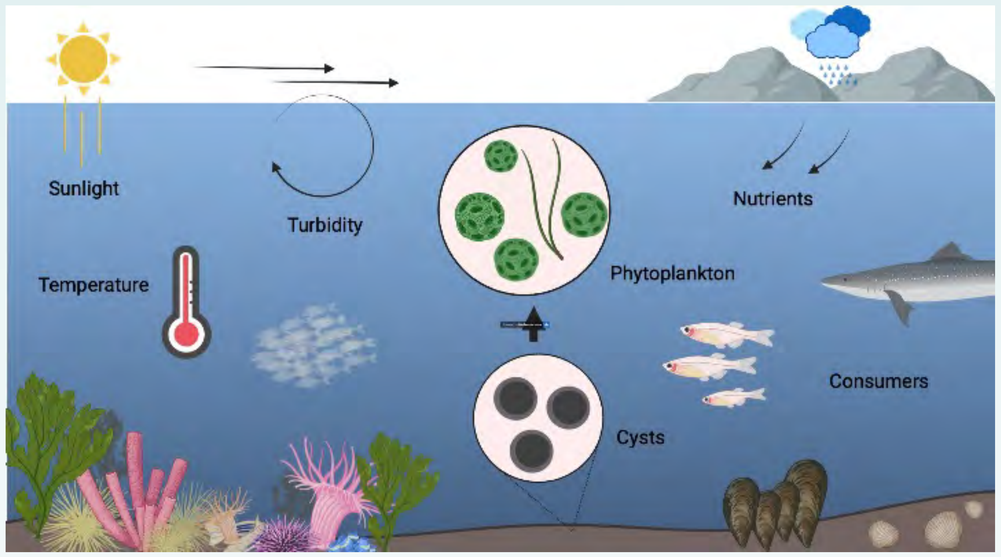

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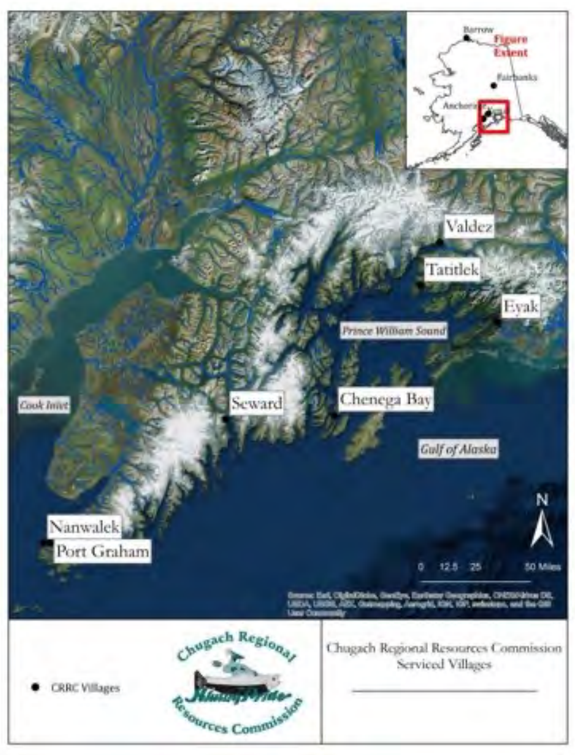
Tatitlek Community Sampler Training; July 2022



3. Why do we monitor HABs?

Human Health Syndromes
associated with phytoplankton

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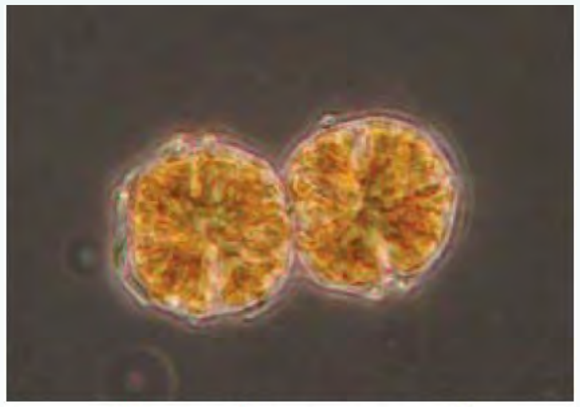
4. What do HABs look like?

- HABs in Alaska are microscopic – through conducting tows the phytoplankton are concentrated and can then be analyzed under the microscope
- Samples are fixed so they can remain stable during shipment across the Chugach region to be processed at APMI



Alexandrium catenella

Pseudo-nitzschia pungens

5. Why it's important to us?

- Tribal Members rely on subsistence resources as part of their daily diet
- CRRC and APMI recognize food security and sovereignty are a high priority issue for the Chugach region
- Traditional harvest cycles and methods are being challenged
- Increased HAB events threaten limited public health resources

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Citizen Monitoring for Ocean Acidification in Alaska

Jacqueline Ramsay[1], Wiley Evans[2], Carrie Weeks[2], Burke Hales[3], Jeff Hetrick[1]
[1]Alutiiq Pride Marine Institute, [2]Hakai Institute, [3]Oregon State University

MONITORING FOR TRENDS/VULNERABILITY

Monitoring for ocean acidification near coastal villages and communities in south-central Alaska has been expanding as interest in assessing OA vulnerabilty to shellfish and a subsistence way of life in our communities increases. This weekly sampling, performed by a citizen sampler or the village environmental coordinator, has proven to be an achievable model that can capture statistically meaningful trends over time and provide needed data to inform management and local community resilience planning efforts.

COMMUNITIES

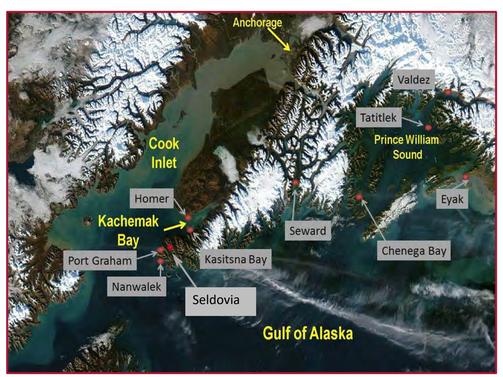
Chenega, Eyak, King Cove, Kotzebue, Little Diomede,

Nanwalek, Nome, Port Graham, Seldovia, Tatitlek, Unalaska,

Valdez, Cordova, **Utqiaġvik** (Barrow)

PARTNERS

- Prince William Sound Science Center - Research cruises
- Kachemak Bay National Estuarine Research Reserve - Research cruises

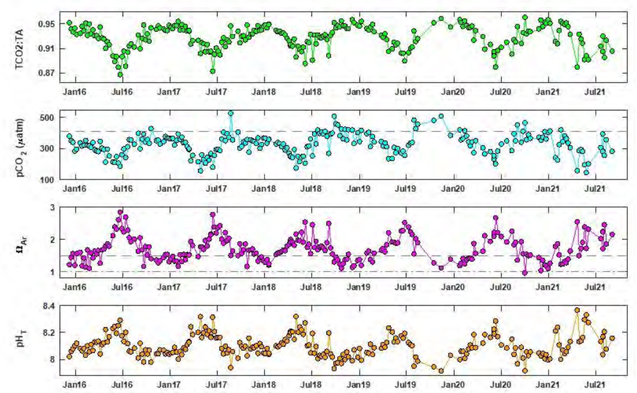


Chugach Region Sites, South Central Alaska

THE OAR LAB AT APMI…

is a Burke-O-Lator laboratory that processes seawater samples collected on a weekly basis by citizen scientists from Alaska Native communities following established protocols for acquiring dissolved inorganic carbon in sea water using APMI produced field kits.

Alutiiq Pride Marine Institute, & OAR Lab, Seward, Alaksa



SELDOVIA, ALASKA

Time series from 2013 – 2019. C. Weeks, et. Al. Hakai, Inst.

NEXT STEPS:

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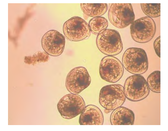
Defining what should be in a community report

- Local "extremes" timing and length
- Min/Max of temperature, salinity, ΩA
- Identify local drivers
- Identify refugia for shellfish

COLLABORATIONS & RESEARCH



Softshell clams

Pinto abalone

APMI cultures a variety of marine species providing the capacity along with the OAR lab to study the effects of OA on larval life stages.

- UAF – Bivalve research & salmon exposure thresholds - Kelley Lab
- UAF – CO_2 Glider studies, Hauri Lab
- Ability to dose with carbonate minerals during low aragonite saturation states
- Species response experiments to varying saturation states
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- Kelp farm/mariculture research – Native Conservancy and The Native Village of Eyak

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Photo by Todd Sformo, NSB-Dept Wildlife Management, **Utqiaġvik** (Barrow), AK

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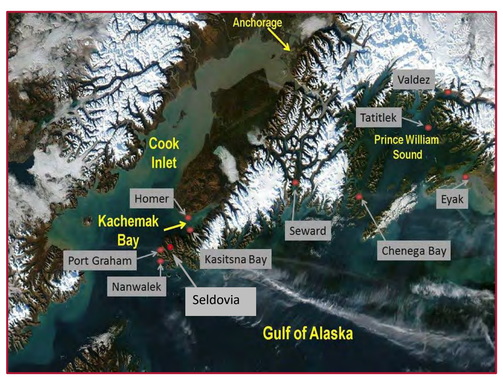

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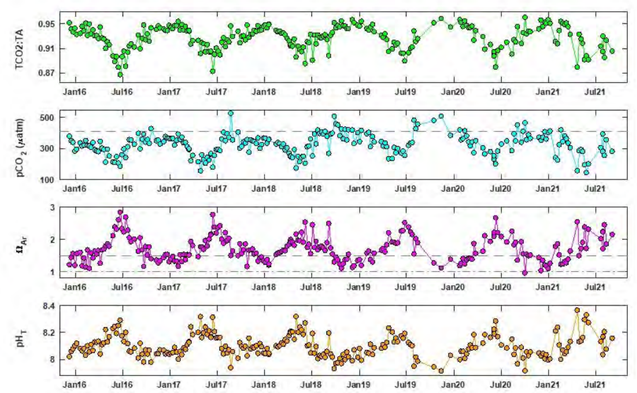

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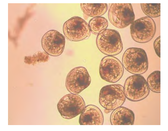

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Photo by Todd Sformo, NSB-Dept Wildlife Management, **Utqiaġvik** (Barrow), AK

Interlaboratory Validation Of A Rapid Saxitoxin Assay For Three Species Of Shellfish Commonly Consumed In Alaska

Kendall Marshburn[1], Annette Jarosz[2], Alison Carl[2], Dustin Carl[2], Shannon Atkinson[1], Maile Branson[2]

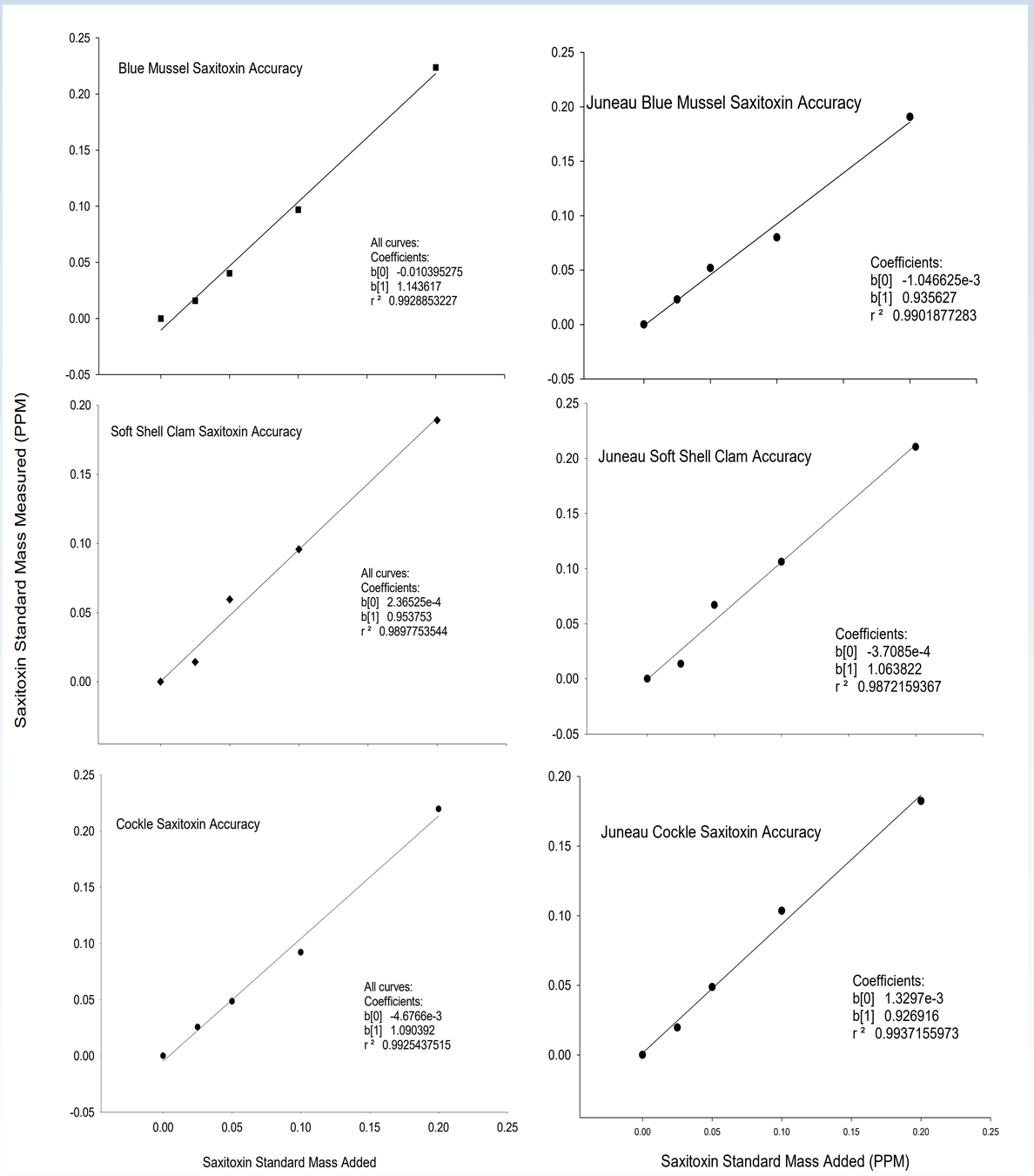
1. University of Alaska Fairbanks
2. Chugach Regional Resources Commission

Abstract

Several species of shellfish are commonly harvested-for-consumption animals that inhabit Alaskan coastal waters including blue mussel (*Mytilus edulis*) (BM), cockle (*Clinocardium nuttalli*) (CK) and the softshell clam (*Mya arenaria*)
(SSC). All three of these species are susceptible to harmful algal bloom (HABs) exposures and tend to accumulate paralytic shellfish toxins (PSTs) in tissues that are consumed by humans and other animals. Among the most prevalent PSTs is saxitoxin (STX), commonly produced by dinoflagellates of Alexandrium spp., which has been identified as a causal
agent of paralytic shellfish poisoning (PSP). As Alaska currently has no State-wide testing and monitoring program for
STX from recreation or subsistence collected shellfish, it is important that multiple laboratories in different locations be capable of delivering comparable data from the most commonly harvested species consumed by non-commercial users.
This will increase both the access to local testing by harvesters and can provide the data necessary to create accurate
mapping of STX presence across the state and potential hotspots that harvesters should avoid. The Chugach Regional
Resources Commission (CRRC), which operates Alutiiq Pride Marine Institute (APMI) in Seward, represents a Tribal consortium comprised of the seven Tribes in the Prince William Sound, Lower Cook Inlet, and Lower Copper River regions
of Alaska. APMI, as part of its Chugach Regional Ocean Monitoring program and in collaboration with the University of
Alaska College of Fisheries and Ocean Sciences (UAF-CFOS) in Juneau, has validated a commercially available enzyme
linked immunosorbent assay (ELISA) (Eurofins Abraxis) for detection of STX in BM, CK, and SSC. Utilizing extractions from species collected in Seward, both APMI and UAF-CFOS Juneau laboratories produced nearly identical parallel displacement, a high degree of accuracy and precision, as well as extraction recoveries that were not statistically different from both labs in all three species. This indicates that both labs can produce comparable data in two geographically distinct locations in the state, increasing accessibility to real-time data regarding the STX concentrations of
locally harvested BM, CK, and SSC.

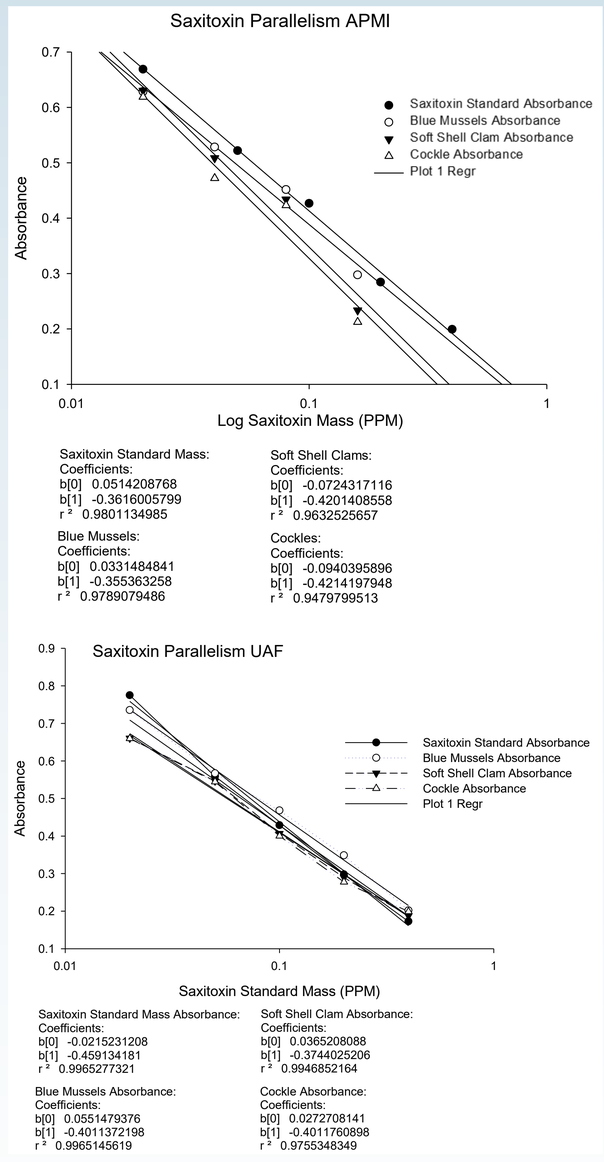
Accuracy

- Tests for potential interference within shellfish sample that are independent of specific antigen-antibody binding.
- R^2 should equal 1 +/- 0.1



Parallelism

- Serial dilutions of shellfish samples are used in conjunction with standard curve to determine assay precision.
- R^2 should be within +/-0.1 units of the standard absorbance



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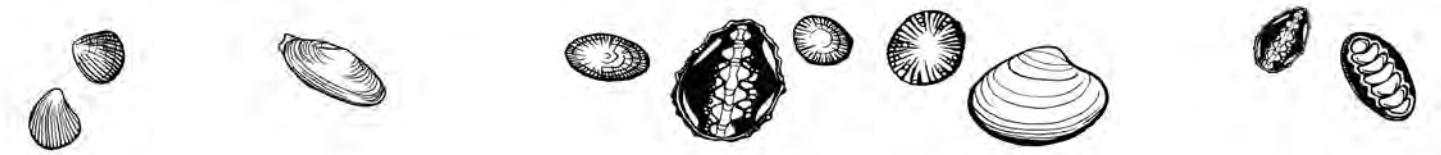


THE CHUGACH REGIONAL OCEAN MONITORING PROGRAM: COMPREHENSIVE BIOTOXIN, PHYTOPLANKTON, AND WATER CHEMISTRY MONITORING THROUGHOUT SOUTHCENTRAL ALASKA

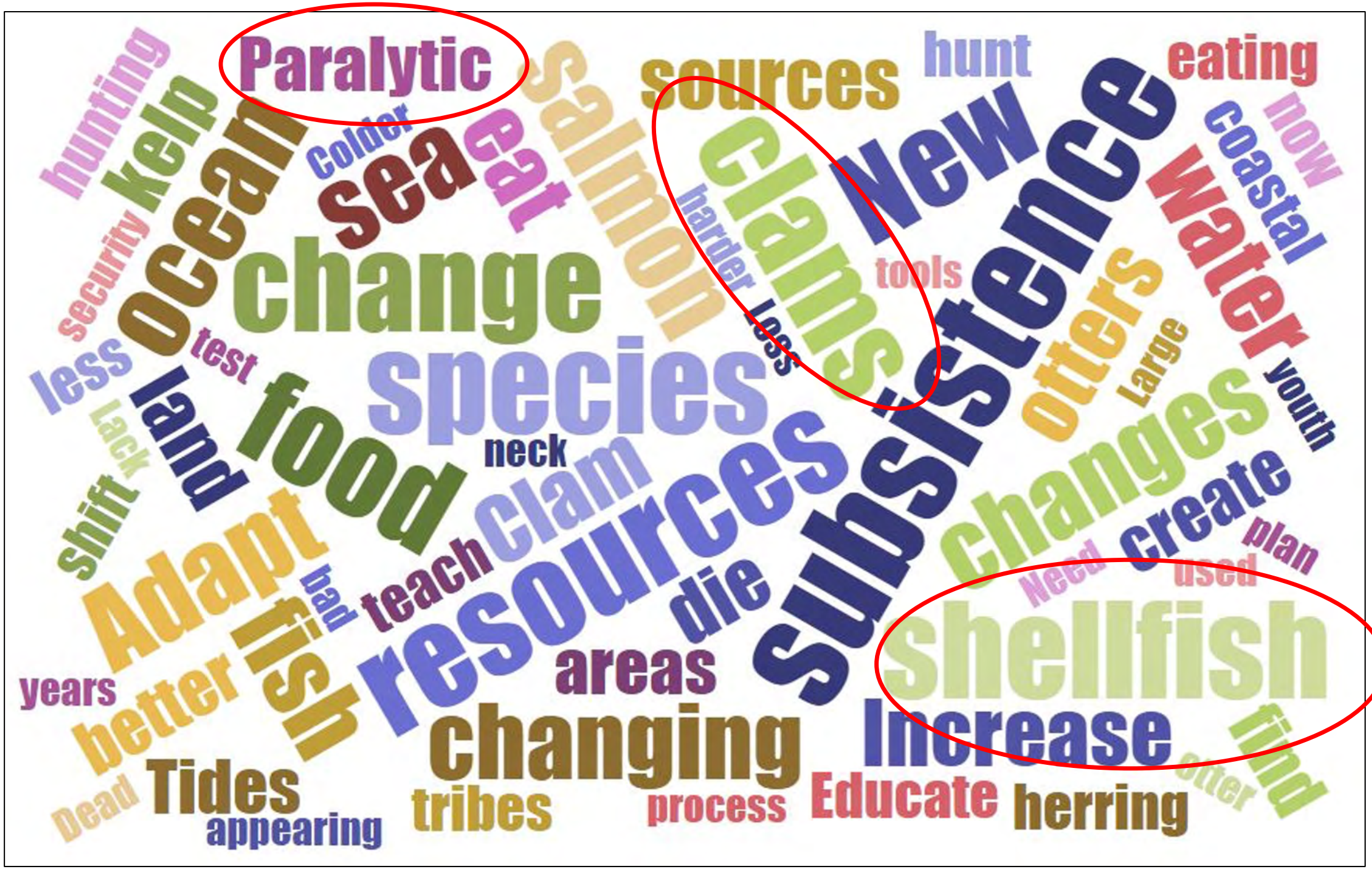
Maile Branson, PhD
Science Director
Alutiiq Pride Marine Institute
Chugach Regional Resources Commission

A Tribal Organization Focusing on Natural Resource Issues affecting the Chugach Region

CHUGACH REGIONAL RESOURCES COMMISSION: WHO ARE WE?

7

- A consortium of seven Southcentral Alaskan Tribes in Prince William Sound and Lower Cook Inlet
- Established to manage natural resources and engage in both terrestrial and marine science across the region on behalf of Tribes
- Operate the Alutiiq Pride Marine Institute in Seward AK


Paralytic
hunting
kelp
ocean
colder
sea
eat
salmon
sources
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new
coastal
now
water
security
change
harder
less
clams
tools
subsistence
otters
less
test
species
large
youth
land
food
neck
changes
Lack
shift
clam
create
plan
Adapt
teach
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Need
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bad
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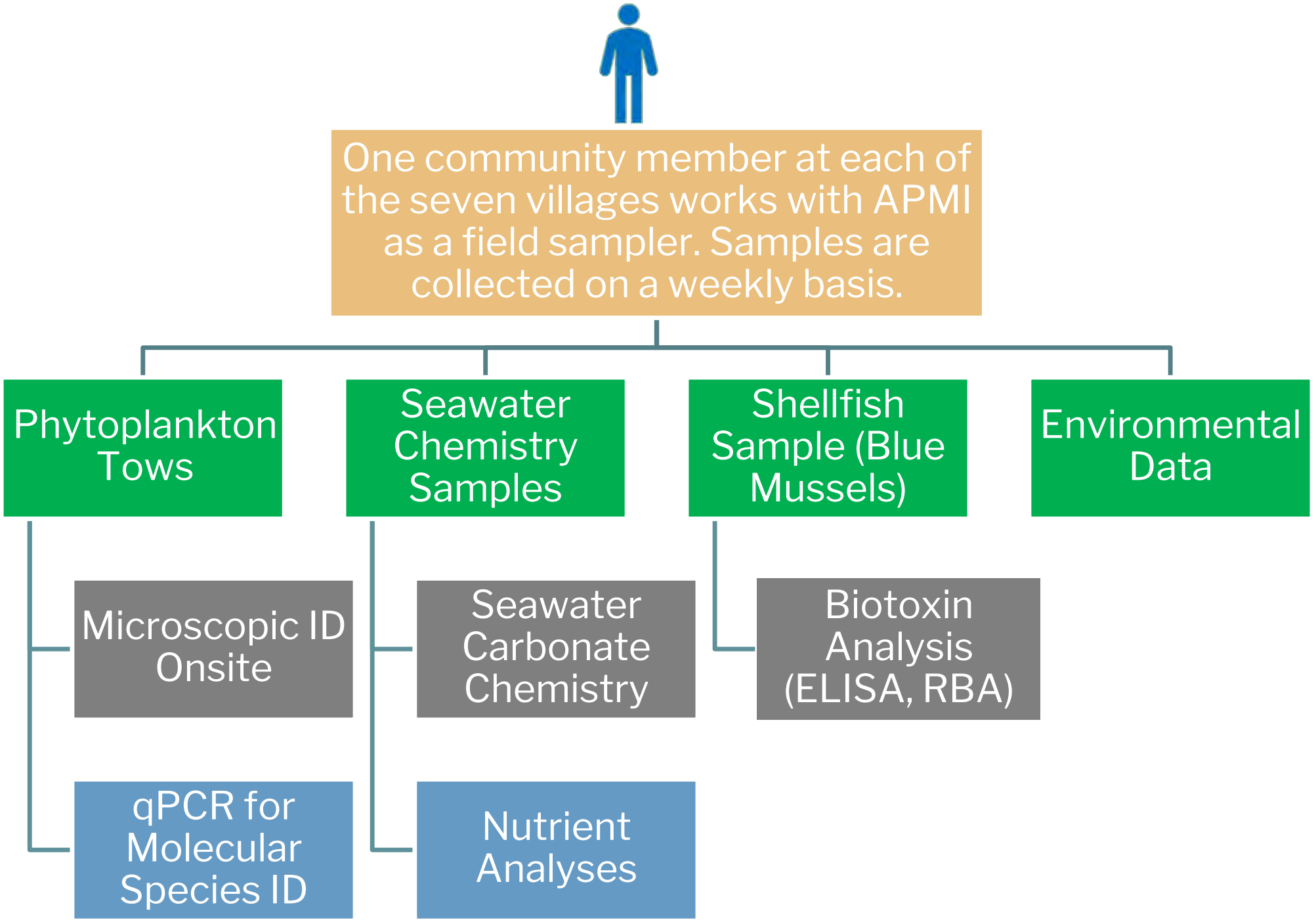
One community member at each of the seven villages works with APMI as a field sampler. Samples are collected on a weekly basis.
Phytoplankton Tows
Seawater Chemistry Samples
Shellfish Sample (Blue Mussels)
Environmental Data
Microscopic ID Onsite
qPCR for Molecular Species ID
Seawater Carbonate Chemistry
Nutrient Analyses
Biotoxin Analysis (ELISA, RBA)

OBJECTIVES AND OUTCOMES

Safe shellfish harvest for all stakeholders (subsistence, mariculture, and recreational users)

Baseline coastal marine conditions in Prince William Sound and Lower Cook Inlet

HAB precipitating factors and ……forecasts?

CHECK US OUT!

www.alutiiqprideak.org

Maile Branson, PhD
Science Director
Alutiiq Pride Marine Institute
Chugach Regional
Resources Commission
Email: maile@alutiiqprideak.org

Environmental Coordinator
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Chemistry Staff
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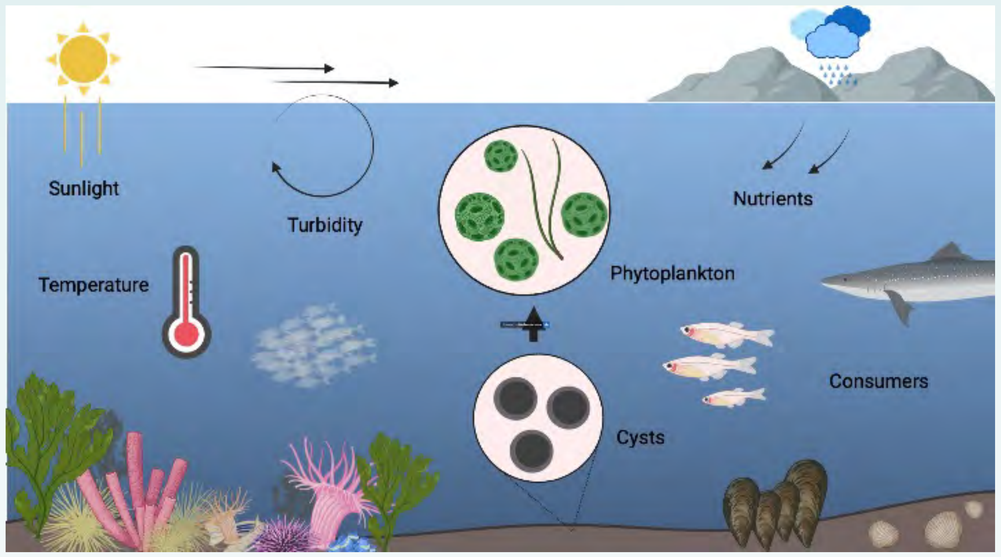

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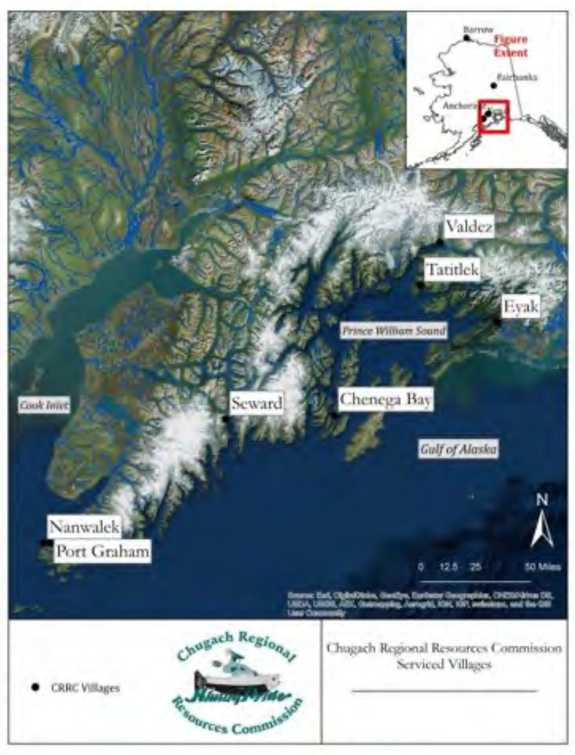

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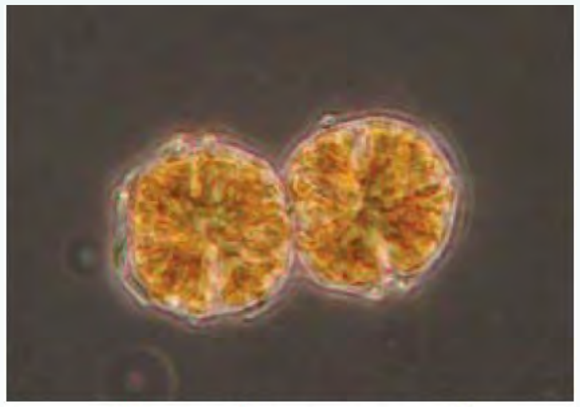
Name of Syndrome	Species and Toxin	Symptoms
Amnesic Shellfish Poisoning **(ASP)**	*Pseudo-nitzschia* **Domoic acid**	Short term memory loss
Paralytic Shellfish Poisoning **(PSP)**	*Alexandrium* Saxitoxin	Loss of motor control

- HABs can cause ASP and PSP
- These are not zoonotic diseases however; these were added to the OneHealth Zoonotic Disease Prioritization list due to rising HAB occurrences in Alaskan coastal waters[1]
- Monitoring acts as an early detection system for communities

4. What do HABs look like?

- HABs in Alaska are microscopic – through conducting tows the phytoplankton are concentrated and can then be analyzed under the microscope
- Samples are fixed so they can remain stable during shipment across the Chugach region to be processed at APMI



Alexandrium catenella

Pseudo-nitzschia pungens

5. Why it's important to us?

- Tribal Members rely on subsistence resources as part of their daily diet
- CRRC and APMI recognize food security and sovereignty are a high priority issue for the Chugach region
- Traditional harvest cycles and methods are being challenged
- Increased HAB events threaten limited public health resources

This work was conducted under funding from the US Administration for Native Americans, US Geological Survey Climate Adaptations Science Center, University of Alaska Biomedical Learning and Student Training, US Environmental Protection Agency Indian General Assistance Program, and the Exxon Valdez Oil Spill Trust. Additionally, this work is supported by our tribal sampling partners.

[1]Centers for Disease Control and Prevention. (2019). *Workshop Summary: One Health Zoonotic Disease Prioritization for Multisectoral Engagement in Alaska*.

CHUGACH REGIONAL RESOURCES COMMISSION

Alutiiq Pride

CHUGACH REGIONAL RESOURCES COMMISSION

Alutiiq Pride

NOAA Ocean Acidification Program (OAP) Community Meeting

La Jolla, CA | Virtual

CHUGACH REGIONAL RESOURCES COMMISSION

INTER-TRIBAL FISH AND WILDLIFE COMMISSION

About Us

- Governed by a board of directors from its seven Member Tribes: Native Village of Chenega, Native Village of Eyak, Native Village of Nanwalek, Native Village of Port Graham, Qutekcak Native Tribe or Seward, Native Village of Tatitlek, and Valdez Native Tribe
- Promotes Tribal sovereignty and protects the traditional subsistence lifestyle of our Tribal Members through the development and implementation of Tribal natural resource management programs to assure the conservation, sound economic development, and stewardship of the natural resources in the traditional territory of the Chugach Region of Southcentral Alaska
- Operate the Alutiiq Pride Marine Institute in Seward, AK

Alutiiq Pride
MARINE INSTITUTE

CHUGACH REGIONAL RESOURCES COMMISSION

Alutiiq Pride

APMI: Quick Facts

The facility was built by the State from EVOS criminal settlement money to be a mariculture technical center and was opened in 1992.

CRRC took over operation of the facility in 1994 to develop a region-wide, Native-led mariculture program.

APMI's main sources of funding come from a Public Law 638 contract and research grants.

Operating funds come from BIA Section 105(l) Lease Agreement


QUTEKCAK
SHELLFISH
HATCHERY

CHUGACH REGIONAL RESOURCES COMMISSION

Alutiiq Pride

Animals grown at APMI

Current

(1) California sea cucumber (Parastichopus californicus)

(2) Pinto Abalone (Haliotis kamtschatkana)

(3) Littleneck clam (Protothaca staminea)

(4) Butter Clam (Saxidomus giganteus)

(5) Soft Shell Clams (Mya arenaria)

(6) Kelp

(7) Bidarki (Katharina tunicata)

Past

(8) Pacific oyster (Crassostrea gigas)

(9) Geoduck clams (Panapea generosa)

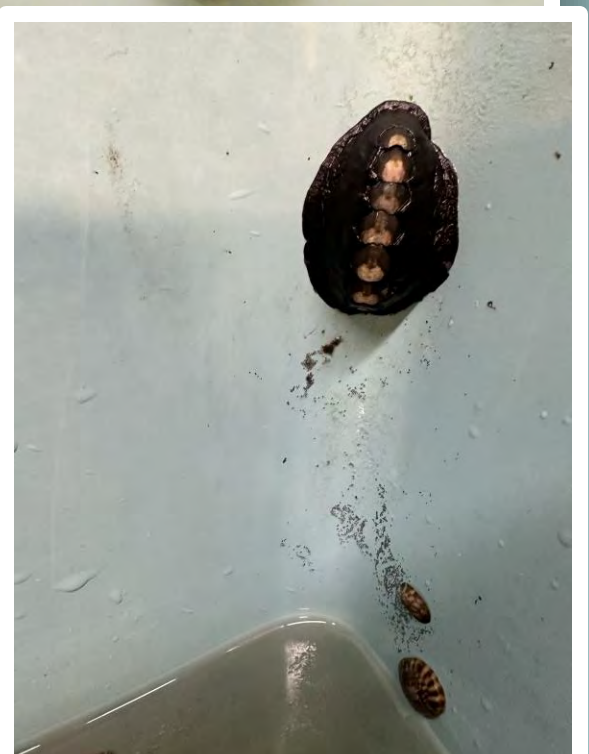
(10) Basket cockle (Clinocardium nuttallii)

(11) Pacific Razor clam (Siliqua patula)

(12) Purple hinge rock scallop (Crassodoma gigantea)

(13) Blue King crab (Paralithodes platypus)

(14) Red King crab (Paralithodes camtschaticus)



CHUGACH REGIONAL RESOURCES COMMISSION

IMPORTANCE

Food represents culture. Food is an intimate personal choice that is influenced by historical patterns, environmental considerations and, most importantly, cultural norms…..

~When the tide is out, the table is set~

Chugach Region Ocean Monitoring Program

Understanding Ocean Acidification Impacts and Planning for Adaptation in Alaska

CHUGACH REGIONAL RESOURCES COMMISSION

Alutiiq Pride

New video highlights Alaska Natives community sampling to track ocean acidification in Alaska

The project and video was funded in part by U.S. EPA, Region 10, Alaska Ocean Observing System, and the NOAA Ocean Acidification Program (Project No. NA20OAR0170514).

CRRC recently released a video summarizing over eight-years of community water quality sampling to track ocean acidification in South-central Alaska. Ocean acidification is a change in chemistry caused by the uptake of carbon dioxide from the ocean that can impact marine life and people who depend on these ecosystems. The project aims to increase awareness of ocean acidification and the importance of the community monitoring program of community samplers from the seven participating tribal communities as well as communities the CRRC serves.

The project is a collaborative, regional effort between CRRC, CRRC's Alutiiq Pride Marine Institute's Chugach Regional Ocean Monitoring Program, Native Village of Eyak, Port Graham Village Council, Valdez Native Tribe, Native Village of Chenega, Seldovia Village Tribe, and Oregon State University.

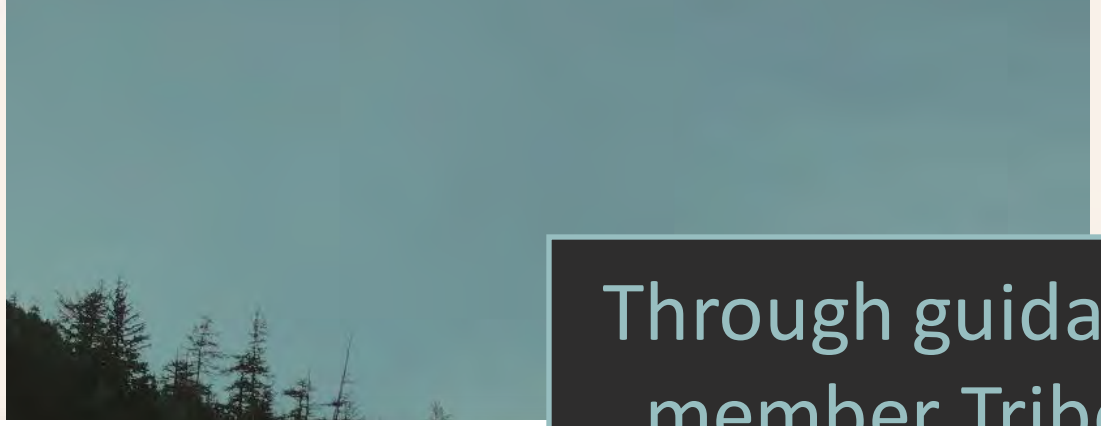
Michael Opheim, the former Environmental Coordinator at Seldovia Village Tribe (now with CRRC as the Inter-Tribal Liaison!), describes that "[Tribal] elders say that this project is important to them because they want their grandchildren to be able to go out and harvest clams. We want to make this sustainable so those younger generations have something to come back to and harvest." This work could not be accomplished without the involvement of tribal communities.

A significant achievement of the project is that "the real work for citizen science and community monitoring for ocean acidification is being led by the tribes in Alaska, which [provides] an example for the rest of the country," says Darcy Dugan, Director of the Alaska Ocean Acidification Network.

View the video and learn more about ocean acidification in Alaska and CRRC's Alutiiq Pride Marine Institute's Chugach Regional Ocean Monitoring Program, at https://www.alutiiqprideak.org/oar.

The video is also hosted on YouTube: https://youtu.be/6FqEgVISoc0


Chugach Region Ocean Monitoring Program



Alutiiq Pride

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Through guidance from our member Tribes and close partnerships with regional Alaska Native organizations, CRRC is bringing tribal voices to ocean acidification research, implications, and applications in the Chugach Region.