***Exxon Valdez* Oil Spill Trustee Council**
Long-Term Research and Monitoring, Mariculture, Education and Outreach
FY25 (Q1+Q2) Semi-annual Project Status Summary

For Instructions for each section below, see Reporting Policy, II (B); the Reporting Policy can be found on the website, https://evostc.state.ak.us/policies-procedures/reporting-procedures/

Project Number: 25220201

Project Title: Chugach Regional Ocean Monitoring (CROM) Program

Principal Investigator(s): Willow Hetrick-Price, Allison Carl, Chugach Regional Resources Commission (CRRC), Alutiiq Pride Marine Institute (APMI). Allison Carl is the author of this report, and it has been reviewed and approved by Willow Hetrick-Price.

Reporting Period: February 1, 2025 – July 31, 2025

Submission Date (Due September 1 immediately following the reporting period): September 1, 2025

Project Website: https://www.alutiiqprideak.org/crom

Please check all the boxes that apply to the current reporting period.

☒ **Project progress is on schedule.**

☐ **Project progress is delayed.**

☐ **Budget reallocation request.**

☐**Personnel changes**
No personnel changes occurred during the reporting period.

Table 1. CRRC CROM Personnel

Position	Employee Name
CRRC Executive Director	Willow Hetrick-Price
APMI Science Director*	Vacant
APMI Biology Laboratory Manager	Allison Carl
APMI Technician #1 (Biology)	Jana Wheat
APMI Chemistry Laboratory Manager	Sierra Lloyd
APMI Technician #2 (Chemistry)**	Vacant
Grants Administrator	Tara Miller

*CRRC will wait to fill this position during an assessment phase which is currently underway. There is strong leadership and collaboration between the Lab Managers. This dynamic is also new, and the Executive Director along with the PI will be assessing the position needs moving forward in CROM.
** CRRC will wait to fill this position to assess the lab's needs. The Chemistry Lab Manager was recently onboarded, and it will not be until there is a better understanding of the organization, communities, and systems in the Chemistry Lab that the Chemistry Lab Manager will solicit to fill this position.

1. Summary of Work Performed:

A. *Administration:* CRRC's administrative employees ensured management of the award funds and maintained compliance with regulatory and financial requirements. The Executive Director provided strategic oversight and managed staff, while the Grant Accountant and Staff Accountant managed financial reporting, budgeting, and expense tracking to ensure fiscal responsibility. The Grants and Contracts Administrator oversaw compliance, reporting, and subaward and contract management. The Administrative Assistant/Travel Coordinator facilitated logistics, documentation, and support for grant-related activities.

B. *CRRC CROM personnel:* there are two unfilled positions under this program (Table 1). To date, unfilled positions have not resulted in programmatic delays.

C. *Laboratory:* All budgeted equipment pieces under the initial phases of this award have been purchased and delivered. All equipment is housed at the APMI facility. Both Laboratory spaces began documenting internal protocols which included assay and equipment protocols, troubleshooting processes and contacts, and inventory and maintenance schedules.

D. *Sample Coordination:* From February 1, 2025, to July 31, 2025, APMI sent out kits which included supplies for collecting the following samples: dissolved inorganic carbon to monitor marine water quality parameters, phytoplankton net tows to monitor for the presence of harmful algae and harmful algae blooms (HABs), and shellfish to monitor for the presence of harmful algal toxins. Sampling kits were sent to participating Chugach communities and partner Tribes and organizations. During this semi-annual reporting period, APMI received 265 samples for dissolved inorganic carbon analysis, 57 phytoplankton samples, 121 water filters for quantitative PCR (qPCR) analysis, 49 samples for total saxitoxin concentration and domoic acid concentration

detections. Samples received, samples analyzed, and data finalized are outlined in Tables 2-6. The sample sets included Chugach communities in the spill affected region and partners outside the funded scope of this project who requested to be included in monitoring efforts.

Table 2. Dissolved inorganic carbon sample status

Samples collected through CROM Program (CRRC staff/Community Samplers)			
Community	Samples Received	Lab Analysis Completed	Data Finalized
Chenega	6	6	6
Eyak	34	34	34
Nanwalek	4	0	0
Port Graham	3	3	3
Seward *	33	25	7**
Tatitlek	1	1	1
Valdez	19	12	7
Total CROM Samples	100	81	58
Samples collected through collaborations (partner Tribes, citizen science, research)			
Kachemak Bay National Estuarine Research Reserve (Homer)	24	24	24
Seldovia Native Tribe	0	0	0
Kenaitze Indian Tribe	34	34	34
Kodiak Area Native Association	107	107	104
Total Samples from Collaborations	165	165	162
Total Samples	**265**	**246**	**220**

*The Seward sample size of dissolved inorganic carbon is lower than expected because APMI has two Burke-O-Lators; one dedicated to continuous monitoring of direct seawater intake from Resurrection Bay, and a second for discrete samples received from community samplers. The recent increase in samples collected in Seward are part of capacity building for Tribal members and APMI interns.

**Many samples from Seward were discarded after analysis due to lack of fixative during sample collection. Samples were discarded and fixative is now used onsite to ensure sample quality. See *APMI CROM Chemistry Laboratory* section for more details.

Table 3. Phytoplankton net tow sample status

Samples collected through CROM Program (CRRC staff/Community Samplers)			
Community	Samples Received	Lab Analysis Completed	Data Finalized
Chenega	2	1	1
Eyak	14	14	14
Nanwalek	1	1	1
Port Graham	4	3	3
Seward	33	31	31
Tatitlek	1	1	1
Valdez	0	0	0
Whittier	1	1	0
Latouche Island	1	1	1
Total Samples	**57**	**53**	**52**

Table 4. Shellfish samples status: total saxitoxin concentration analysis

Samples collected through CROM Program (CRRC staff/Community Samplers)			
Community	Samples Received	Lab Analysis Completed	Data Finalized
Chenega	0	0	0
Eyak	0	0	0
Nanwalek	6	0	0
Port Graham	2	0	0
Seward	21	0	0
Tatitlek	3	3	3
Valdez	0	0	0
Cook Inlet	3	0	0
Whittier	1	0	0
Latouche Island	1	0	0
Samples collected and analyzed through collaborations (partner tribes, citizen science, research)			
Kachemak Bay National Estuarine Research Reserve (Homer)	7	0	0
Prince William Sound Stewardship Foundation (PWS)	2	0	0
Seldovia Native Tribe	3	0	0
Overall Samples	**49**	**3**	**3***

*CROM Biology Lab staff experienced challenges with the equipment used for total saxitoxin concentration analysis during this reporting period. See *APMI CROM Biology Laboratory* section for more details.

Table 5. Shellfish samples status: domoic acid concentration analysis

Samples collected through CROM Program (CRRC staff/Community Samplers)			
Community	Samples Received	Lab Analysis Complete	Data Finalized
Chenega	0	0	0
Eyak	0	0	0
Nanwalek	6	1	1
Port Graham	2	1	1
Seward	21	13	13
Tatitlek	3	3	3
Valdez	0	0	0
Lower Cook Inlet	3	1	1
Whittier	1	0	0
Latouche Island	1	1	1
Samples collected and analyzed through collaborations (partner tribes, citizen science, research)			
Kachemak Bay National Estuarine Research Reserve (Homer)	7	3	3
Prince William Sound Stewardship Foundation	2	2	2
Seldovia Native Tribe	3	2	2
Overall Samples	**49**	**27**	**27**

Table 6. Water filters status (qPCR analysis)

Samples collected through CROM Program (CRRC staff/Community Samplers)			
Community	Samples Received	Lab Analysis Complete	Data Finalized
Chenega	0	0	0
Eyak	24	0	0
Nanwalek	0	0	0
Port Graham	0	0	0
Seward	94	0	0
Tatitlek	0	0	0
Valdez	3	0	0
Total CROM Samples	**121**	**0**	**0***

*CROM laboratory staff are currently finalizing laboratory protocols. qPCR data will be finalized after interlaboratory validations are completed. See *APMI CROM Biology Laboratory* section for more details.

APMI Ocean Chemistry Laboratory, Sierra Lloyd, Chemistry Laboratory Manager:

A. *New laboratory staff and training:* The Chemistry Laboratory Manager traveled to the Hales Lab at Oregon State University (OSU) February 16 - 21, 2025, for intensive training on the Burke-O-Lator protocols, continuous monitoring, and discrete sample analysis. The Chemistry Lab Manager has since restored function to both Burke-O-Lators and completed the long backlog of samples. Dr. Burke Hales from the Hales Lab also traveled to APMI on July 13, 2025, to assist with the necessary coding to restore function to the newer-model Burke-O-Lator, review protocols and train the Chemistry Lab Manager on the equipment in-house.
B. *Dissolved inorganic carbon analyses (discrete samples):* Since February 1, 2025, a total of 265 dissolved inorganic carbon samples were received from CRRC communities and partner organizations (Table 2). During this project period, 11 samples were lost in transit from Kodiak Area Native Association; these samples were not included in the number of samples received (Table 2). In the future, APMI will supply KANA with sturdier shipping materials to prevent accidents like this. A monthly collection of triplicate samples was requested for QA/QC purposes. Of the 265 samples received in the reporting period, 246 samples were analyzed and 220 were included in the 2025 data set. Of the 265 samples received, two were not analyzed as they were known to be taken improperly. Of the 246 samples analyzed, 31 were excluded during QA/QC analysis. Of the excluded samples, 4 were excluded due to analyst errors, while the remaining 27 samples were excluded due to suspected improper preservation methods; these samples were collected in Seward and suspected to be unfixed, as they had pCO_2 values of over 1000 µatm, which is generally considered to be implausible in seawater samples. This sampler was trained to use the fixative and CROM staff have not observed this issue since the training. Samples with average standard deviations greater than 1% of the measured sample value indicate minor sampler error. Error under 10% may indicate the process of off-gassing during collection time,

whereas larger error indicates sampler error (e.g., missing fixative or organic contamination in the sample). Community samplers with recurring errors have been contacted and provided copies of protocols. The 220 samples that passed QA/QC are presented in cumulative time series for each region containing data from all analyzed samples under this project (Figures 1-20). Dissolved inorganic carbon trends are best recognized over a longitudinal time scale, making comprehensive figures important, therefore all data presented here are from the full duration of sampling efforts at each site.

C. *Dissolved inorganic carbon analysis (continuous monitoring):* APMI's CROM Chemistry Laboratory houses two Burke-O-Lators; these allow the program to run discrete samples without disrupting the Burke-O-Lator that provides continuous monitoring of incoming seawater at APMI. The Chemistry Lab supports continuous ocean chemistry monitoring efforts in Resurrection Bay, using the facility's marine water intake. The data from the continuous monitoring efforts are live streamed to the Alaska Ocean Observing System (AOOS) Ocean Data Explorer (Ocean Data Explorer: Alutiiq Pride Marine Institute Burke-o-Lator). Data streaming was down when the Chemistry Lab Manager arrived on site and has since been restored as of April 1, 2025. During this reporting period, there were occasional pauses in the data stream due to regular maintenance. When continuous monitoring is down, either for troubleshooting or regular maintenance, the data archived can be found on the AOOS Ocean Data Explorer.

D. *Nutrient analyses:* APMI procured a small spectrophotometer in the previous reporting period with the intent of establishing and validating protocols for nutrient analysis prior to procurement of the autoanalyzer budgeted for fiscal year 2026. The spectrophotometer has since been used to support small scale ocean monitoring project (See *other collaborations* for more details); however, it has been identified that the more precise autoanalyzer is required to incorporate more sensitive data needed to provide meaningful insight around nutrient analysis near Chugach communities. The Chemistry Lab Manager began researching equipment models and costs and started to develop the necessary standard protocols for sample collection and preservation to ensure quality data are being produced. Further research into the needs associated with upcoming equipment procurement is ongoing. These needs include ensuring lab infrastructure can maintain electrical requirements for the equipment; obtaining necessary reagents and sample storage to ensure high quality data are produced from the program; and building an inventory of additional supplies needed for nutrient sampling (e.g., bottles, filters, fixatives etc.).

APMI Biology Laboratory, Allison Carl, Biology Laboratory Manager & Jana Wheat, Biology Laboratory Technician:

A. *HAB event response:* Through the CROM program, biology staff worked closely with regional Tribes and partners including Port Graham, Nanwalek, Seldovia, and the Alaska Harmful Algal Bloom (AHAB) Network during a recent HAB event in Kachemak Bay. This bloom occurred during July 2025 where increased numbers of *Pseudo-nitzschia* spp. were observed throughout Kachemak Bay. CROM staff attended event response meetings, coordinated expedited phytoplankton and shellfish samples from Nanwalek, Port Graham, and Seldovia Tribal

communities. Additionally, CROM staff assisted in sample coordinating and analysis of blue mussels, gooseneck barnacles, and razor clam samples from the Kachemak Bay National Estuary Research Reserve (KBNERR) that were collected from western Cook Inlet and Ninilchik. CROM Biology Lab staff coordinated, processed and analyzed samples for the detection of domoic acid in a timely manner and sent results to the AHAB Network and KBNERR for public communication.

B. *Coordinating efforts:* CROM staff coordinated regularly collected samples throughout the Chugach region. The program received samples from Eyak, Nanwalek, Port Graham, Qutekcak, and Valdez. In addition to these Chugach community samples, the program also onboarded a sampler in the City of Whittier, coordinated samples with Seldovia Village Tribe, and received opportunistic blue mussel samples from the Prince William Sound Stewardship Foundation (PWSSF). CROM biology staff participated in monthly AHAB Networks calls to stay up to date on state-wide monitoring efforts and worked towards standardizing field and laboratory methods, as well as to strategize response to HAB events. The Biology Lab Manager holds a seat on the AHAB Steering Committee and participated in discussions about ongoing coordinating efforts and future directions of the AHAB Network.

C. *Phytoplankton net tows and microscopy:* During this reporting period 57 phytoplankton net tow samples were received by participating communities. A total of 53 samples were analyzed via microscopy for harmful algae species identification by APMI staff (Table 3; Figure 21). Laboratory staff recorded the presence and absence of other algal species common to southcentral Alaska (Figure 22). Samples not yet analyzed were received at the end of the reporting period and have not been processed. Microscopy results for target HAB species were categorized into three groups (absent, detected and elevated) based on cell counts (detected = 1-10 cells per slide; elevated ≥ 10 cells per slide).

   i. ***Alexandrium* spp. results:** *Alexandrium* spp. were detected via microscopy on one occasion in Tatitlek in May 2025. Detected cells were observed in elevated numbers. The Tribe was notified immediately via email which included a toxin report, language around paralytic shellfish toxins, and contacts for more resources or questions.

   ii. ***Pseudo-nitzschia* spp. results:** In 2025, elevated levels occurred on several occasions in Seward, Port Graham, and Eyak; elevated levels were observed between April and July, but detections began as early as March.

   iii. ***Dinophysis* spp. results:** *Dinophysis* spp. were frequently observed at low levels throughout the project period with elevated levels observed in Seward in May and July.

D. *Harmful Algae Bloom Modeling:* Model development was initiated during this reporting period, and 2025 data will be included in the model during the next reporting period.

E. *Laboratory update:* The Biology Laboratory determines domoic acid concentration levels via the Gold Standard Diagnostics [ON0021] ABRAXIS® Domoic Acid (Onsite Technologies) ELISA

and identifies total saxitoxin concentration using a receptor binding assay (RBA). The Biology Laboratory Manager successfully moved the Microbeta2 plate reader for RBAs from the UAF Seward Marine Center to the APMI biology lab on March 21, 2025. During the reporting period, CROM biology lab staff experienced unexpected delays in the analysis of total saxitoxin concentration due to missing equipment protocols. On May 8, 2025, during a routine field service appointment for the plate reader, the service technician from the equipment manufacturer accidentally deleted all background protocols for the equipment. The Lab Manager restored known protocols (i.e., general details the machine needs to know about the assay); however, the missing background protocols (i.e., normalization processes that are applied to the results once the machine is done reading) live within layers of folders. Ultimately, the machine could not properly read activity in the assay plate wells. It took several plates worth of trouble shooting to identify the missing background protocols as the reason for the faulty assay results. While the equipment was down, APMI reached out to the Southeast Alaska Tribal Ocean Research (SEATOR) Program's Environmental Research Lab to run community samples that were suspected to contain high levels of saxitoxin. SEATOR is an intertribal organization who also uses the RBA and graciously agreed to run these community samples at no cost to CRRC or the Tribe.

F. *Shellfish toxin testing:* APMI received a total of 49 shellfish for HAB toxin analysis (Tables 4 – 5). Of the samples received, CROM staff sent out three shellfish samples for analysis via RBA for the detection of total saxitoxin concentration and analyzed 26 shellfish samples via enzyme-linked immunosorbent assay (ELISA) for the detection of domoic acid.
    i. **Saxitoxin detection results:** Soft-shell clams, blue mussels, and butter clams were collected near Tatitlek during the same time of the elevated *Alexandrium* spp. cell counts in May 2025. All three of the samples sent out for analysis returned positive results (Appendix A). Blue mussels and butter clams were found to be holding toxins at 475 µg/100g and 411 µg/100g respectively, which are well over the regulatory limit of 80 µg/100g. Butter clams are known to hold saxitoxin for long periods of time, however high toxin levels in the blue mussels indicate there was a bloom at the time of sample collection. The Tribe was contacted immediately and made aware of the presence of paralytic shellfish toxins (Appendix B). CROM staff are working to increase sampling efforts in this area to identify seasonal shifts in HAB populations.
    ii. **Domoic acid detection results:** Domoic acid detections throughout the region exhibited concentrations well below the FDA regulatory limit (20 µg/g). Increased sampling in Kachemak Bay during a *Pseudo-nitzschia* spp. bloom resulted in numerous domoic acid detections in late July (Figure 23).

G. *Molecular lab*: CROM's Biology Laboratory staff integrated environmental DNA (eDNA) and quantitative PCR (qPCR) for phytoplankton detection. Laboratory staff continued to run standards for *Alexandrium* spp. Numerous standards were examined to establish a limit of detection for the equipment (see *Project Setbacks* section D for more details). In-state validation

options are currently being explored. Once validated, phytoplankton species identification data will be finalized and reported.

i. **Sample collection:** Samples are collected using a Smith-Root eDNA Citizen Scientist sampler; this consists of a vacuum pump attached to a 2-L collection reservoir and tubing, a sterile filter can be attached to the tubing. Through collaborative efforts with CRRC's Tribal Fish and Wildlife Department's Herring Monitoring Project funded by the Administration of Native Americans, APMI received water filter samples from Cordova that will be analyzed for HAB species. CRRCs Biology staff are working to ensure assay accuracy and efficiency prior to sample processing. All sample filters have had DNA extracted and are being stored at -80°C until analysis. There is a current backlog of 309 sample filters. Once protocols are established and validated, lab staff will focus on processing the backlog and implementing increased eDNA sampling throughout the region.

Annual Sampler Workshop (all CROM staff):

APMI hosted the annual water sampler workshop virtually on May 7, 2025. CRRC's Indian Genial Assistance Program (IGAP) and IGAP Environmental Coordinator is heavily involved in hosting this event; due to the unfilled IGAP position and uncertainty in federal funding at the time of the event, the workshop was shifted from an in-person event to virtual workshop. There were 25 attendees from Tribal and partner organizations. In past years during virtual events, the process of reviewing sampling protocols was a challenge due to limited bandwidth for streaming videos from the harbor making it difficult for samplers to see how field methods look in practice. To remedy this, CROM staff worked to create videos of both field and lab protocols. All Tribal samplers involved in the CROM Program were invited, as were samplers and partners from other regions. This workshop included educational talks on harmful algae, shellfish toxins, ocean acidification, and the role of marine nutrients in the development of harmful algal bloom events. An introduction to eDNA and sample protocols were included in this year's workshop to program participants. The flyer, agenda, sign in sheet, and presentations can be found in Appendix C.

Community Travel (available CROM staff):

CROM staff traveled to Port Graham and Valdez to train samplers; these communities were unable to schedule a visit during the previous reporting period. Below is an overview of community travel:

A. *Valdez (06/13/2025):* The Biology Lab Manager traveled to Valdez to train a new sampler. Previously, to help fill the role of sampling, Prince William Sound College hosted student samplers in Valdez; during this reporting period, a community member was identified and trained for environmental sampling to increase regularly collected samples. CROM staff reviewed all sampling protocols in depth and collected a set of eDNA samples. Because the harbor master was not present at the time to give permission, CROM staff were unable to set up the blue mussel net during this visit. Valdez has a large and active boat harbor, CROM staff connected with harbor staff and waited for permission to hang the net via email. The mussel net was hung on July 2025.

B. *Port Graham (06/26/2025):* The Biology Laboratory Manager visited the Port Graham IGAP Environmental Coordinator to check in and review sampling protocols. CROM staff worked with the Environmental Coordinator to teach the Summer Youth Program participants about environmental sampling and long-term regional monitoring. The youth participants helped collect blue mussels, set up the holding net, and collected a set of CROM samples.
C. *Whittier (08/11/2025):* The CRRC IGAP Environmental Coordinator traveled to Whittier to train a regional participant to collect environmental samples. The Environmental Coordinator reviewed water sampling field methods, assisted in collecting blue mussels for toxin monitoring, and hung the holding net in a slip hosted by Lazy Otter Boat Charters.

Data Dissemination and Management:

A. *Axiom Research Workspace:* 2025 program data were updated on Research Workspace. Data included dissolved inorganic carbon, phytoplankton monitoring, and shellfish toxin (domoic acid) data sets. Forward-facing data are available to the public through the AOOS Gulf of Alaska Data Portal here (https://gulf-of-alaska.portal.aoos.org/#metadata/7825fa08-4bc8-4032-836c-1b3f08fcd0a1/project).
B. *Public Service Announcements (PSAs):* When HAB toxin levels were elevated or above regulatory limits, CRRC shared community PSAs directly with Tribal leaders (Appendix B). CRRC supports its Tribes by providing information to Tribal leaders and their communities to support informed shellfish harvests and baseline near-shore data. CRRC is not a regulatory agency and does not implement any regulations in any Tribal or local community.
C. *CRRC's CROM Story Map*: The IGAP Environmental Coordinator has assumed responsibility of continuing the CROM Story Map which will be available to the public upon completion. To ensure quality data and science communication, a few more steps must be taken to publish the story map live to the CRRC and APMI web pages. The page will house maps of CROM sample locations, include graphs and visuals of program data, and give information on importance and relevance of long-term data.

Networks and Working Groups:

Staff working under the CROM Program participated in the following networks and working groups:

A. *Alaska HAB (AHAB) Network:* Biology staff attended the virtual, monthly AHAB meetings and the Biology Lab Manager maintained a seat on the Network's steering committee.
B. *Alaska OA (AOA) Network:* The Chemistry Lab Manager attended the virtual, monthly AOA meetings.
C. *The Alaska/Washington (AKWA) eDNA working group:* The Biology Lab Manager attended the virtual, monthly AKWA meetings.
D. *CROM quarterly meetings:* CROM staff hosted these meetings through CRRC's IGAP Environmental Coordinator. Due to the IGAP Coordinator position vacancy, these meetings were paused during reporting period. A new IGAP Environmental Coordinator was hired in July 2025

and both meetings will begin again in September 2025. These are a set of two meetings: one for CROM program samplers in the region, and another for state-wide samplers and program managers. Sampler meetings give CROM staff an opportunity to talk about results and give those who are sampling in the communities an opportunity to ask questions and give feedback. The state-wide meetings are for those sampling or managing sampling programs around the state. These meetings are used as a time to troubleshoot assays, standardize programs, discuss partnerships and outreach opportunities, and highlight upcoming events or funding opportunities.

Work scheduled for the next reporting period (August 1, 2025 – January 31, 2026):

A. *Laboratory and data processing:*
   i. **Toxin data finalization:** All toxin data from the 2025 project period will be processed and data will be reported out to communities and updated on Axiom Research workspace. Up-to-date toxin and environmental data will be included in the developing HAB model.
   ii. **Validation for qPCR equipment and assays:** CROM biology staff are currently working to validate molecular methods for detecting HAB species. This is a delicate process and lab staff anticipate having the assay validated during the full project period.
   iii. **CROM HAB interlaboratory verifications:** Upon completion of the 2025 field season, the CROM Biology Lab will send domoic acid and phytoplankton samples to the NOAA NCCOS lab in Charleston. Select domoic acid samples from the potential bloom in Kachemak Bay will be sent for liquid chromatography-mass spectrometry (LC-MS). Low-level detections of domoic acid have the potential to have matrix effects, resulting in potentially less accurate results. LC-MS is highly specific and can identify compounds even at low levels. Although CROM staff have already validated ELISA methods for domoic acid, this is another step in assuring data quality. Select phytoplankton samples with also be sent to NOAA NCCOS for speciation. Key samples with elevated levels of *Pseudo-nitzschia* spp., *Alexandrium* spp., and/or *Dinophysis* spp., will be analyzed via scanning electron microscopy (SEM). Phytoplankton consists of numerous groups of unique species, which can be extremely difficult to identify via light microscopy. SEM is an extremely precise method for phytoplankton speciation which results in both accurate speciation and detailed images of species present in the samples.
   iv. **Autoanalyzer procurement and protocols:** The final piece of equipment funded under this program is the autoanalyzer for nutrient analysis to be housed in the APMI Chemistry Lab. The procurement process will begin in the second half of the project period and the equipment will be purchased in the fiscal year 2026. The Chemistry Lab Manager is working to select key analytes, develop sample methods and lab protocols to be implemented and validated upon procurement of the equipment.

B. *Conferences:* CROM staff are preparing to attend the following conferences to participate in data dissemination, community outreach, and education:
   i. Seward Science Symposium (October 2025)

ii. Pacific Northwest Indigenous Aquaculture Summit (September 2025)
iii. Cordova Science Gathering (January 2026)
iv. Alaska Marine Science Symposium (January 2026)
v. Collective Alaska Native Perspectives (CANP) (April 2026)

C. *Reporting Schedule:* As recommended by the Trustee Council, CRRC will complete semi-annual reports to increase oversight on program goals and deadlines. Along with these reports to EVOSTC, increased updates will be given to regional communities to include reports and raw data. CROM staff are developing a reporting template and schedule to roll out by the end of the annual reporting period.

D. *Collaboration:* The following collaborative efforts are scheduled for the remainder of the annual reporting period:
   i. **Northern Gulf of Alaska LTER Cruise with UAF (September 15-24, 2025):** the CROM Lab Technician will participate in water sampling using Conductivity, Temperature and Depth Instruments.
   ii. **HAB Event Response:** CRRC staff are working to schedule a Tribal consultation with Tribes in Kachemak Bay. Staff are working to coordinate and in-person consultation alongside KBNERR with Nanwalek, Port Graham, and Seldovia. The group is planning on giving a brief overview of this summer's potential HAB event and response strategy. The goal is to receive feedback on how our programs can better support Tribal communities and subsistence resources. Following the consultation CRRC and KBNERR will convene at the APMI facility in Seward to work through research agreements, future goals, and review sampling and laboratory methods. The goal of this collaboration is to fill gaps in data regarding Kachemak Bay, and overall, find ways to best respond to HAB events and support informed subsistence use.

Project setbacks during this reporting period:

A. *Community Sampling Coverage:* The program has struggled to maintain samplers in Tatitlek and Chenega. CROM staff will continue to connect with community members through regional networks, travel, and events to identify interested participants in each Chugach community.

B. *Sampling accessibility:* Samples are obtained from a dock or harbor; Nanwalek does not have a harbor, which makes water sampling difficult in this community. To remedy this, Nanwalek's community sampler has been collecting various water chemistry samples from different areas around the Village. APMI staff are analyzing samples from Nanwalek and will continue to work with this sampler to identify safe and accessible areas to appropriately collect samples.

C. *Laboratory infrastructure:* The initial Burke-O-Lator, supported in part by AOOS, is designed for continuous monitoring and malfunctioned during the time when the Chemistry Laboratory Manager position was vacant. To preserve the asset, this piece of equipment was shut down during the previous reporting period (FY24 Annual Report). After being hired in January 2025, the Chemistry Lab Manager completed her training at OSU (February 17, 2025) and has re-

established the continuous monitoring in Resurrection Bay and completed analysis on the full backlog of discrete community samples. The continuous monitoring system was reinstated in April 2025, but the data stream experiences outages due to regular maintenance and cleaning, heavy rain events, and routine parts replacement and calibration.

D. *Biological sample analysis turnover time:*
   vi. **Molecular lab:** The most common challenge during implementation of eDNA analysis is contamination. CROM biology staff worked to produce negative controls but regularly experienced positive detections, particularly for HAB species; this is likely attributed to primer contamination in assay reagents. CROM staff ordered new reagents and are refining assay protocols to ensure the lab is producing high-quality data.
   vii. **Receptor binding assay:** APMI uses the receptor binding assay (RBA) for total saxitoxin concentration. On May 8, 2025, during a routine field maintenance service from the manufacturer, all protocols coded into the machine were lost. The Biology Laboratory Manager contacted the manufacturer to restore lost protocols but has been given little guidance. The Biology Lab Manager has also worked with SEATOR and NOAA NCCOS to restore equipment protocols. It is anticipated that this hold-up will not delay the next semi-annual project report. All protocols have been backed up and stored on the Biology Lab Managers computer, as well as on CRRC's online storage system.

2. Products:

Peer-reviewed publications:
N/A

Reports:
N/A – Reports are anticipated to be distributed after the field sampling season.

Popular articles:
N/A

Conferences and workshops: APMI staff presented the CROM Program significance, methods, and data at the following conferences and workshops.

APMI Annual Water Sampler Workshop: Seward, AK, May 7, 2025 (Appendix C)

1. Carl, A. Chugach Regional Resources Commission, Alutiiq Pride Marine Institute, and CROM Overview. Oral presentations.

2. Wheat, J., and Carl, A. Phytoplankton and HABs Shellfish Sampling Methods and Results. Oral presentation.

3. Lloyd, S. Ocean Acidification Sampler Training. Oral presentation.

4. Lloyd, S. Ocean Acidification Results and Impacts. Oral presentation.

Kodiak Area Native Association Water Quality Workshop: Kodiak, AK, June 3-5, 2025

1. Lloyd, S. Ocean Acidification Sampler Training. Oral presentation.

Public presentations: CRRC staff presented this project at the following public events (presentations with slides included in Appendix D).

CRRC Southcentral Inter-Tribal Subsistence Cooperative Management Alliance meeting, March 7, 2025
Carl, A. Overview of the Chugach Regional Ocean Monitoring Program. Oral virtual presentation.

PWSSF Natural History Symposium, Whittier, AK, May 13, 2025
McKnight, R. Introduction to the Chugach Peoples, CRRC Programs, and Land Acknowledgement. Oral presentation.

Stewards of the Bay: Community Connections Series, Seward, AK, February 27, 2025.
McKnight, R., and Carl, A. CROM Program: next steps in molecular monitoring. Oral presentation.

Data and/or information products developed:
CRRC worked on a GIS story map, funded through this grant and the EPA IGAP program. The CRRC CROM story map reviews community participation, datasets, graphs, and next steps for the program and will be finalized during the next reporting period.

Data sets and associated metadata:
Complete datasets for all activities under this award are available to the public online at the Alutiiq Pride Marine Institute website (www.alutiiqprideak.org/crom). Data sets and metadata are now updated quarterly on the Axiom Research Workspace and are available to the public through the AOOS Gulf of Alaska Data Portal (https://gulf-of-alaska.portal.aoos.org/#metadata/7825fa08-4bc8-4032-836c-1b3f08fcd0a1/project/files).

Additional Products not listed above:
CRRC updated its Alutiiq Pride quarterly newsletter format (Appendix E). The spring and summer newsletters included an update on eDNA sampling and partner projects supported in part by CROM. Full newsletters are shared via social media and are available to the public through the CRRC website (https://crrcalaska.org/category/news/).

3. Coordination and Collaboration:

The Alaska SeaLife Center or Prince William Sound Science Center:
Through CRRC's involvement with the Community Organized Restoration and Learning (CORaL) Network (Project Number 25220400), CRRC has kept the Alaska SeaLife Center (ASLC) or Prince William Sound Science Center (PWSSC) apprised of efforts of this project. Efforts to share data will continue. See more details under *the EVOSTC Education and Outreach Program* section.

EVOSTC Long-Term Research and Monitoring Program:
N/A

EVOSTC Mariculture Projects:
Samples and environmental data for this project were collected near kelp farm test sites funded by EVOSTC (Project Number 25220300), Prince William Sound Kelp Mariculture Development for Habitat Restoration and Local Economy. The CROM Chemistry Lab supports this project through samples processing and analysis.

EVOSTC Education and Outreach Program

A. *CORaL Network:* Data from this project are shared through the CORaL Network, an EVOSTC funded collaboration between the ASLC, PWSSC, Center for Alaskan Coastal Studies, Alaska Sea Grant, the Alutiiq Museum and Archaeological Repository (EVOSTC project 24220503), and Chugach Regional Resources Commission (EVOSTC Project Number 25220400). The CORaL Network is designed to build upon existing resources within the spill effected region through collaborative efforts. The overarching goals are to ensure that science outreach is relevant, co-created, and culturally responsive to regional communities encouraging public use of available knowledge & resources related to the EVOS region. CROM data and information was shared with the public, Tribes, and researchers through the following CORaL program events:
    i. **Stewards of the Bay Community Connection Series:** CROM discussions were held during these series events on February 27, 2025 (Appendix D).

Other Collaborations and efforts funded under this program:

A. *Prince William Sound Stewardship Foundation:* CRRC regularly participated in PWSSF projects and events. The PWSSF hosts their annual summer projects and participants collect blue mussel samples from Prince William Sound which are then frozen and sent to APMI for HAB toxin analysis. The Foundation also hosted the annual Natural History Symposium in Whittier and CRRC staff were invited to start the day with an introduction to the region and highlights from the CROM program.
B. *Kodiak Area Native Association water quality workshop:* CRRC regularly partnered with other Tribal organizations through the CROM Program. CRRC staff traveled to Kodiak to provide water sampling methods and train samplers in neighboring Tribes.

C. *Research Collaborations:* Through the CROM Biology Lab and Mariculture Department, staff engaged in various research projects and partnerships through the University of Alaska System. CROM staff supported numerous research collaborations with the University of Alaska Anchorage. Projects are ongoing and include saxitoxin exposures on blue mussels, hydrocarbon exposures on soft-shell clams, and the detection of HAB toxins in marine birds from die-offs in the Aleutian Islands. CROM staff supported ongoing research with the University of Alaska Fairbanks and the EPSCOR Interface of Change project; CROM biology staff collected soft-shell and butter clam samples throughout different live stages in a hatchery setting.

D. *National Ocean Science Bowl (NOSB):* CROM staff were asked to assist with a field trip with Seward High School's NOSB teams aboard the UAF *R/V Nanuq* into Resurrection Bay. The Chemistry Lab Manager attended field trips and gave overviews and demonstrations of carbonate chemistry sampling and eDNA field sampling methods. CROM staff worked to support the Seward High School during this event by volunteering as NOSB competition staff.

E. *Educational Development:* APMI supported the following students that have used CROM data as part of their educational development:

   i. **APMI Internships:** APMI hosted a marine science internship for youth (high school, recent high school graduates, and new college students). APMI participated in internship development in collaboration with Seward High School which allowed local students to receive school credit for internship participation. This internship is designed to inform students of the scientific fields represented at APMI and how they relate to marine health and cultural continuity. The internship exposes students to three tracks of focus: Mariculture, Chemistry, and Biology, and includes a focused project at the end of the internship. During the 2025 spring semester, CROM supported one high school intern. This student focused her internship project on understanding nitrate and phosphate contents in kelp grown in Prince William Sound (Appendix F).

   ii. **University of Alaska Graduate Programs:**

      a. The APMI Mariculture Director is enrolled in the Master of Science program at UAF CFOS using CROM data for her thesis. Her project focuses on saxitoxin congener profiles in various species throughout different seasons and analyzes the correlations between size and toxicity in butter clams.

      b. The APMI Biology Lab Manager was admitted into the University of Alaska Anchorage's Department of Biological Sciences Graduate Program in the fall of 2023 to pursue a Master of Science. Her thesis project focuses on intertidal eukaryotic diversity and, in part, produces data related to harmful algal species presence in multiple areas of Resurrection Bay. This project is also working to validate self-preserving filters for field use in rural communities and remote sampling areas to be processed in the CROM eDNA lab.

EVOSTC Individual Projects not listed above:

N/A

Trustee or Management Agencies:
CRRC's APMI staff submit annual holding permits through the Alaska Department of Fish and Game (Appendix G). Blue mussels are collected in bulk in April and are held in a mussel net at the dock where samples are collected. Permits allow community samplers to hold blue mussels on the dock throughout the sampling season.

Indigenous and Local Communities: CROM was created at the request of CRRC's board, that is comprised of seven Tribal governing members. The CRRC Board serves at the direction of each Tribal Council and Board Members are chosen specifically because of their natural resource management inclinations. As part of this project, CRRC's Executive Director provided quarterly updates to the CRRC's Board of Directors through distribution of Board packet material. The Executive Director also requested each Board member to encourage their Tribe to increase the participation of their community samplers. The inception of this program was a desire for shellfish safety monitoring in the CRRC communities, as expressed to CRRC staff by Tribal members. Below is a list of outcomes from the CROM program on local and Indigenous communities through engagement that occurred during the reporting period:

A. *Local Capacity:* Since its inception, the CROM program has expanded local capacity for marine research through multiple avenues. Staff engaged with students, researchers, educators, Tribal members, environmental organizations, and community members, which has directly strengthened citizen science and collaborative monitoring efforts. The program has invested in building and maintaining robust laboratory spaces tailored to local needs. CROM laboratories are active partners in long-term monitoring and marine research collaborations, serving as a bridge between community priorities and scientific inquiry. CRRC's CROM staff support environmental research and community food safety and security, particularly in rural Southcentral Alaska. Through these activities, the CROM program is creating sustainable infrastructure and partnerships that ensure long-term monitoring capacity remains rooted in local and Tribal communities.
B. *In-state collaborations:* The CROM program accepts samples through various partnerships which include Tribes and citizen scientists throughout the region and state (Table 7). These samplers expressed an interest in specific environmental parameters related to their communities. They are responsible for coordinating samples with APMI staff, and the CROM program provides sampling supplies (e.g., reusable bottles, phytoplankton nets, mussel bags, preservatives, data sheets, etc.).

Table 7. Types of samples received from external entities

Participating Entity	**Sample Types Received**

The City of Adak	Ocean chemistry
Kenaitze Indian Tribe	Ocean chemistry
Kodiak Area Native Association	Ocean chemistry
Seldovia Village Tribe	Shellfish, phytoplankton tow, ocean chemistry
Qawalangin Tribe of Unalaska	Ocean Chemistry

4. Response to EVOSTC Review, Recommendations and Comments (if applicable):
N/A

5. Budget:

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5-YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$343,695	$266,046	$361,095	$370,122	$379,375	$1,720,332	699,671.60
Travel	$17,452	$35,860	$17,452	$35,860	$17,452	$124,076	$68,240
Contractual	$23,925	$17,725	$17,725	$22,725	$18,925	$101,025	$69,294
Commodities	$21,150	$71,044	$17,050	$16,800	$19,900	$145,944	$125,588
Equipment	$150,000	$35,443	$0	$0	$40,000	$225,443	$159,439
Indirect Costs (report rate here)	$60,608	$59,617	$61,668	$66,470	$64,999	$313,362	$181,737
SUBTOTAL	$616,830	$485,735	$474,989	$511,977	$540,651	$2,630,182	$1,303,969
General Administration (9% of subtotal)	$55,515	$43,716	$42,749	$46,078	$48,659	$236,716	N/A
PROJECT TOTAL	$672,345	$529,451	$517,738	$558,054	$589,310	$2,866,899	
Other Resources (In-Kind Funds)	$0	$0	$0	$0	$0	$0	

INSTRUCTIONS: This summary page provides a five-year overview (FY 22-26) of proposed funding and actual cumulative spending which includes the **non-trustee agency** and **trustee agency workshseets**. **This Summary Page should automatically populate as the formulas reference the cells in the non-trustee agency and trustee agency worksheets. Please make sure the totals given are correct.** The column titled 'Actual Cumulative' will be updated each fiscal year and included in the annual report (include information on the total amount actually spent for all completed years of the project). On the Project Annual Report Form, if any line item exceeds a 10% deviation from the originally-proposed amount; provide detail regarding the reason for the deviation.

COMMENTS: Per EVOSTC Direction,reporting reflect expenses based on invoicing. At the time of reporting CRRC has not fully closed it's July billing period.

6. Figures

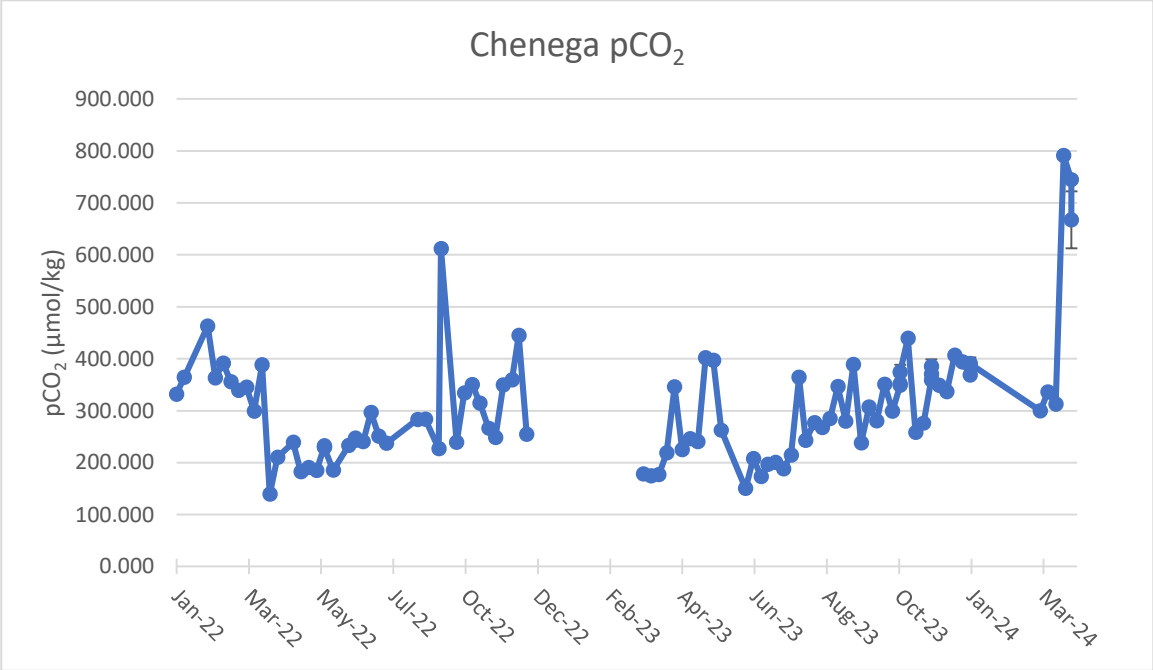

Figure 1. pCO_2 ($\mu mol\ kg^{-1}$) at Chenega for samples collected from 01/16/2022 - 3/31/2024. Standard deviation between triplicate and duplicate samples denoted by error bars. The Chenega sample set contains 4 triplicates (mean ± standard deviation) on 05/29/2022 (230.688±1.225), 06/26/2022 (245.060±2.301), 10/29/2023 (358.246±14.080), and 12/31/2023 (382.504±12.126) and 2 duplicates on 11/26/2023 (372.098±18.753) and 3/31/2024 (705.735±54.751). Error bars are not visible due to small standard deviation values.

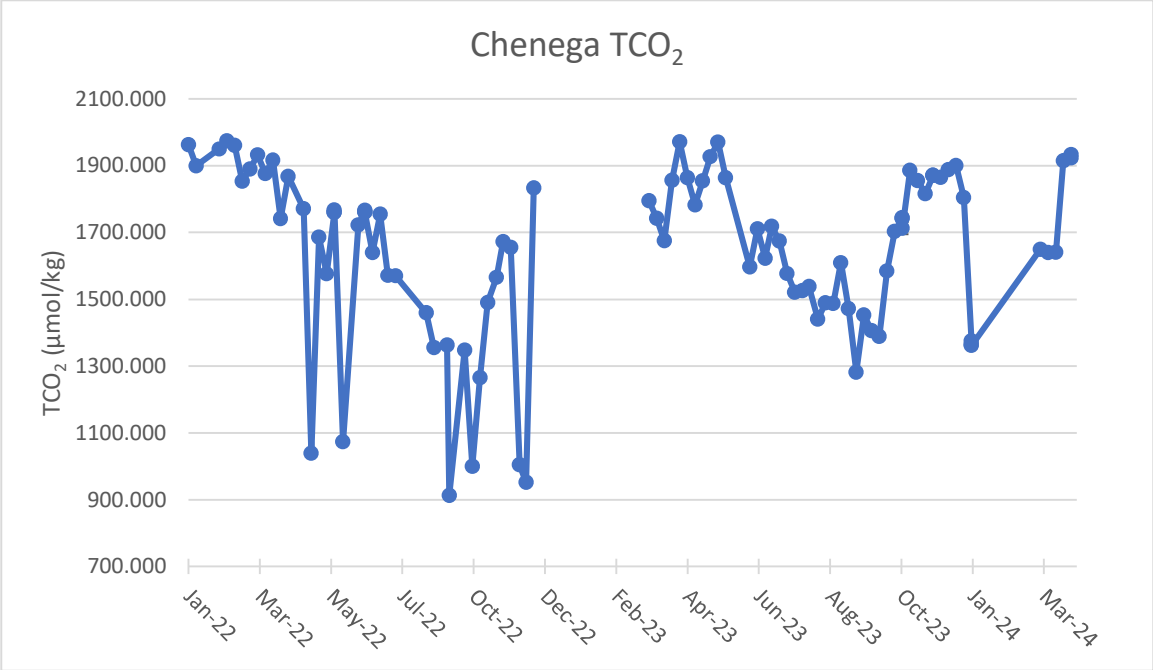

Figure 2. TCO_2 (µmol kg^{-1}) at Chenega for samples collected from 01/16/2022 - 3/31/2024. The Chenega sample set contains 4 triplicates (mean ± standard deviation) on 05/29/2022 (1762.904±4.045), 06/26/2022 (1763.237±2.966), 10/29/2023 (1733.317±18.119), and 12/31/2023 (1367.775±7.290) and 2 duplicates on 11/26/2023 (1870.886±0.740) and 3/31/2024 (1928.235±7.601). Error bars are not visible due to small standard deviation values.

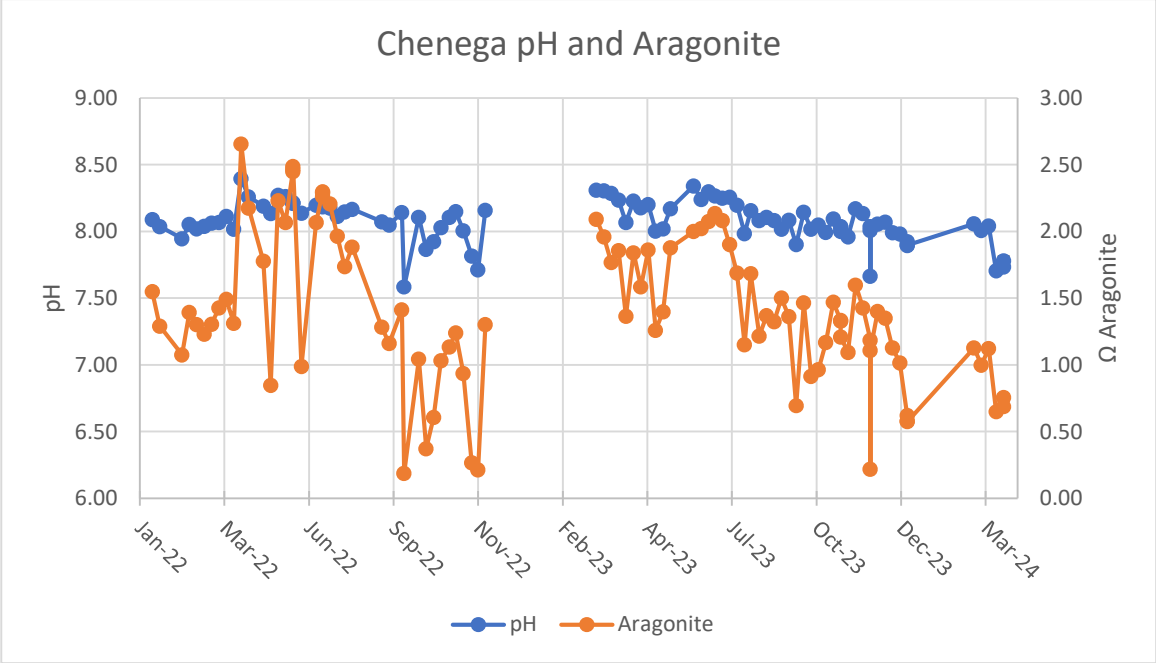

Figure 3. pH and aragonite saturation (no units associated) at Chenega for samples collected from 1/16/2022 - 3/31/2024. The Chenega sample set contains 4 triplicates (mean ± standard deviation) on 05/29/2022 (8.213±0.003; 2.456±0.019), 06/26/2022 (8.189±0.004; 2.284±0.019), 10/29/2023 (8.023±0.022; 1.147±0.054), and 12/31/2023 (7.906±0.01; 60.592±0.026) and 2 duplicates on 11/26/2023 (8.024±0.021; 1.291±0.071) and 3/31/2024 (7.758±0.033; 0.722±0.049). Standard deviation between triplicate and duplicate samples denoted by error bars.

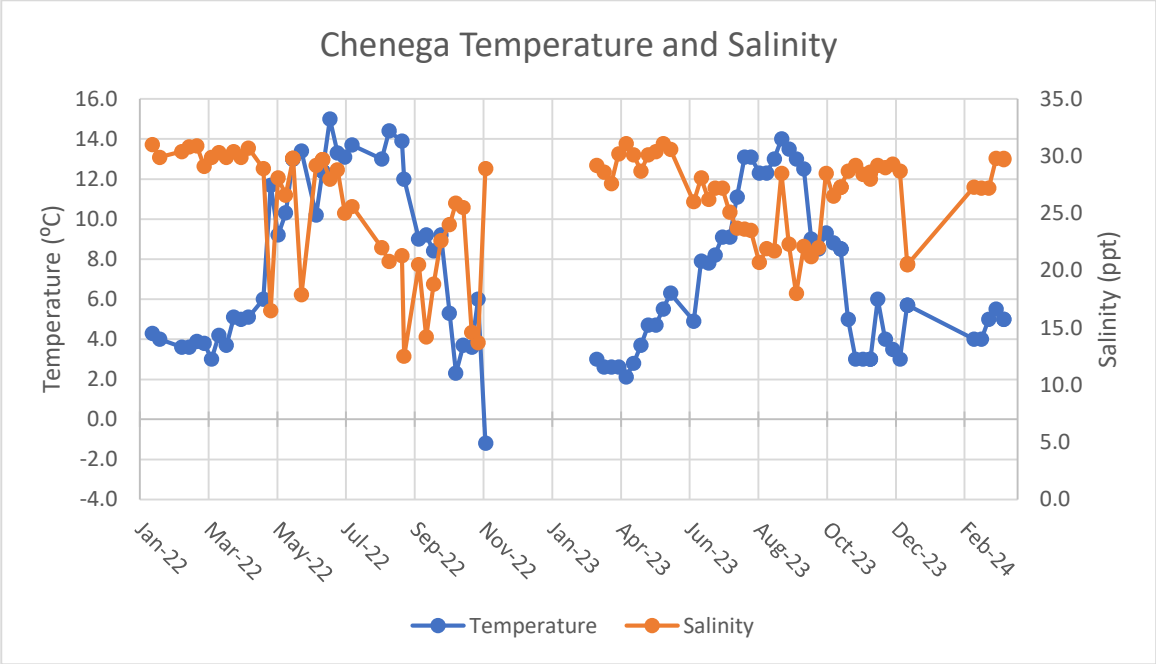

Figure 4. Temperature and salinity at Chenega for samples collected from 01/16/2022 - 3/31/2024. The Chenega sample set contains 4 triplicates (mean ± standard deviation) on 05/29/2022 (13.0 ± 0.0; 29.8 ± 0.0), 06/26/2022(12.4± 0.0; 29.7± 0.0), 10/29/2023(8.5± 0.0; 27.3± 0.0), and 12/31/2023 (5.7± 0.0; 20.5±0.1) and 1 duplicate on 3/31/2024 (5.0±0.0; 29.8±0.1). Error bars are not visible due to small standard deviation values.

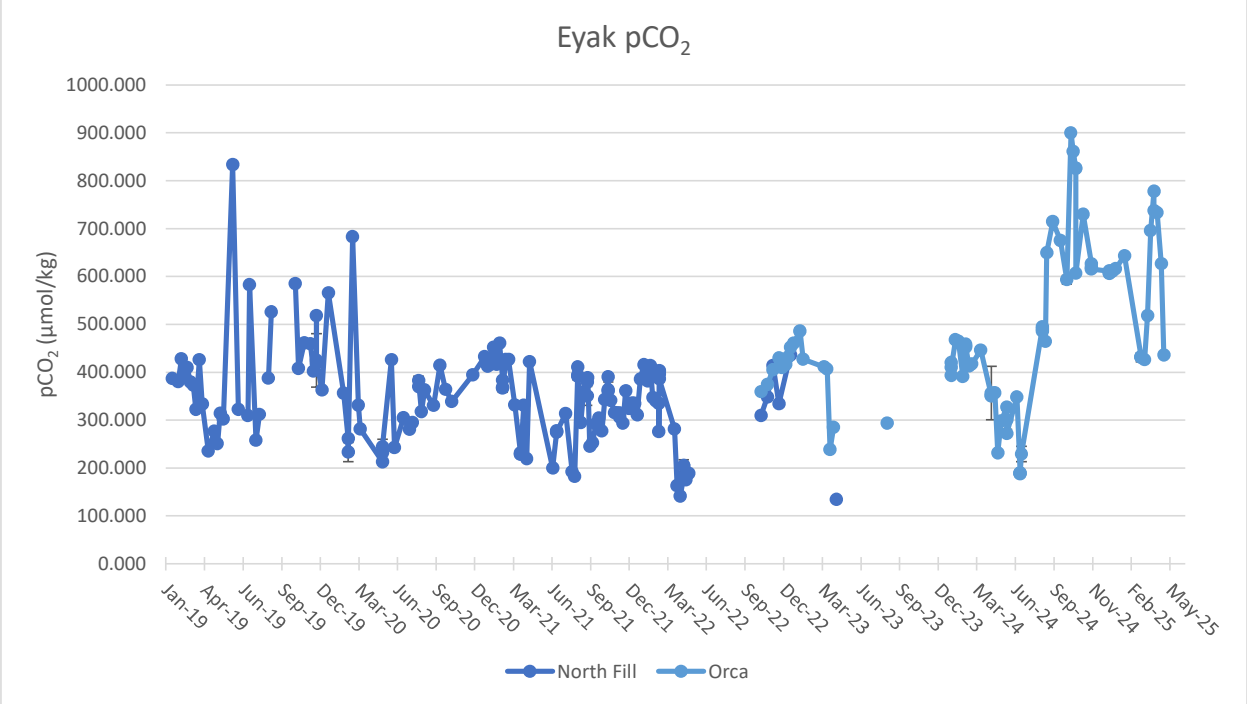

Figure 5. pCO_2 (µmol kg^{-1}) at the Eyak sites (which transitioned from North Fill to Orca Bay in 2022) for samples collected from 1/16/2019 - 5/15/2025. The Eyak data set contains 21 triplicates (mean ± standard deviation) on 12/18/2019 (453.789±55.850), 5/20/2020 (229.628±15.782), 1/27/2021 (424.345±7.189), 2/24/2021 (372.859±9.193), 4/7/2021 (229.780±1.398), 6/30/2021 (275.910±1.478), 8/18/2021 (398.714±10.665), 10/28/2021 (371.422±16.559), 12/16/2021 (325.086±0.704), 1/28/2022 (391.225±8.429), 2/24/2022 (394.786±7.844), 4/22/2022 (197.937±12.126), 01/06/2024 (407.867±13.614), 02/08/2024 (455.233±2.838), 04/08/2024 (352.668±3.261), 05/14/2024 (299.865±27.287), and 06/14/2024 (188.609±0.994), 8/5/2024(490.303±4.269), 10/22/2024 (752.697±126.638), 11/27/2024 (620.263±5.470), 1/8/2025 (608.390±2.583), and 3/23/2025 (431.567±0.690), and 4 duplicates on 3/1/2020 (247.250±19.937), 8/12/2020 (376.158±8.890), 9/9/2021 (364.811±19.987), 11/24/2021 (310.527±6.323), and 4/22/2025 (757.415±28.518). Standard deviations between triplicate samples denoted by error bars.

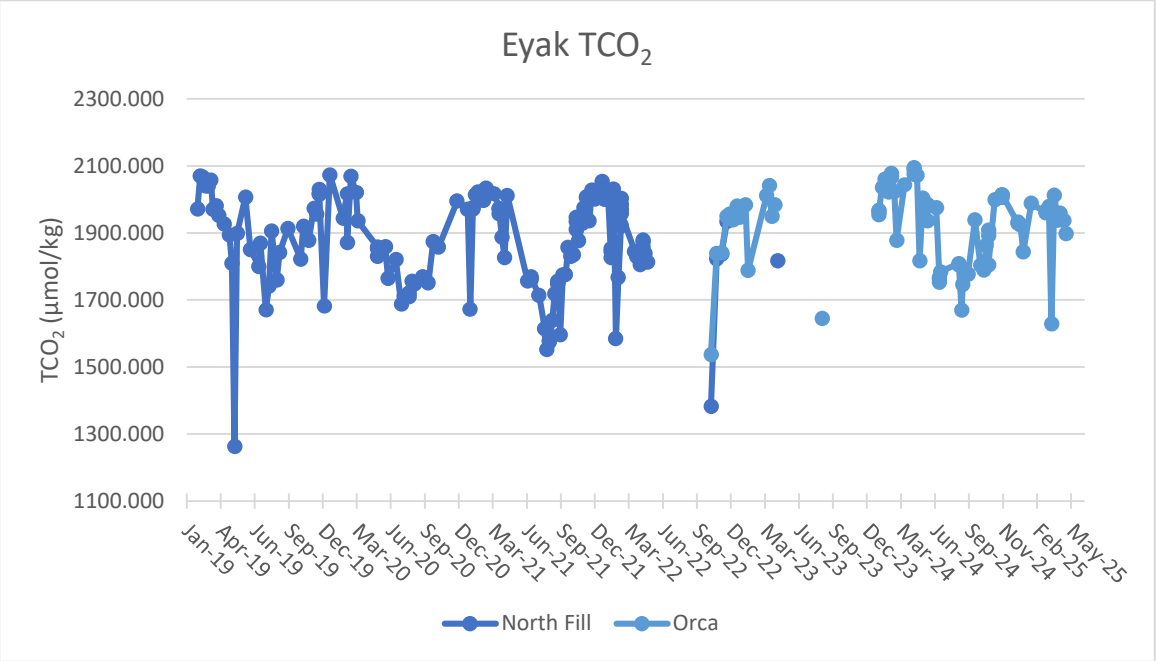

Figure 6. TCO_2 (µmol kg^{-1}) at the Eyak sites (which transitioned from North Fill to Orca Bay in 2022) for samples collected from 1/16/2019 - 5/15/2025. The Eyak data set contains 21 triplicates (mean ± standard deviation) on 12/18/2019 (2021.367±7.944), 5/20/2020 (1847.324±14.960), 1/27/2021 (1973.400±1.791), 2/24/2021 (1998.558±1.237), 4/7/2021 (1967.769±8.773), 6/30/2021 (1765.535±3.940), 8/18/2021 (1583.563±10.126), 10/28/2021 (1930.728±18.098), 12/16/2021 (2009.592±7.742), 1/28/2022 (1841.756±13.911), 2/24/2022 (1970.838±13.299), 4/22/2022 (1870.019±11.420), 01/06/2024 (1962.704±7.140), 02/08/2024 (2071.252±5.798), 04/08/2024 (2087.252±9.791), 05/14/2024 (1967.223±27.0705), 06/14/2024 (1761.615±7.033), 8/5/2024 (1806.580±2.294), 10/22/2024 (1868.700±56.214), 11/27/2024 (2011.657±5.089), 1/8/2025 (1930.637±1.883), and 3/23/2025 (1963.533±2.862), and 4 duplicates on 3/1/2020 (1944.065±103.028), 8/12/2020 (1716.458±8.074), 9/9/2021 (1752.094±5.827), 11/24/2021 (2006.837±0.853), and 4/22/2025 (1940.125±3.076). Standard deviations between triplicate samples denoted by error bars.

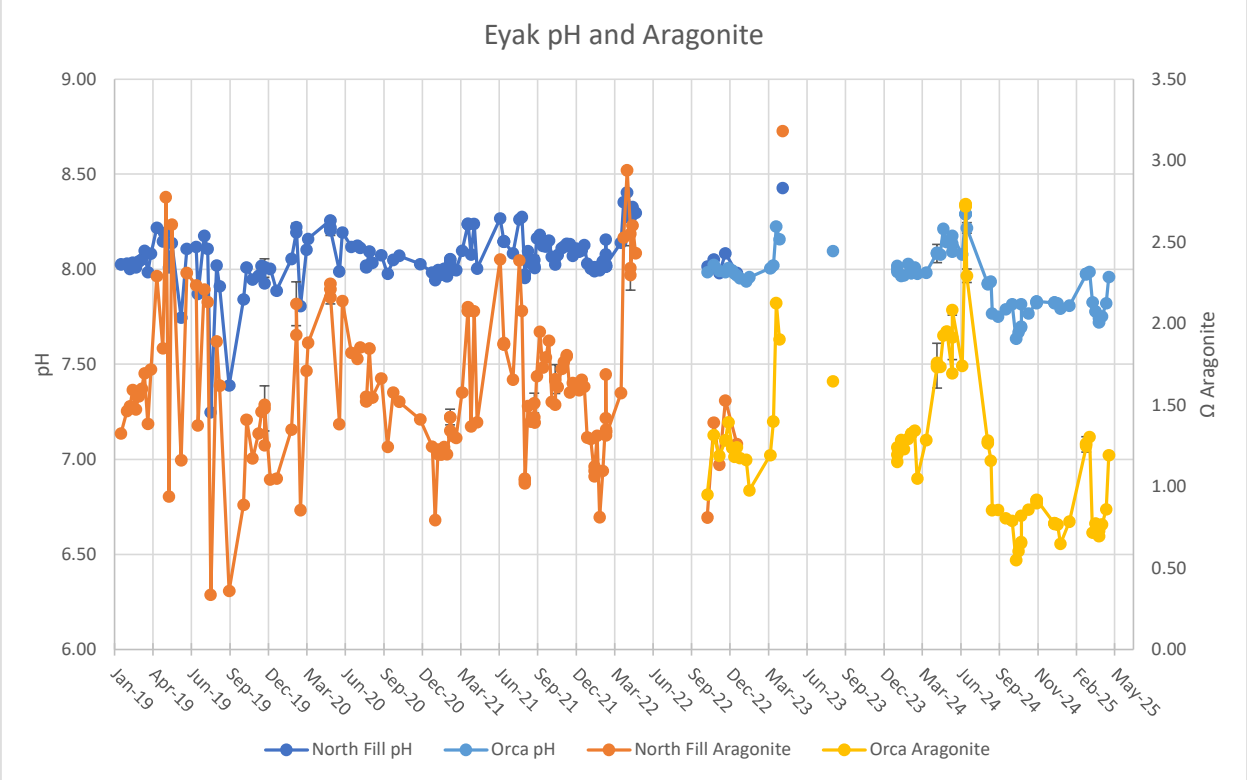

Figure 7. pH and aragonite saturation (no units associated) at the Eyak sites (which transitioned from North Fill to Orca Bay in 2022) for samples collected from 1/16/2019 - 5/15/2025. The Eyak data set contains 21 triplicates (mean ± standard deviation) on 12/18/2019 (7.981±0.049; 1.412±0.138), 5/20/2020 (8.227±0.027; 2.206±0.135), 1/27/2021 (7.988±0.007; 1.212±0.015), 2/24/2021 (8.047±0.009; 1.399±0.048), 4/7/2021 (8.238±0.002; 2.086±0.013), 6/30/2021 (8.146±0.001; 1.875±0.005), 8/18/2021 (7.965±0.009; 1.035±0.015), 10/28/2021 (8.049±0.022; 1.604±0.089), 12/16/2021 (8.105±0.002; 1.619±0.013), 1/28/2022 (7.999±0.010; 1.094±0.031), 2/24/2022 (8.018±0.006; 1.328±0.013), 4/22/2022 (8.286±0.026; 2.397±0.136), 01/06/2024 (8.002±0.015; 1.196±0.044), 02/08/2024 (7.981±0.001; 1.325±0.002), 04/08/2024 (8.085±0.003; 1.745±0.014), 05/14/2024 (8.135±0.042; 1.898±0.196), 06/14/2024 (8.291±0.001; 2.727±0.008), 8/5/2024 (7.925±0.004; 1.273±0.009), 10/22/2024 (7.737±0.069; 0.712±0.096), 11/27/2024 (7.827±0.005; 0.911±0.012), 1/8/2025 (7.824±0.002; 0.773±0.003), and 3/23/2025 (7.975±0.001; 1.257±0.009), and 4 duplicates on 3/1/2020 (8.208±0.020; 2.026±0.135), 8/12/2020 (8.015±0.008; 1.537±0.021), 9/9/2021 (8.033±0.022; 1.469±0.061), 11/24/2021 (8.129±0.007; 1.803±0.006), and 4/22/2025 (7.732±0.016; 0.712±0.024). Standard deviations between triplicate samples denoted by error bars.

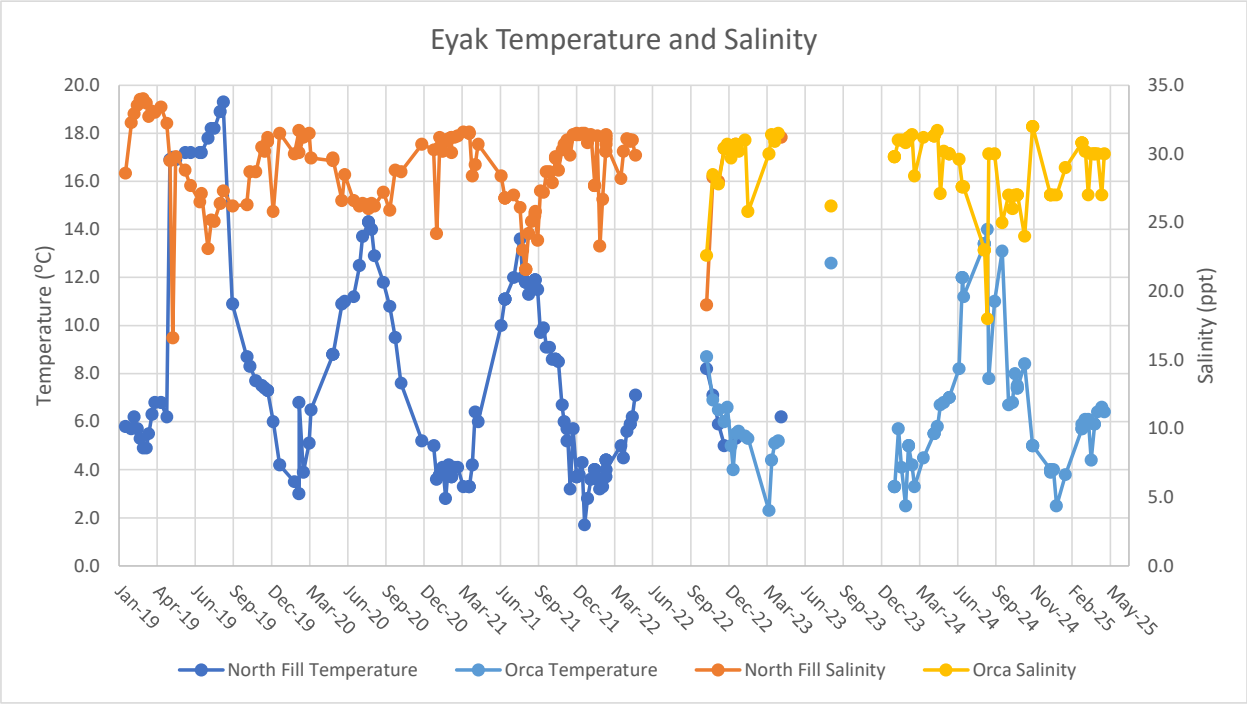

Figure 8. Temperature and salinity at the Eyak sites (which transitioned from North Fill to Orca Bay in 2022) for samples collected from 1/16/2019 - 5/15/2025. The Eyak data set contains 5 triplicates (mean ± standard deviation) for temperature and salinity on 12/18/2019 (7.3±0.0; 31.0±0.2), 5/20/2020 (8.8±0.0; 29.6±0.1), 1/27/2021 (3.8±0.0; 30.7±0.4), 2/24/2021 (3.7±0.0; 30.8±0.6), 4/7/2021 (3.3±0.0; 31.5±0.1), 6/30/2021 (11.1±0.0; 26.8±0.0), 8/18/2021 (11.8±0.0; 21.6±0.0), 10/28/2021 (8.6±0.0; 29.7±0.1), 12/16/2021 (3.7±0.0; 31.4±0.1), 1/28/2022 (4.0±0.0; 27.7±0.0), 2/24/2022 (4.3±0.4; 31.1±0.2), 4/22/2022 (5.9±0.0; 31.0±0.1), 01/06/2024 (3.3±0.0; 29.8±0.0), 02/08/2024 (5.0±0.0; 31.2±0.1), 04/08/2024 (5.5±0.0; 31.3±0.0), 05/14/2024 (7.0±0.0; 31.3±0.0) 06/14/2024 (7.0±0.0; 30.0±0.0), 8/5/2024 (13.4±0.0; 23.0±0.0), 10/22/2024 (7.4±0.1; 27.0±0.0), 11/27/2024 (5.0±0.0; 32.0±0.0), 1/8/2025 (4.0±0.1; 27.0±0.0), and 3/23/2025 (5.8±0.1; 30.8±0.0), and 4 duplicates on 3/1/2020 (4.9±2.7; 30.9±1.1), 8/12/2020 (14.3±0.0; 26.3±0.1), 9/9/2021 (11.9±0.0; 25.6±0.1), 11/24/2021 (5.5±0.4; 31.0±0.1), and 4/22/2025 (5.9±0.0; 30.0±0.0). Error bars are not visible due to small standard deviation values.

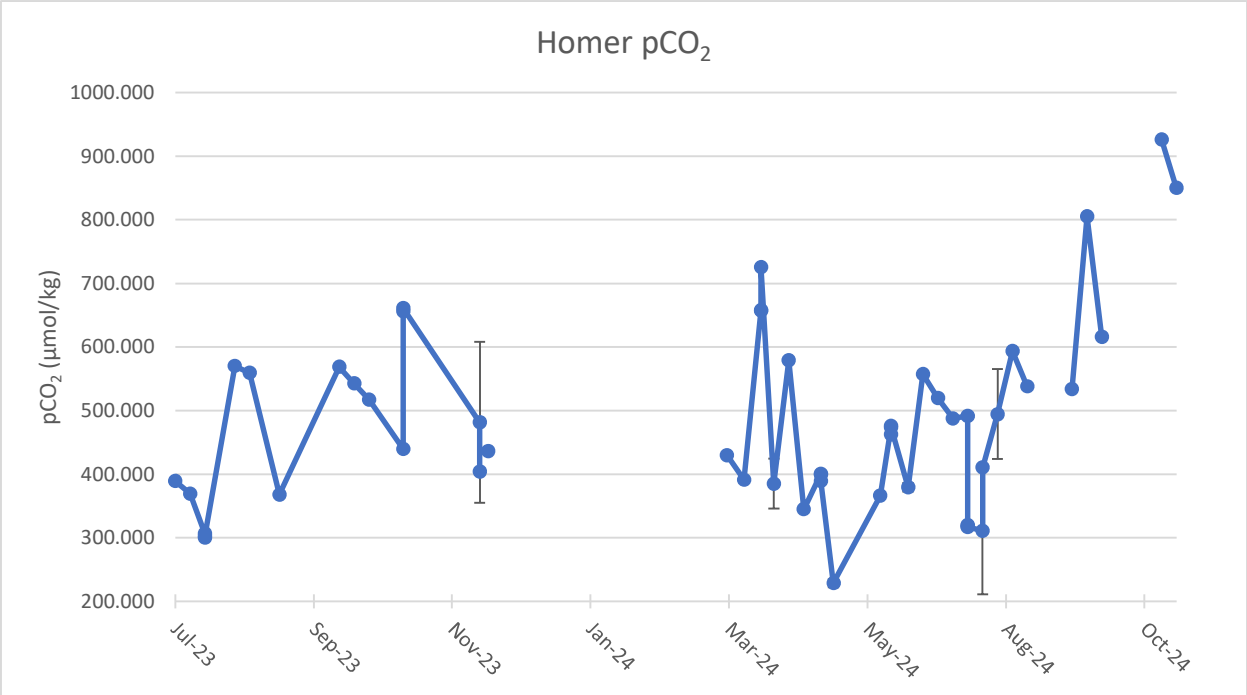

Figure 9. pCO_2 (µmol kg^{-1}) at Homer site for samples collected from 07/11/2023 - 10/23/2024. The Homer data set contains 6 triplicates (mean ± standard deviation) on 07/25/2023 (303.048±3.418), 10/26/2023 (585.516±39.259), 04/11/2024 (680.285±126.453), 05/09/2024 (396.342±54.705), 06/11/2024 (470.653±7.116), and 07/17/2024 (376.053± 99.869), and 2 duplicates on 12/01/2023 (442.832±6.144) and 07/24/2024 (360.655±70.605). Standard deviation between triplicate and duplicate samples denoted by error bars.

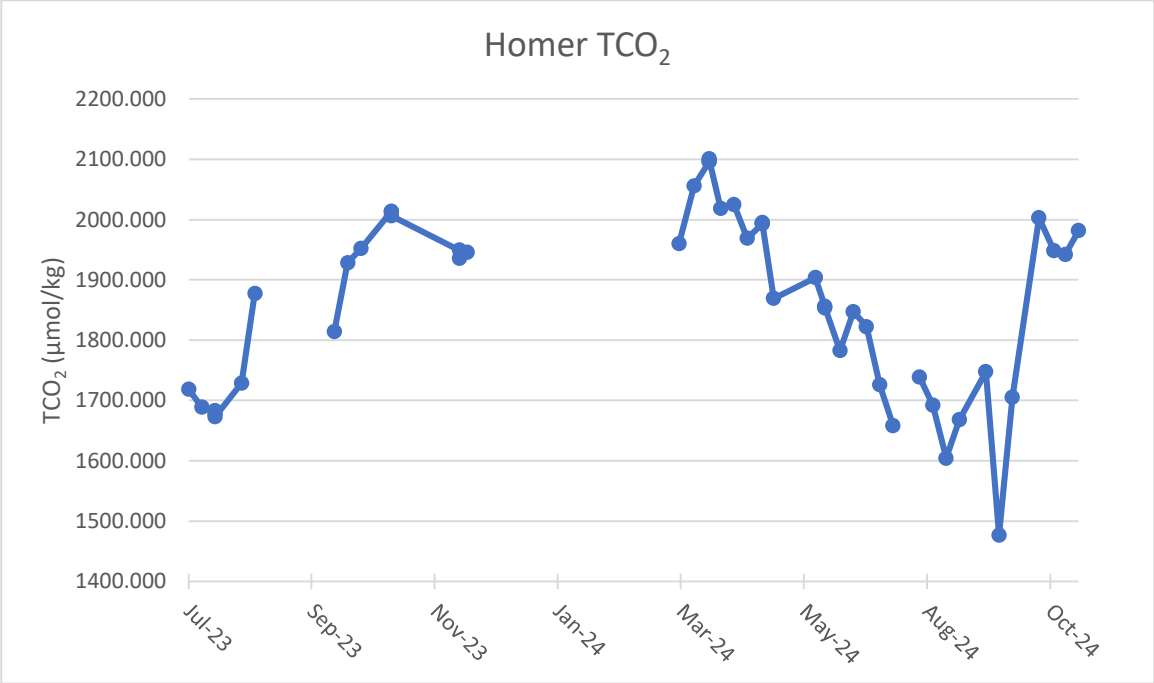

Figure 10. TCO_2 (µmol kg^{-1}) at Homer site for samples collected from 07/11/2023 – 10/23/2024. The Homer data set contains 5 triplicates (mean ± standard deviation) on 07/25/2023 (1677.977±5.093), 10/26/2023 (2010.839±3.955), 04/11/2024 (2098.175±2.351), 05/09/2024 (1993.803±1.009), and 06/11/2024 (1855.080±1.254) and 1 duplicate on 12/01/2023 (1942.513±9.715). Error bars are not visible due to small standard deviation values.

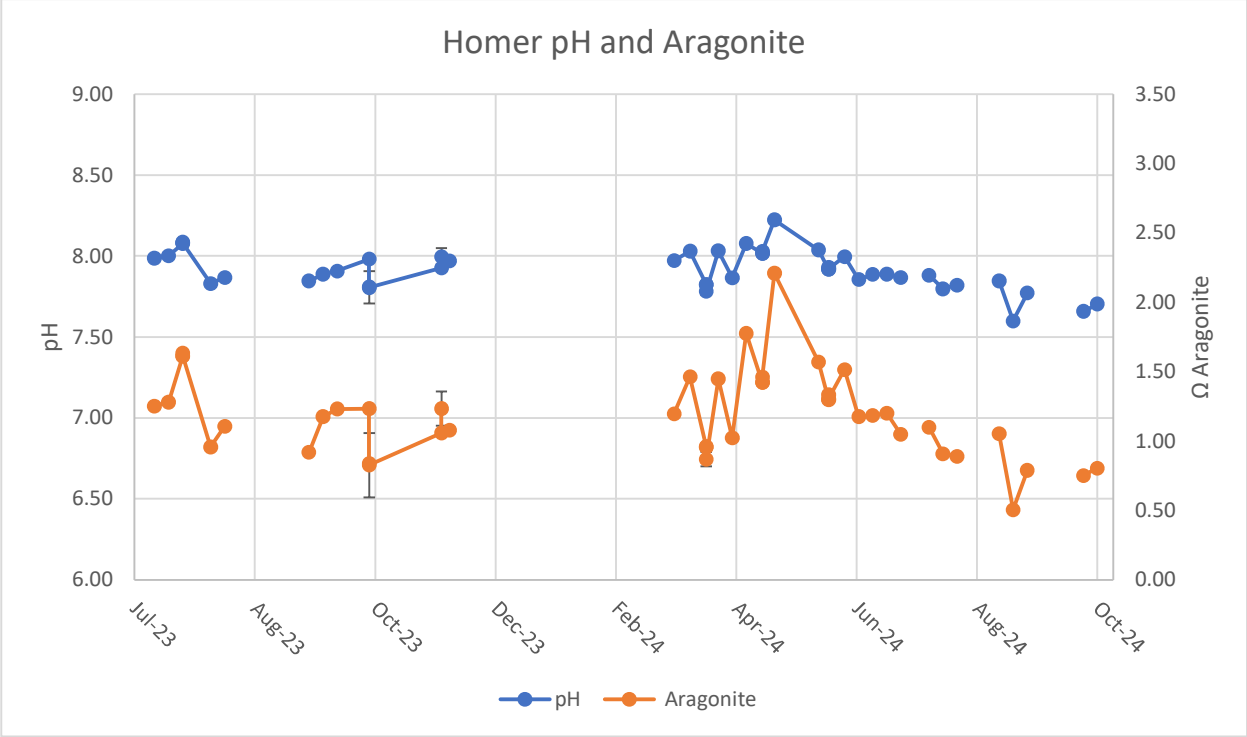

Figure 11. pH and aragonite saturation (no units associated) at Homer site for samples collected from 07/11/2023 – 10/23/2024. The Homer data set contains 5 triplicates (mean ± standard deviation) for pH and aragonite on 07/25/2023 (8.082±0.004; 1.621±0.012), 10/26/2023 (7.866±0.100; 0.967±0.231), 04/11/2024 (7.811±0.025; 0.929±0.051), 05/09/2024 (8.021±0.007; 1.436±0.0221), and 06/11/2024 (7.923± 0.01; 1.312± 0.020), and 1 duplicate for pH and aragonite on 12/01/2023 (7.962±0.050; 1.147±0.123). Standard deviation between triplicate and duplicate samples denoted by error bars.

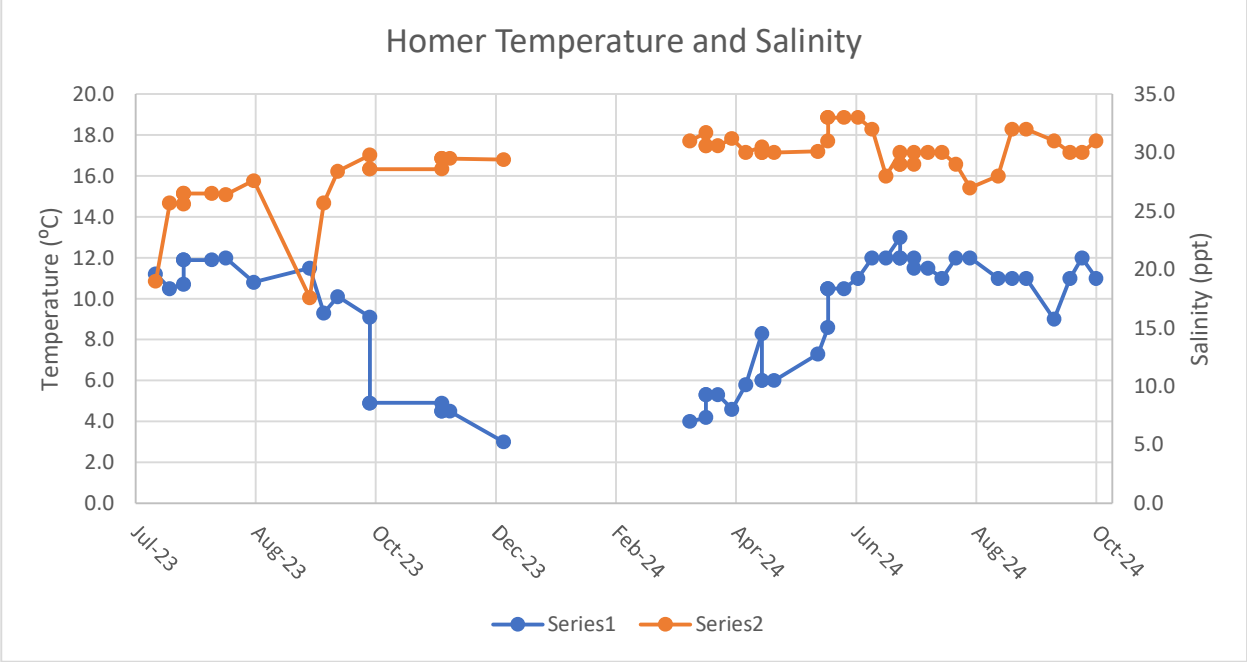

Figure 12. Temperature and salinity at Homer site for samples collected from 07/11/2023 – 10/23/2024. The Homer data set contains 3 triplicates (mean ± standard deviation) for temperature and salinity on 07/25/2023 (11.0±0.0; 26.5±0.0), 10/26/2023 (4.9±0.0; 28.6±0.0), 04/11/2024 (5.3±0.0; 28.6±0.0), and 05/09/2024(6.0±0.0; 30.0±0.0), 06/11/2024 (10.5±0.0; 33.0±0.0), 07/17/2024 (12.0±0.0; 29.0±0.0) and 2 duplicates for temperature and salinity on 12/01/2023 (4.5±0.0; 29.5±0.0) and 07/24/2024 (11.5±0.0; 30.0±0.0). Error bars are not visible due to small standard deviation values.

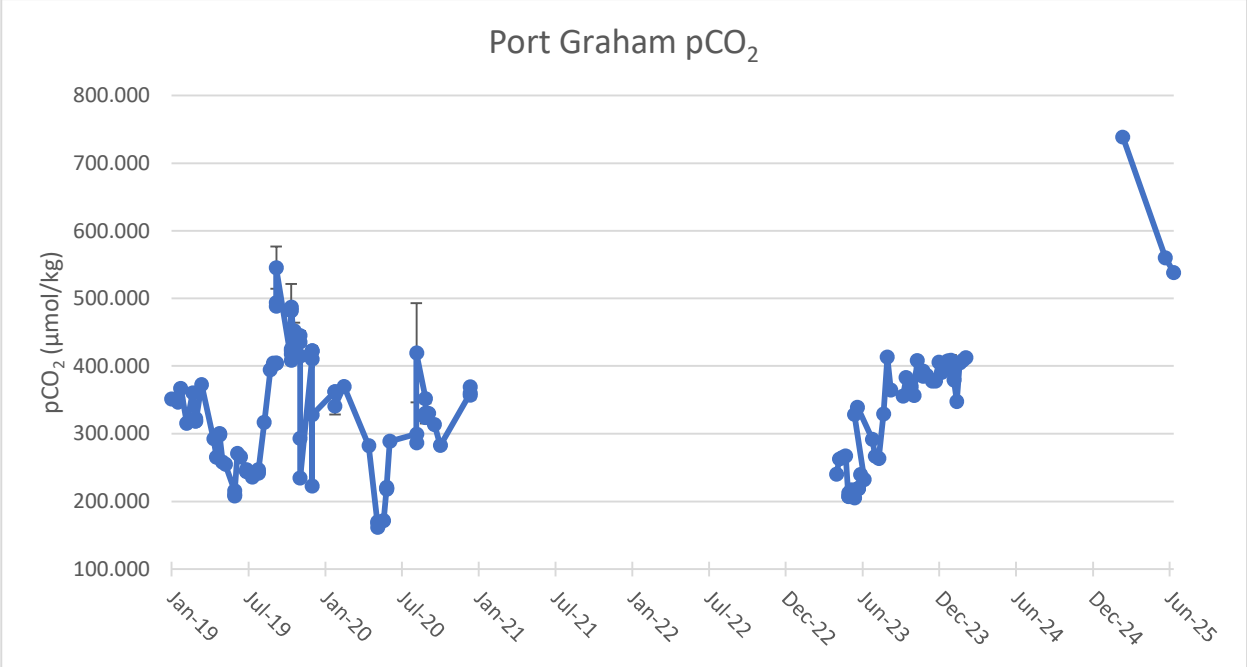

Figure 13. pCO_2 (µmol kg^{-1}) at the Port Graham site for samples collected from 01/18/2019 – 06/25/2025 The Port Graham sample set includes 21 triplicates (mean ± standard deviation) on 02/01/2019 (349.524±3.251), 03/15/2019 (320.036±2.220), 05/10/2019 (299.388±1.075), 06/14/2019 (211.509±4.123), 07/12/2019 (245.381±1.755), 08/09/2019 (244.369±2.828), 09/20/2019 (404.473±0.088), 10/25/2019 (416.298±7.175), 11/01/2019 (439.113±12.083), 11/15/2019 (431.892±6.976), 12/13/2019 (418.283±7.035), 02/05/2020 (355.220±12.318), 05/15/2020 (166.648±4.211), 06/05/2020 (219.406±1.435), 08/14/2020 (335.304±73.353), 09/04/2020 (335.361±14.819), 12/18/2020 (362.171±6.438), 05/24/2023 (209.199±2.892), 06/16/2023 (219.181±0.116), 11/15/2023 (389.770±4.055), and 01/19/2024 (403.065±7.179). Standard deviation between triplicate samples denoted by error bars.

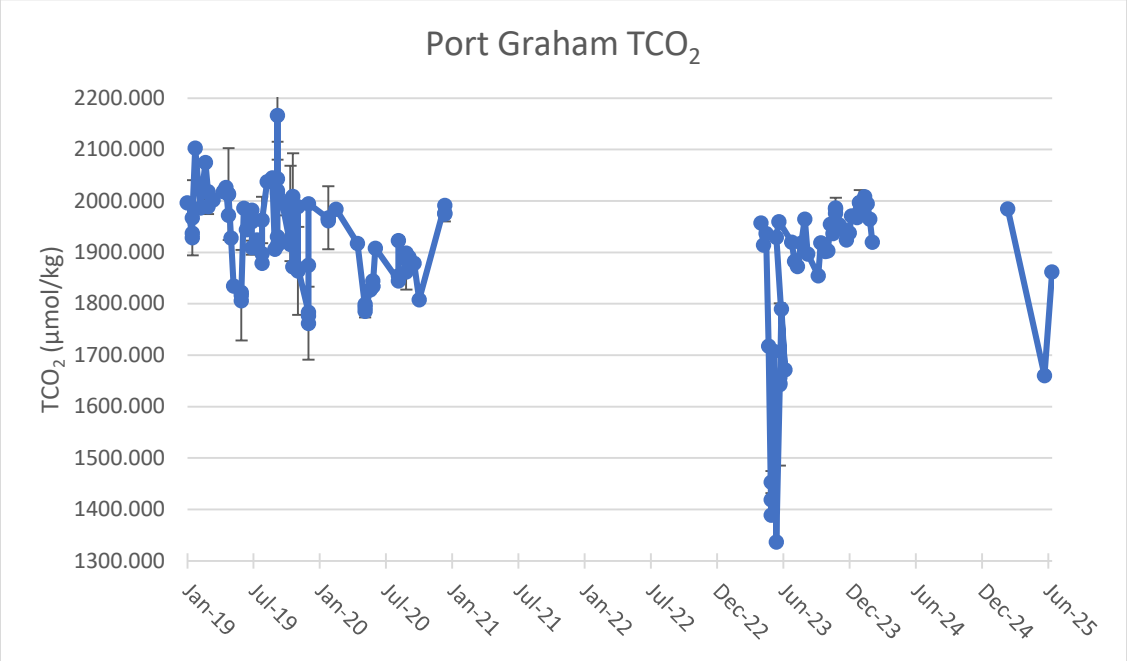

Figure 14. TCO_2 (µmol kg^{-1}) at the Port Graham site for samples collected from 01/18/2019 – 06/25/2025. The Port Graham sample set includes 21 triplicates (mean ± standard deviation) on 02/01/2019 (1944.787±20.094), 03/15/2019 (2007.943±16.161), 05/10/2019 (1999.763±23.824), 06/14/2019 (1815.341±8.181), 07/12/2019 (1950.495±37.284), 08/09/2019 (1913.384±44.090), 09/20/2019 (2003.974±11.427), 10/25/2019 (1921.299±4.858), 11/01/2019 (1948.489±69.672), 11/15/2019 (1908.983±1.351), 12/13/2019 (1774.593±11.023), 02/05/2020 (1964.955±2.800), 05/15/2020 (1792.891±7.089), 06/05/2020 (1837.981±6.261), 08/14/2020 (1874.419±42.752), 09/04/2020 (1882.354±18.695), 12/18/2020 (1981.141±9.066), 05/24/2023 (1420.559±32.145), 06/16/2023 (1648.896±7.311), 11/15/2023 (1982.762±5.644), and 01/19/2024 (1991.462±10.120). Standard deviation between triplicate samples denoted by error bar.

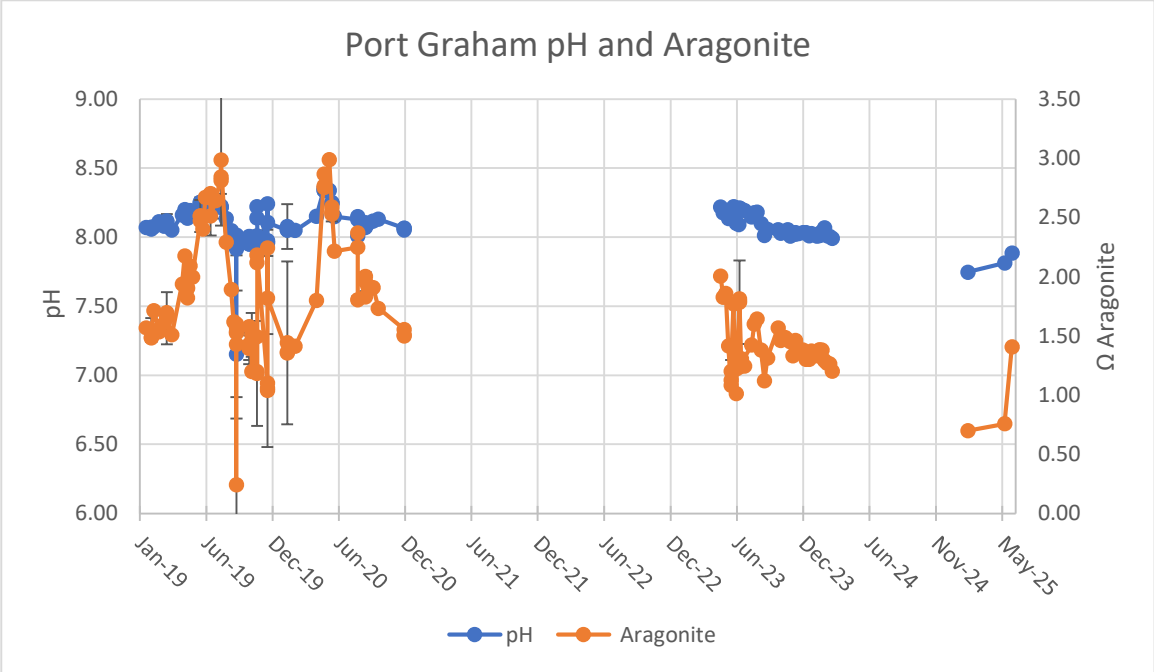

Figure 15. pH and aragonite saturation (no units associated) at the Port Graham site for samples collected from 01/18/2019 – 06/25/2025 The Port Graham sample set includes 21 triplicates (mean ± standard deviation) for pH and aragonite on 02/01/2019 (8.064±0.007; 1.506±0.039), 03/15/2019 (8.114±0.003; 1.673±0.023), 05/10/2019 (8.144±0.006; 1.875±0.048), 06/14/2019 (8.247±0.006; 2.498±0.023), 07/12/2019 (8.216±0.004; 2.625±0.100), 08/09/2019 (8.218±0.005; 2.879±0.092), 09/20/2019 (8.012±0.002; 1.586±0.018), 10/25/2019 (7.995±0.007; 1.414±0.013), 11/01/2019 (7.979±0.013; 1.385±0.165), 11/15/2019 (7.959±0.008; 1.189±0.011), 12/13/2019 (7.965±0.009; 1.065±0.031), 02/05/2020 (8.059±0.015; 1.385±0.048), 05/15/2020 (8.343±0.010; 2.794±0.062), 06/05/2020 (8.246±0.004; 2.553±0.031), 08/14/2020 (8.095±0.076; 2.141±0.297), 09/04/2020 (8.088±0.018; 1.930±0.090), 12/18/2020 (8.060±0.008; 1.520±0.030), 05/24/2023 (8.179±0.010; 1.135±0.060), 06/16/2023 (8.208±0.002; 1.797±0.015), 11/15/2023 (8.027±0.006; 1.444±0.019), and 01/19/2024 (8.016±0.008; 1.348±0.029). Standard deviation between triplicate samples denoted by error bars.

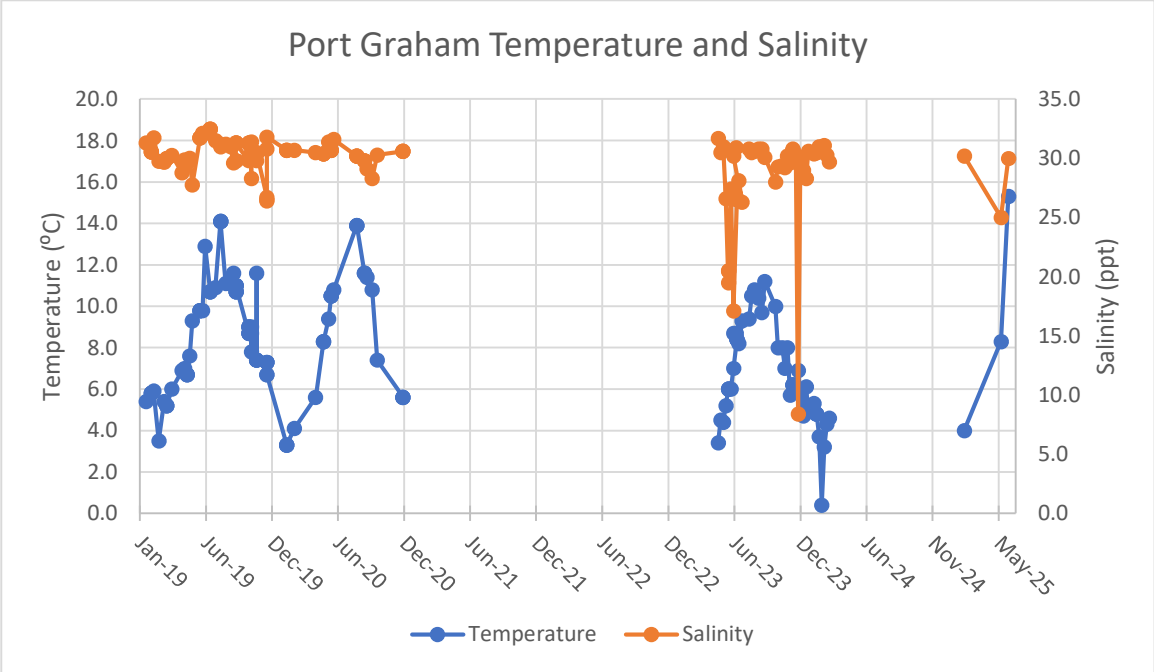

Figure 16. Temperature and salinity at the Port Graham site for samples collected from 01/18/2019 – 06/25/2025 The Port Graham sample set includes 21 triplicates (mean ± standard deviation) for temperature and salinity on 02/01/2019 (5.80±0.0; 30.5±0.0), 03/15/2019 (5.2±0.0; 30.0±0.0), 05/10/2019 (6.7±0.0; 29.7±0.0), 06/14/2019 (9.8±0.0; 31.7±0.0), 07/12/2019 (10.7±0.0; 32.5±0.0), 08/09/2019 (14.1±0.0; 31.1±0.1), 09/20/2019 (10.7±0.0; 29.8±0.0), 10/25/2019 (8.7±0.0; 30.0±0.2), 11/01/2019 (8.5±0.6; 30.1±1.6), 11/15/2019 (7.4±0.0; 30.4±0.0), 12/13/2019 (7.3±0.0; 26.5±0.1), 02/05/2020 (3.3±0.0; 30.7±0.0), 05/15/2020 (8.3±0.0; 30.4±0.0), 06/05/2020 (10.5±0.0; 30.7±0.0), 08/14/2020 (13.9±0.0; 30.2±0.0), 09/04/2020 (11.6±0.0; 29.8±0.0), 12/18/2020 (5.6±0.0; 30.6±0.0), 05/24/2023 (6.0±0.0; 20.2±0.6), 06/16/2023 (8.4±0.0; 26.5±0.1), 11/15/2023 (6.2±0.0; 30.7±0.1), and 01/19/2024 (4.8±0.0; 30.5±0.0). Standard deviation between triplicate samples denoted by error bars.

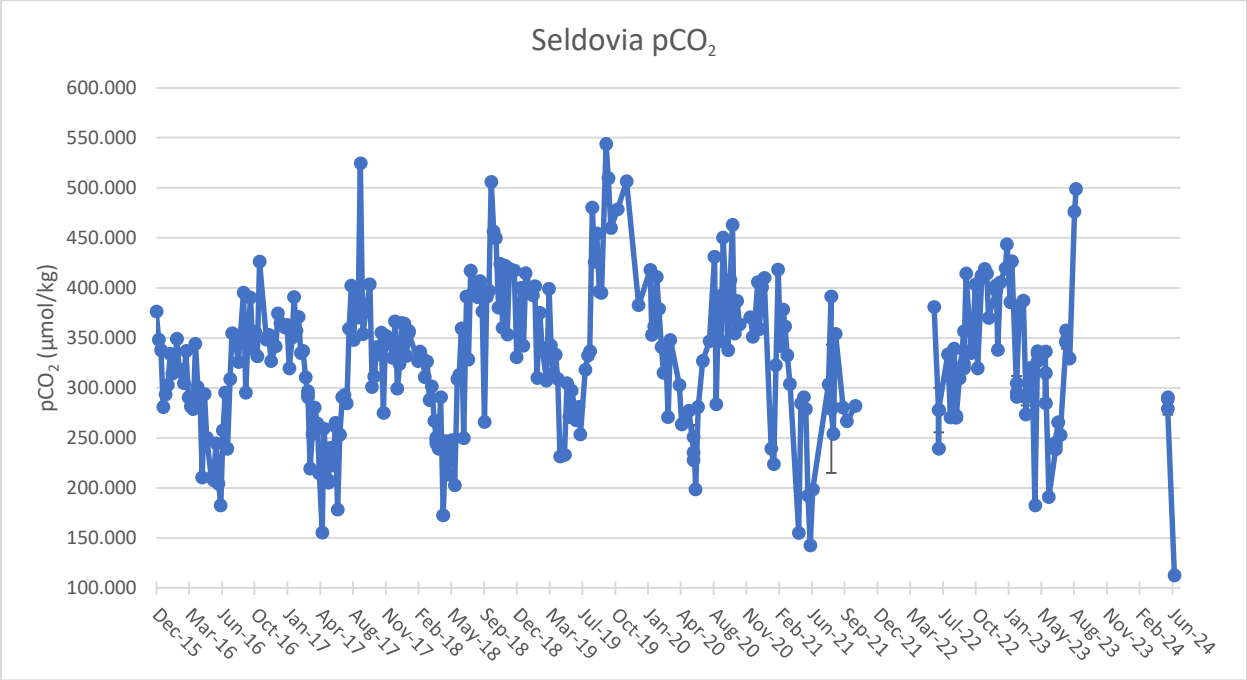

Figure 17. pCO_2 (µmol kg^{-1}) at the Seldovia Village Tribe site for samples collected from 12/10/2015 - 06/11/2024. The Seldovia sample site includes 20 triplicates (mean ± standard deviation) on 03/16/2017 (293.679±3.003), 05/18/2017 (206.469±0.933), 06/08/2017 (263.667±1.717), 01/18/2018 (356.249±0.859), 04/12/2018 (247.732±3.030), 06/05/2020 (238.209±11.811), 07/30/2021 (317.589±64.156), 06/23/2022 (265.147±22.255), 08/15/2022 (271.105±1.104), 09/08/2022 (333.570±20.255), 10/06/2022 (344.140±10.031), 11/01/2022 (411.215±1.444), 12/16/2022 (399.736±2.891), 02/16/2023 (297.167±6.999), 03/16/2023 (285.561±10.375), 04/20/2023 (332.595±5.166), 05/15/2023 (312.101±25.999), 06/15/2023 (242.281±3.351), 07/17/2023 (350.099±6.621), and 05/22/2024 (286.416±6.095). Standard deviation between triplicate samples denoted by error bars.

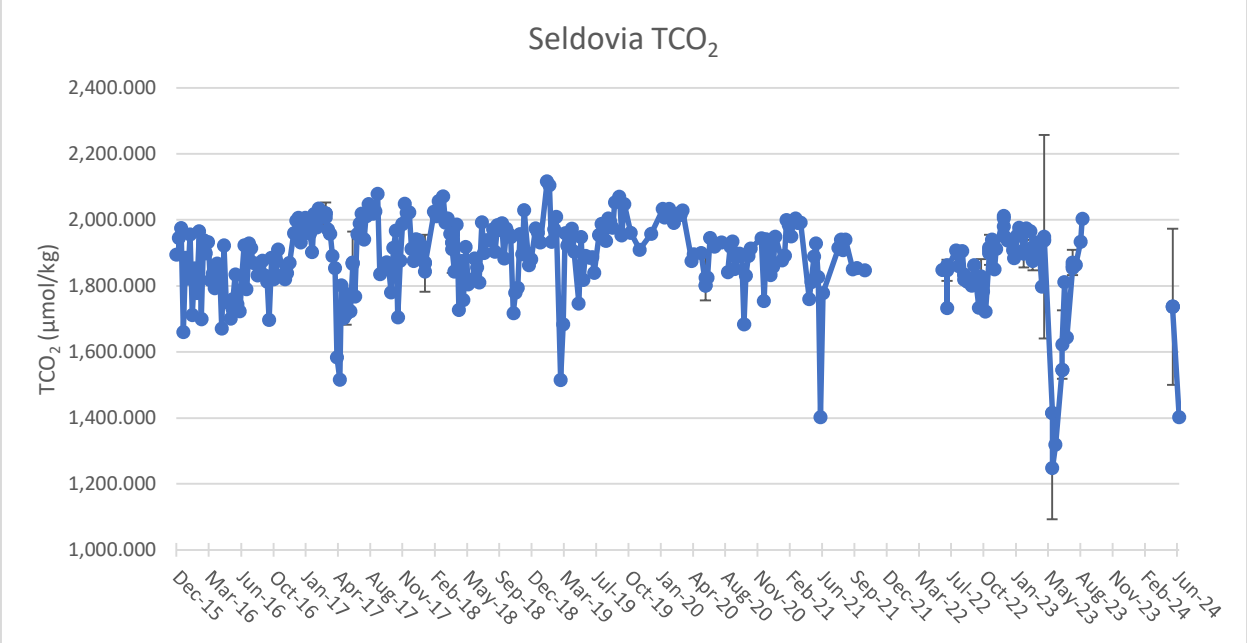

Figure 18. TCO_2 (µmol kg^{-1}) at the Seldovia Village Tribe site for samples collected from 12/10/2015 - 06/11/2024. The Seldovia sample site includes 20 triplicates (mean ± standard deviation) on 03/16/2017 (2016.195±6.832), 05/18/2017 (1716.653±3.052), 06/08/2017 (1869.489±2.445), 01/18/2018 (1861.388±11.775), 04/12/2018 (1924.729±11.775), 06/05/2020 (1809.757±13.744), 07/30/2021 (1924.446±14.841), 06/23/2022 (1814.554±70.774), 08/15/2022 (1829.141±8.886), 09/08/2022 (1812.917±10.311), (10/06/2022 (1818.381±13.625), 11/01/2022 (1908.553±8.785), 12/16/2022 (1999.475±16.707), 02/16/2023 (1904.623±5.917), 03/16/2023 (1900.030±21.272), 04/20/2023 (1942.581±5.962), 05/15/2023 (1359.796±96.295), 06/15/2023 (1571.444±44.157), 07/17/2023 (1862.493±8.593), and 05/22/2024 (1737.717±0.960). Standard deviation between triplicate samples denoted by error bars.

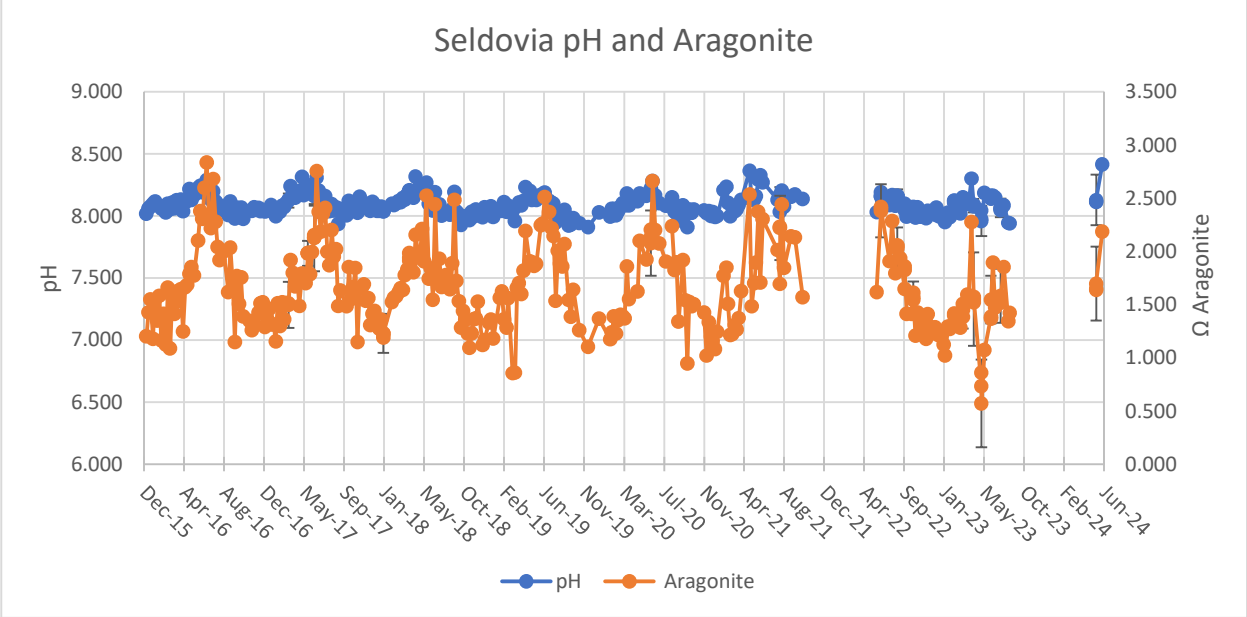

Figure 19. pH and aragonite saturation (no units associated) at the Seldovia Village Tribe site for samples collected from 12/10/2015 - 06/11/2024. The Seldovia sample site includes 20 triplicates (mean ± standard deviation) for pH and aragonite saturation on 03/16/2017 (8.127±0.003; 1.505±0.006), 05/18/2017 (8.244±0.001; 1.983±0.002), 06/08/2017 (8.163±0.003; 2.138±0.013) 01/18/2018 (8.039±0; 1.217±0.021), 04/12/2018 (8.200±0.006; 1.945±0.036), 06/05/2020 (8.206±0.017; 2.139±0.063), 07/30/2021 (8.121±0.076; 2.049±0.307), 6/23/2022 (8.168±0.019; 2.400±0.018), 08/15/2022 (8.079±0.002; 2.044±0.015), 09/08/2022 (8.079± 0.027; 1.778± 0.112), *10/06/2022 (8.063±0.011; 1.576±0.033), 11/01/2022 (7.995±0.001; 1.288±0.006), 12/16/2022(8.015±0.003; 1.266±0.019), 02/16/2023 (8.116±0.011; 1.382±0.042), 03/16/2023 (8.130±0.017; 1.447±0.062) 04/20/2023 (8.083±0.006; 1.549±0.025), 05/15/2023 (7.992±0.045; 0.721±0.145), 06/15/2023 (8.151±0.011; 1.434±0.098), 07/17/2023 (8.057±0.008; 1.549±0.032), and 05/22/2024 (8.119±0.009; 1.660±0.032). Standard deviation between triplicate samples denoted by error bars.*

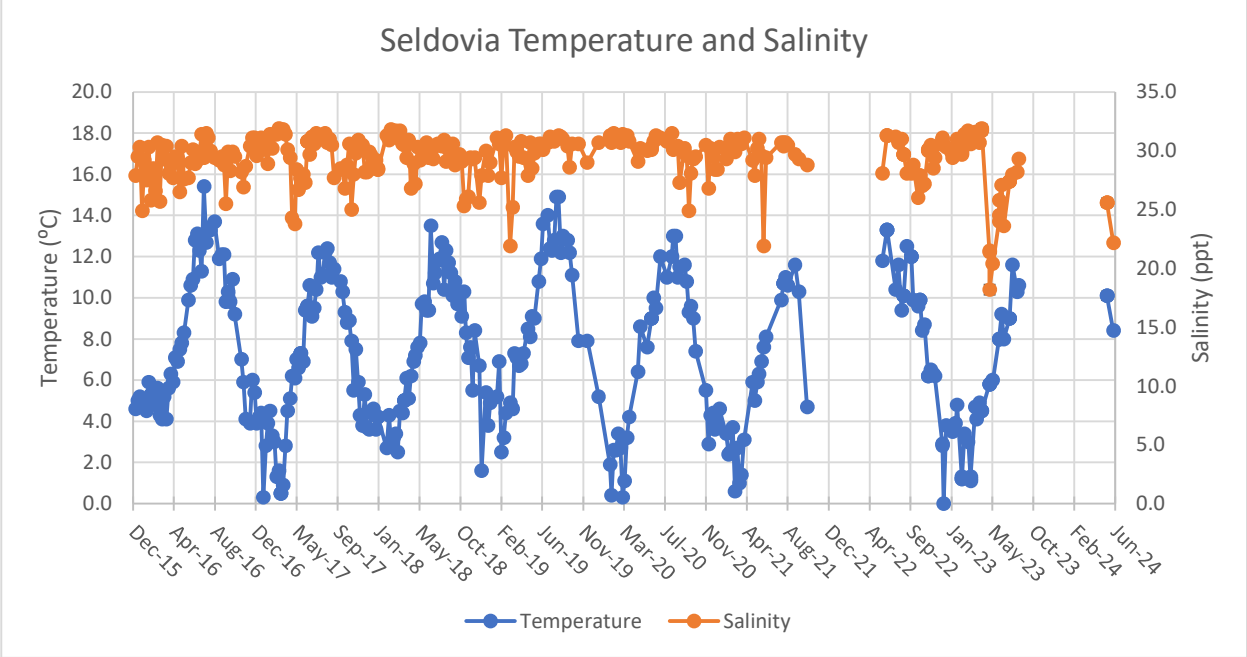

Figure 20. Temperature and salinity at the Seldovia Village Tribe site for samples collected from 12/10/2015 - 06/11/2024. The Seldovia sample site includes 20 triplicates (mean ± standard deviation) for temperature and salinity on 03/16/2017 (0.5±0.0; 31.6±0.1), 05/18/2017 (7.3±0.0; 27.7±0.1), 06/08/2017 (9.6±0.0; 30.8±0.0) 01/18/2018 (4.2±0.0; 28.4±0.1), 04/12/2018 (5.0±0.0; 30.6±0.1), 06/05/2020 (9.0±0.0; 30.2±0.1), 07/30/2021 (10.7±0.0; 30.6±0.1), 06/23/2022 (13.3±0.0; 31.3±0.0), 08/15/2022 (10.1±0.0; 29.7±0.0), 09/08/2022 (12.0±0.0; 28.2±0.1), 10/06/2022 (9.9±0.0; 27.9±0.0), 11/01/2022 (6.2±0.0; 30.1±0.1), 12/16/2022 (2.9±0.1; 31.0±0.0), 02/16/2023 (1.2±0.1; 29.8±0.1), 03/16/2023 (1.2±0.1; 30.7±0.1), 04/20/2023 (4.5±0.0; 31.8±0.1), 05/15/2023 (5.8±0.0; 20.4±1.9), 06/15/2023 (8.0±0.0; 24.8±0.9), 07/17/2023 (9.0±0.0; 27.4±0.0), and 05/22/2024 (10.1±0.0; 25.6±0.0). Standard deviation between triplicate samples denoted by error bars.

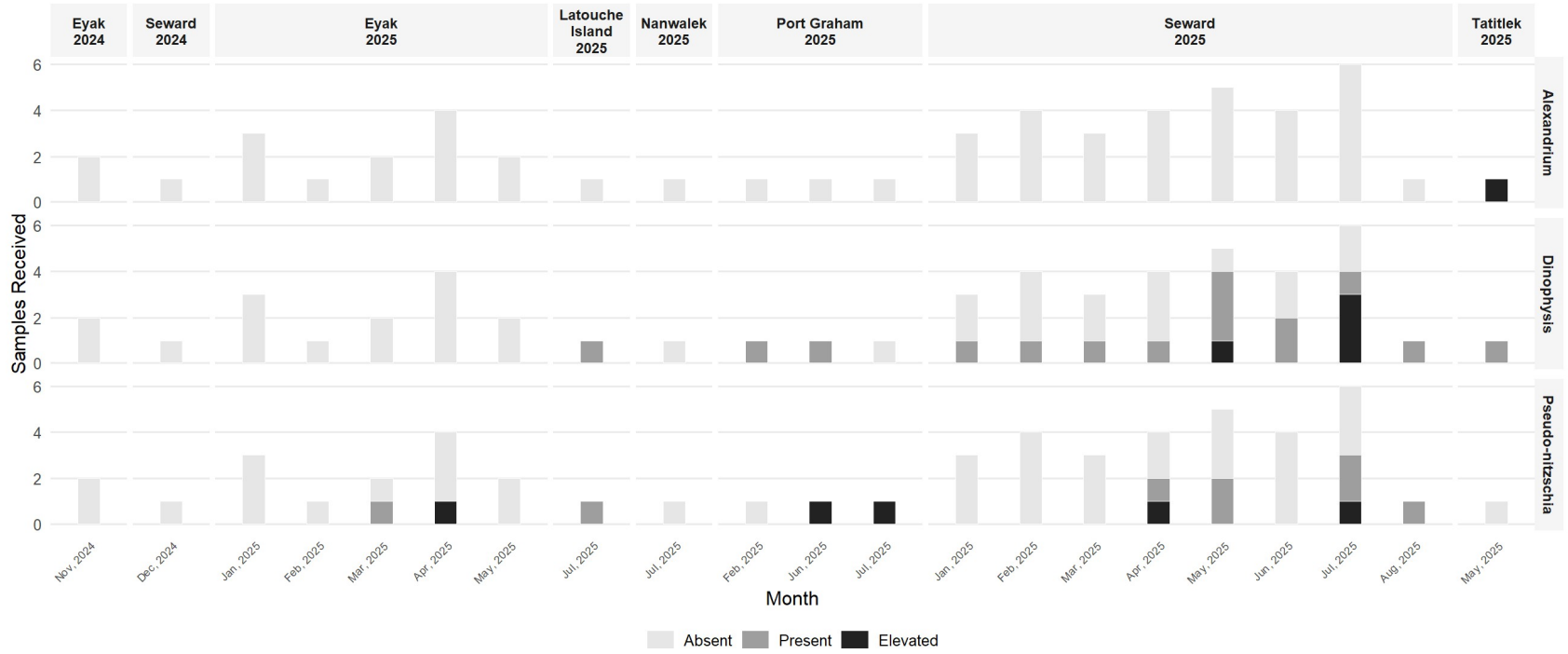

Figure 21. Prevalence of Dinophysis spp., Pseudo-nitzschia spp., and Alexandrium spp. from phytoplankton tows analyzed via microscopy from November 2024 to August 2025 (n=52). Results are categorized into three groups, absent, detected, and elevated, based on cell counts (detected = 1-10 cells per slide; elevated ≥ 10 cells per slide).

Figure 22. Observed presence of phytoplankton species common to southcentral Alaska. Numbers represent present/absent observations of phytoplankton for each sample received (i.e., number of times observed/number of samples received that month).

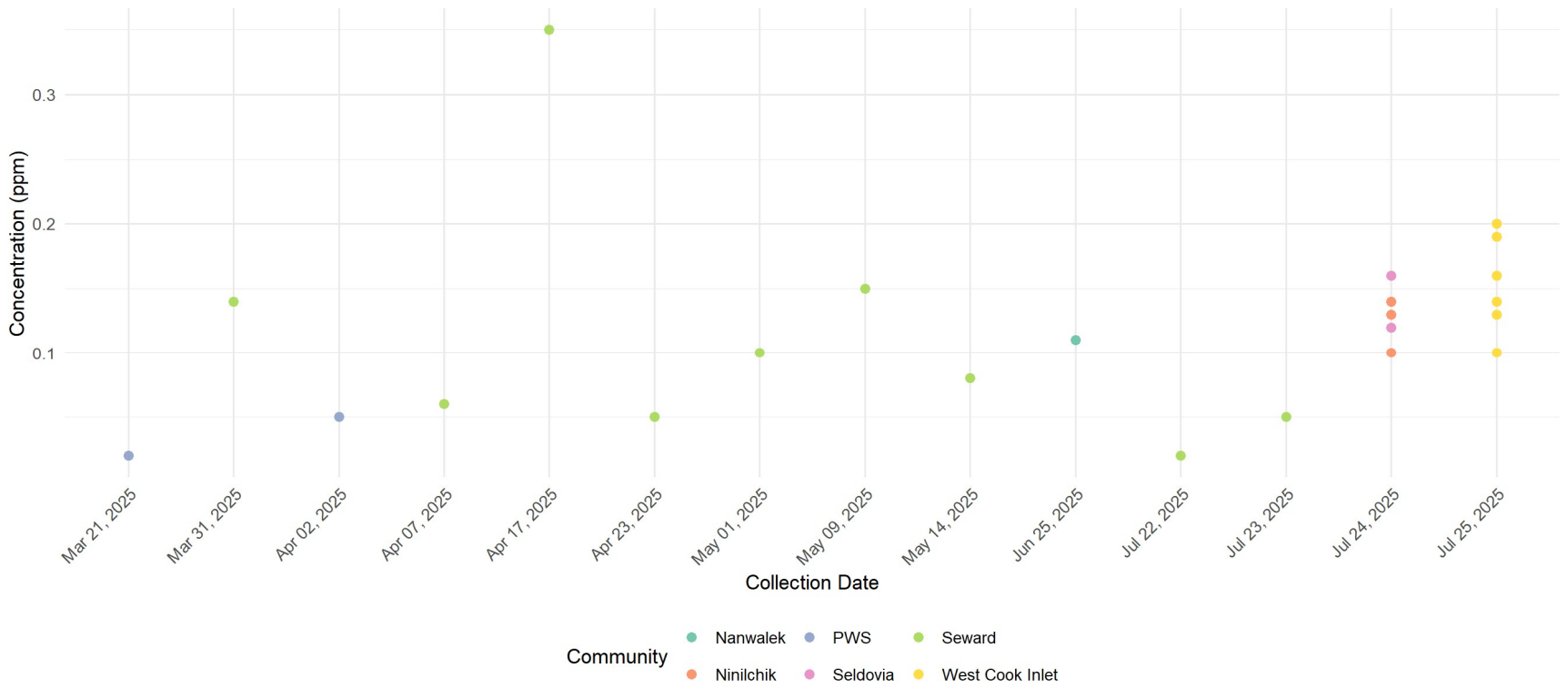

Figure 23. Domoic acid concentrations in bivalves collected from 2025 samples (n=27). The dots represent the samples that resulted in detectable concentrations. All detections were well below the U.S. FDA regulatory limit of 20 ppm. Each dot represents a detection and is colored coded to the community or area where the sample was collected.

***Exxon Valdez* Oil Spill Trustee Council**

Long-Term Research and Monitoring, Mariculture, Education and Outreach

FY25 (Q1+Q2) Semi-annual Project Status Summary