***Exxon Valdez* Oil Spill Trustee Council**
Long-Term Research and Monitoring, Mariculture, Education and Outreach
Annual Project Reporting Form

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: 23220302

Project Title: Sustainable mariculture development for restoration and economic benefit in the EVOS spill area

Principal Investigator(s): Ginny Eckert (University of Alaska Fairbanks), Katrina Hoffman (Prince William Sound Science Center), John Whissel (Native Village of Eyak), Hannah Wilson (Alaska Fisheries Development Foundation)

Reporting Period: February 1, 2023 – January 31, 2024

Submission Date (Due March 1 immediately following the reporting period): March 1, 2024

Project Website: www.pwssc.org/mar-recon

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

☒ **Project progress is on schedule.**

Many components within the project are on schedule and proceeding as planned:

The oceanographic and plankton surveys (Components 1 and 2A) conducted along with the marine bird and mammal surveys in Prince William Sound (Components 2D and 2E), have all been completed as expected.

Activities within the Benthic Component are on schedule. In 2023, field work was completed at all farms, except for one kelp farm in Prince William Sound (due to the depth and configuration of this farm) and one oyster farm in Kodiak (due to logistical constraints). Infaunal samples are being processed, other data (epifaunal and fouling communities) have been QA/QC'ed and will be entered into the Axiom Research Workspace soon.

The Kelp Farming Method Component (Component 3A) is also on schedule. PIs have completed one planned objective (Objective 3C.1) and plan to work on Objective 3C.2 in 2024.

☒ **Project progress is delayed.**

Due to the delay of initial project funds and complex logistics, some component activities are behind schedule. Delays are outlined by component below.

PIs in the Physicochemical Environment Component (Component 1) were not able to deploy the full suite of production array sensors at every site in 2023. For some sites (i.e., Simpson Bay Oyster Co.), it was due to more deliberation being needed on how to best attach the sensors so they will make it through the intense winter season at that site. At all sites, the sensor deployment was timed with the out planting of the kelp farms. Kelp farmers in Kodiak anticipate seeding their kelp lines in February, thus the sensors will be deployed regionally then. In addition, no control sites were deployed this year. When considering where to put the control sites in each region, it was determined that more information was needed to find an adequate location that sampled the same water but did not have any farm influence. For this reason, researchers plan to take this initial year of research to determine and plan which areas will be best for a control site in the future.

At this time, PIs in the Pelagic Fish Component (Component 2C) have established a methodology for imaging sonar sampling on farms, practiced these methods at the Native Village of Eyak (NVE) research farm, and completed sampling and initial data analysis at the Royal Ocean Kelp Company seaweed farm. We are in the process of coordinating sampling of the Simpson Bay oyster farm (awaiting harbor access) and NVE farm (awaiting out-planting of seaweed). We are still evaluating the hiring of a post-doctoral researcher given the potential loss of funding after 2026, which is when the hiree would conduct the bulk of their work utilizing data compiled from across the Mar ReCon project. We are considering starting the hiring process between summer-fall 2024 after re-evaluating their role within the project to ensure a productive and successful post-doctoral fellowship. The Pelagic Fish Component was also delayed by the arrival of an appropriate transducer for the scientific echosounder that will be used to observe forage fish schools during surveys.

Skiff-based marine mammal and bird surveys in Kachemak Bay and Kodiak (Components 2D and 2E) were not accomplished during FY23 due to the departure of a key position on the project. This delay is being resolved for FY24 by making changes to personnel allocations to this project. Our difficulties with equipment acquisition (ADF&G skiffs and driver availability) we experienced are also being resolved in FY24 by switching to contracted skiff support. We anticipate March 2024 surveys at Kachemak Bay and Kodiak will demonstrate success given these field changes.

The start of the Drivers of Regional Variation Component (Component 3A) is delayed due to the need for extended discussions about the scope of the project, the plan for execution, and the bandwidth of participating personnel/farmers. This project is 100% dependent on the production arrays that were deployed a few months ago.

The Oyster Selective Breeding Component (Component 3B) is delayed due to the initial delay in award funding which led to delays in hiring an FTE hatchery manager, equipment purchasing, and the overall timeline of hatchery production. Currently, equipment has been and is continuing to be purchased to modify existing infrastructure at NOAA to meet hatchery needs. The project is progressing as the hatchery has capacity to cultivate microalgae now.

The Product Development Component (Component 5) is delayed as the proposed post-doctoral researcher has not been hired.

Project Timeline, Milestones, and Tasks for FY22-FY26 from the final proposal are described within each of the tables below. "C" indicates completed, "D" indicates delayed, "X" scheduled as planned.

Table 1. These timelines, milestones, and tasks will be accomplished by PIs **Umanzor, Hollarsmith, Kelley, Pinchuk, Eckert, and Campbell**. Objectives addressed by these activities include Component 1: Mariculture and the physical environment, objectives 1.1, 1.2, and 1.4; Component 2: Mariculture interactions with biological communities, objectives 2A.1 and 2A.2, and Component 3, Enhancing farm production, objective 3A - Regional Variation.

	FY22				**FY23**				**FY24**				**FY25**				**FY26**			
Milestone/Task	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Milestone Objective 1																				
Equipment purchase/calibration		C	C	C																
Carbonate system deployment					C															
Sensor data/bottle sampling							C		X		X		X			X				
Carbonate chemistry data analysis										X		X		X		X	X		X	C
Carbonate chemistry model prep																			X	C
Milestone Objective 1b																				
Purchasing/testing equipment	D	D	C	C																
Zooplankton and eDNA sampling																				
Sample processing																				
Data analysis and synthesis																				
Milestone Objective 3A																				
Coordination/training with farmers			D	D																

Kelp and oyster sampling						D	D	D	X	X	X	X	X	X	X				
Sample processing							D	D			X	X			X	X			
Data analysis																X	X	X	X	X
Fatty acid analyses									X	X	X	X	X	X	X	X				
Isotope analyses									X	X	X	X	X	X	X	X				
Polyculture kelp/oyster sampling																				
Reporting																				
*Annual reports					C				X				X				X			
Final report																		X	X	X
Deliverables																				
Peer reviewed papers																	X	X	X	C
Data posted online												X				X				X

Table 2. These timelines, milestones, and tasks will be accomplished by PIs **Konar** and **Long** from the University of Alaska and NOAA. Objectives addressed by these activities include Component 2B, Benthic Communities, objectives 2B.1-2B.6.

	FY22				**FY23**				**FY24**				**FY25**				**FY26**			
Milestone/Task	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Milestone: Monitoring																				
Site Selection (evaluated annually)				C	C				X				X							
Recruit Graduate Student (changed to post-doc)			C																	C
Supplies Purchasing			C	C																
Sampling – Field Work			D	D		C	C			X	X			X	X					
Sample Processing			D	D			C	C			X	X			X	X	X			
Analyses				D				C				X				X	X	X		
Reporting																				

Annual reports				C					X				X				X			
Final report																				
Deliverables																				
Manuscript publications																			X	X
Contribute to data synthesis									X								X			
Present at conferences					C				X				X				X			
Website updates					D				X				X				X			
Data Upload					D				X				X				X			

Table 3. PWS-Specific Ecosystem Surveys. These timelines, milestones, and tasks will be accomplished by PIs **Cypher**, **Campbell**, and **Schaefer** from the PWSSC. Objectives addressed by these activities include 1.3, 2A.3, 2C, 2D, and 2E.1

	FY22				**FY23**				**FY24**				**FY25**				**FY26**			
Milestone/Task	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Expand GWA LTRM to MAR (Objs. 1.3, 2A.3, 2C.1, 2D, 2E.1)																				
Equipment purchasing			C																	
Sampling cruises		D		C	C	C		C	X	X		X	X	X		X	X	X		X
Sample processing/data analysis				D		C		C		X		X		X		X				X
Fish imaging sonar (2C.2, 2C.3)																				
Equipment purchasing				C																
Imaging sonar cruise (2C.2)					C			C	X			X	X			X	X			X
Data analysis					C			C	X			X	X			X	X			X
Compare sonar data to eDNA (2C.3)									X				X				X			
EcoPath modeling (2C.4)																				
Hiring of postdoctoral researcher				D	D															
Data compilation							D	D	X				X				X			

Data processing and model prep										X	X	X		X	X	X				
EcoPath modeling																X	X	X	X	X
Model adaptation to other regions																				
Reporting																				
Annual reports					C				X				X				X			
Final Report																				
Deliverables																				
Manuscript publication																	X			
Contribute to Data synthesis									X											
Present at conferences									X								X			
Delta Sound Connections		X				X			X				X				X			
Website updates					D				X				X				X			
Data Upload					D				X				X				X			

Table 4. These timelines, milestones, and tasks will be accomplished by PI **Umanzor** from the University of Alaska Fairbanks. Objectives addressed by these activities include Component 3: Enhancing farm production, objectives 3C1, 3C2, and 3C3.

	FY22				**FY23**				**FY24**				**FY25**				**FY26**			
Milestone/Task	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Objective 3C.1											C									
Measure photosynthetic activity and morphometrics					C	C														
Data processing and analysis						C	C	C												
Objective 3C.2 - sugar kelp																C				
Measure photosynthetic activity and morphometrics					C	C			X	X										
Sample processing							C	C			X	X								
Data processing and analysis												X	X	X	X					

Objective 3C.2 - sugar kelp																			C
Measure the effect of trimming on kelp performance													X	X			X	X		
Sample processing															X	X	X	X	X	
Data processing and analysis																X	X	X	X	
Objective 3C.3 – sugar kelp																				C
Salinity and temp effect on juvenile sporophytes														X	X	X	X	X		
Data processing and analysis																	X	X	X	
Reporting																				
*Annual reports									X				X				X			
Final report																				
Deliverables																				
Peer-reviewed paper																				X
Data posted online									X				X				X			

Table 5. These timelines, milestones, and tasks will be accomplished by PI **Rehberg** from ADF&G. Objectives 2E.2, 2E.3, and 2E.4 are addressed in the Marine Mammal sub-component. Activity 2E.1 is on Table 4.

	FY22				**FY23**				**FY24**				**FY25**				**FY26**			
Milestone/Task	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Objective 2E.2																				
Cooperatively design farmer surveys	D	D	D																	
Obtain farmer survey data				D				D				X				X				X
Summarize survey data					D	D			X	X			X	X			X	X		
Objective 2E.3																				
Install time-lapse cameras		D	D																	
Service cameras and retrieve data						D				X				X				X		

Analyze camera data							D	D			X	X			X	X			X	X
Objective 2E.4																				
Focused mitigation discussion and planning																X	X	X	X	X
Reporting																				
Annual reports					C				X				X				X			
Final Report																				
Deliverables																				
Interim results to study participants					D				X				X				X			
Marine mammal interaction workshop																X				X
Present at conferences									X											
Lay audience article or presentation													X							

Table 6. These timelines, milestones, and tasks will be accomplished by PIs **Eckert**, **Wilson**, **Good**, **Whissel**, **Hollarsmith**, and **Kelley**. They address objectives 3A.3, 3B.1, 3B.2, and 3B.3 from Component 3: Enhancing farm production.

	FY22				**FY23**				**FY24**				**FY25**				**FY26**			
Milestone/Task	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Milestone: breeding program																				
Set up wet lab space	D	D	D	D																
Obtain broodstock					C	C														
Spawn and rear larvae								D	X			X	X			X	X			
Milestone: Grow-out on farms																				
Grow juvenile oysters in FLUPSY									X				X				X			
Grow-out on farms										X	X	X	X	X	X	X	X	X	X	X
Milestone: Physiology																				
Growth model												X				X				X

Reporting																			
Annual reports					C				X				X				X			
Final report																				
Deliverables																				
Peer reviewed paper																	X	X	X	C
Data posted online													X				X			

Table 7. These timelines, milestones, and tasks will be accomplished by PIs **Fong** and **Good**. They address objectives 4.1-4.4 from Component 4: Economic feasibility.

	FY22				**FY23**				**FY24**				**FY25**				**FY26**			
Milestone/Task	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Milestone																				
Literature Review				D	C															
Expert Opinion Solicitation					D	C	C													
Seed Market Research							C	C												
Conceptual Hatchery Development								D	X	X										
Data Gatherings										X	X									
Baseline Bioeconomic Model Established											X	X								
Economic Model Simulation												X	X							
Final Report and Recommendations Preparations													X	X						
Reporting																				
*Annual reports				C				C				X		X						
Final report																				

Table 8. These timelines, milestones, and tasks will be accomplished by PIs **Fong, Sannito,** and **Good**. They address objective 5.1 from Component 5: Product Development.

Milestone/Task	**FY22**				**FY23**				**FY24**				**FY25**				**FY26**			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Milestone: Product Development Cycle 1																				
Phase 1: Engagement, Secondary Information Sources and Advisory Committee	D	D																		
Phase 2. Conduct Focus Groups and/or Expert to Define Product Attributes and Survey Design		D	D	D																
Phase 3. Consumer taste Panels and/or Value Chain Intermediary Product Evaluation				D	D	D	D													
Phase 4. Dissemination of Results and Outreach Activities							D	D												
Reporting																				
*Annual reports				C				C												
Final report								C												
Deliverables																				
Peer reviewed paper									X											
Data posted online									X											
Outreach Activities and Extension Publication								D	X											
Milestone: Product Development Cycle 2																				
Phase 1: Engagement, Secondary Information Sources and Advisory Committee									X	X										
Phase 2. Conduct Focus Groups and/or Expert to Define Product Attributes and Survey Design										X	X	X								

Phase 3. Consumer taste Panels and/or Value Chain Intermediary Product Evaluation											X	X	X	X					
Phase 4. Dissemination of Results and Outreach Activities														X	X				
Reporting																			
*Annual reports											X				X				
Final report															X				
Deliverables																			
Peer reviewed paper																X			
Data posted online																X			
Outreach Activities and Extension Publication															X	X			
Milestone: Product Development Cycle 3																			
Phase 1: Engagement, Secondary Information Sources and Advisory Committee																X	X		
Phase 2. Conduct Focus Groups and/or Expert to Define Product Attributes and Survey Design																	X	X	X
Phase 3. Consumer taste Panels and/or Value Chain Intermediary Product Evaluation																			X
Phase 4. Dissemination of Results and Outreach Activities																			
Reporting																			
*Annual reports																			X
Final report																			
Deliverables																			
Peer reviewed paper																			

Data posted online																				
Outreach Activities and Extension Publication																				

Table 9. These timelines, milestones, and tasks will be accomplished by PIs **Good, Wilson,** and **Eckert**. They address objectives 6.1-6.4 from Component 6: Outreach.

	FY22				**FY23**				**FY24**				**FY25**				**FY26**			
Milestone/Task	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Milestone: Objective 1																				
Task 1: Farm site visits			C		C		C			X	X			X	X			X	X	
Task 2: Create and update information clearinghouse	D				C				X				X				X			
Task 3: Farmer extension and support	C	C	C	C	C	C	C	C	X	X	X	X	X	X	X	X	X	X	X	X
Task 4: Training workshops - exact timing TBD	C			C	C			C	X			X	X			X	X			
Task 5: Annual meetings	D				C				X				X				X			
Milestone: Objective 2																				
Task 1: Create videos and outreach materials			C				C				X				X				X	
Task 2: Host listening sessions			D				C				X				X				X	
Task 3: Create FAQs or other docs				D				D				X				X				X
Milestone: Objective 3																				C
Task 1: Host workshops								D				X								
Reporting																				
*Annual reports					C				X				X				X			

Deliverables																			
Videos and outreach materials				D				C				X				X				X

Table 10. These timelines, milestones, and tasks will be accomplished by PI **Hoffman**. They address objectives 7.1-7.3 from Component 7: Administration.

	FY22				**FY23**				**FY24**				**FY25**				**FY26**			
Milestone/Task	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Milestone: Program planning & coordination																				
Annual program planning			C				C		X				X				X			
Circulate annual PI mtg. notes				C				C				X				X				X
Milestone: **Fiscal administration**																				
Issue subaward contracts		C			C				X				X				X			
Annual audit field testing				C				C				X				X				X
Milestone: Reporting																				
Annual reports					C				X				X				X			
Final report to sponsoring fiscal agency (5-year allocation)																				X

☒ **Budget reallocation request.**

Due to the delayed release of EVOSTC funds, we submitted a no-cost extension request to the EVOSTC Executive Director, which was approved on April 12, 2023. We also submitted a no-cost extension request for FY23 funds, which was approved on April 8, 2024.

☒ **Personnel changes.**

Julie Decker, a former project PI and a member of the project leadership team (Industry Lead), left her position as Executive Director of Alaska Fisheries Development Foundation (AFDF). Her role has been filled by Hannah Wilson, AFDF Development Director, who was previously involved in the project in a supporting role. A 2-page C.V. for H. Wilson is included at the end of this document.

1. Summary of Work Performed:

Overview

The overarching goal of the Mariculture Research and Restoration Consortium (Mar ReCon) is to support restoration, habitat enhancement, and economic development through research and partnerships between scientists and seaweed and shellfish farmers. The project is comprised of seven components organized within three broad categories: Restoration, Farm and Business Development, and Program Management. Each component consists of several subcomponents that are linked with other subcomponents in the project.

The project has made progress toward achieving project objectives, including developing partnerships with nine farms across the spill-affected region, initiating fieldwork to monitor impacts of mariculture on the environment and biological communities and vice-versa, developing kelp cultivation methods, presenting training workshops and forums, submitting papers for peer review, and presenting at professional and community meetings. Furthermore, kelp and oyster farmers have already taken on new roles as research collaborators, with sampling and data collection responsibilities poised to increase during the upcoming field season.

A summary of the work performed by Mar ReCon during the reporting period is presented by component below.

Component 1: Mariculture and the Physicochemical Environment

In June of 2023, all the sensors needed for the production arrays were ordered. Sensors ordered included: 13 YSI EXO2s, 11 Onset HOBO conductivity sensors, 12 PME MiniPAR sensors, and 14 Lowell TCM-1 tilt current sensors. We ordered YSI EXO2 sensors instead of the sensors originally listed in the proposal as they are higher quality and able to capture a variety of water quality parameters (i.e., conductivity, temperature, salinity, oxygen, chlorophyll, and turbidity). Additionally, we ordered large battery packs and stainless-steel cages to ensure the sensors' longevity. For the use of farmer collected water profiles at each site, we ordered 13 RBR Concerto CTDs in replacement of the Sontek CastAway loggers, as they record higher quality

data and are easier to use. We also ordered waterproof field tablets (Samsung ActiveTab 3) for each farmer to control the RBRs and immediately view the data.

In July and August of 2023, we designed and built a prototype of the array in Kodiak. Mock sensors made of PVC material measuring the same length and weight as the real sensors were created to deploy on the test array at a farm site in Kodiak. This array was left in the water over the summer and monitored to ensure that the production array design is stable in real life conditions, prior to adding any expensive equipment. Designs for the array were made in collaboration with Alf Pryor, a partner kelp farmer in Kodiak, and collaborating aquaculture researchers. The array design proved to be stable and secure when checked on later in the fall. During the month of October, we received all sensors ordered for the production arrays. They were calibrated and bench tested in the lab prior to deployment.

In October, two members of the Mariculture and the Physicochemical Environment team (Arron Jones and Sierra Greene) visited all sites in Kachemak Bay and Prince William Sound. They worked with farmers to deploy and/or attach the production arrays on the farms in a manner that worked for both the scientific data collection and the farmers' working needs. All sensors (YSI, MiniPAR, and HOBO loggers) were put at each site in these two regions, except the Simpson Bay Oyster Co. site. This farm can experience large amounts of icing in the winter, so more information was needed on site before deploying expensive equipment for a long period of time. For this reason, we deployed two inexpensive salinity and temperature sensors (HOBO conductivity loggers) to collect background data over the winter. Each farmer in Kachemak Bay and Prince Willam Sound also received an RBR Concerto CTD and field tablet to collect water profile data on their farms throughout the year. We conducted trainings for the sensors with each farmer on site in October as well as at the PI meeting in Cordova in January 2024.

In January 2024, three members of the Mariculture and the Physicochemical Environment team (Ginny Eckert, Sierra Greene, and Jessica Whitney) visited the three partnering farm sites in Prince William Sound to check on the sensors. All equipment looked to be in good condition. We replaced the HOBO conductivity loggers and MiniPAR logger to offload the data collected over the previous months. Data is currently being analyzed and is expected to be available in February.

Also, during this reporting period, PhD student Josie Haag and PI Kelley were able to lab test and QA/QC all oceanographic instrumentation prior to deployment. All instruments were deployed at farms in the three regions and are currently collecting pH, temperature, oxygen concentration data. These data will be used to constrain the carbonate system to estimate the carbon flux associated with farmed kelp across the three EVOS regions. We expect to collect the data generated from this in April/May of this year and begin data analysis.

In addition, PI Kelley and PhD student Haag were able to determine the resource use of farmed oysters and mussels using bulk stable isotope analysis. This work has been written up as a peer-review publication, titled "Seasonal resource use by the Pacific oyster (*Crassostrea gigas*) and the Pacific blue mussel (*Mytilus trossulus*) in an Alaskan estuary using bulk stable isotopes". This manuscript should be submitted to a journal within the next reporting period. This work was carried out in Jakolof Bay, Alaska in collaboration with our farmer partner Lindsey Olsen from Spinnaker Sea Farms.

Below are figures from the stable isotope work demonstrating several key points from the study. First, that farmed oysters and mussels consume kelp across all sampling seasons, indicating that farmed kelp provide an additional source of food for farmed oysters and mussels (Figure 1). Second, in addition to consuming farmed kelp, oysters also consume microzooplankton, placing oysters one trophic level above mussels, a previously undescribed difference between the two bivalves (Figure 2). Third, that mussels and oysters do not differ in terms of carbon sources utilized seasonally (Figure 2).

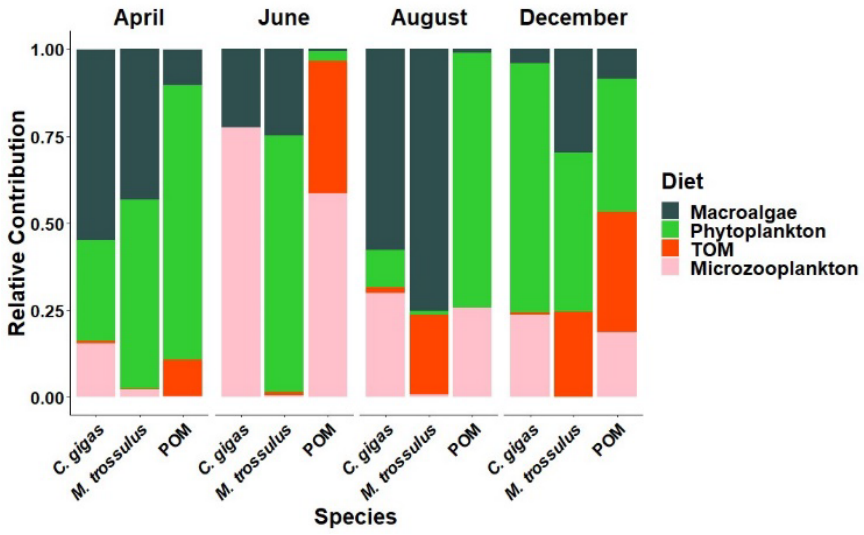


Figure 1. Proportion of endmember contributions to the particulate organic matter (POM) pool, and the resource use of Crassostrea gigas and Mytilus trossulus across the study period in Jakolof Bay. TOM = terrestrial organic matter.

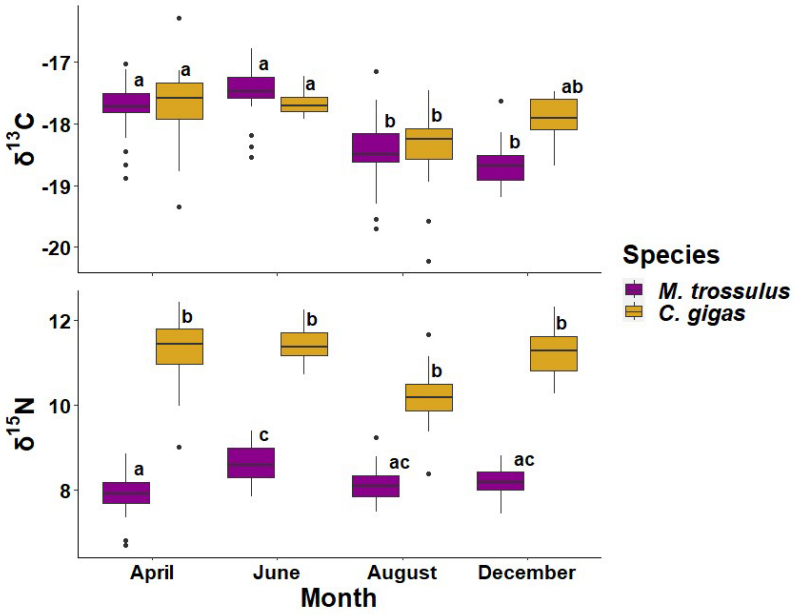


Figure 2. Mean $\delta^{13}C$ and $\delta^{15}N$ signatures of oysters (yellow) and mussels (purple) from Jakolof Bay over the study period. Boxplots with different letters are significantly different according to Tukey HSD Test or Dunn's Test ($\alpha = 0.05$).

Finally, PI Campbell completed surveys in Prince William Sound in March, May, July, and November. Casts were conducted to collect conductivity, temperature, depth (CTD), chlorophyll fluorescence, turbidity, oxygen, and nitrate profile data, and water samples were collected for extracted chlorophyll-a analysis. CTD data have been processed and are available on the workspace. Laboratory chlorophyll-a analysis will be completed in Q1 of FY24.

Component 2A: Mariculture with Biological Communities, Plankton

PI Campbell completed surveys in Prince William Sound in March, May, July, and November and plankton were collected at all stations. Plankton identification is very time intensive and is generally done within a year of collection. The samples are in the analysis pipeline and will be processed in FY24.

Component 2B: Mariculture with Biological Communities, Benthic Communities

In March and then again in May, PI Konar and Post-doc Ulaski visited and dove at the Kachemak Bay farms to survey the habitat at each farm, select control areas, and obtain preliminary data on substrate type and fouling organisms. During these visits, we were able to

meet and chat with Larry Olson (Jakolof Bay) and Sean Crosby (Peterson Bay and Bootleggers Cove).

In May, PI Chris Long and the Kodiak dive team visited and dove on Chiniak Bay Kelp farms and selected control sites. Data from benthic transects and quadrats were collected, and files sent to UAF. Benthic cores were collected and transported to UAF for processing.

Opportunistically, throughout May and June, PI Konar and post-doc Ulaski deployed oceanographic drifters at farms in Kachemak Bay to track surface water movement around farm areas. This was done to further characterize sites by determining the trajectory of water flow away from the farms during outgoing tides to ensure water was not moving towards our control sites. No drifters deployed at farm sites went by any of the control sites. We were able to conduct these deployments through collaboration and shared logistics with the EVOSTC Gulf Watch Long-Term Research and Monitoring Nearshore Component and the Alaska National Science Foundation EPSCoR project.

In July, PI Konar and post-doc Ulaski re-sampled the fouling communities on oyster cages at the three Kachemak Bay oyster farms. This sampling was done in conjunction with the Alaska National Science Foundation EPSCoR project, which shared logistics. At this time, we also sampled infaunal and epifaunal communities for the first time at these farms and at their selected control sites. Two graduate students (Mack Hughes and Maddi McArthur) assisted in this sampling and gained valuable field and diving experience.

In September, PI Konar and post-doc Ulaski re-sampled the fouling communities on oyster cages at the three Kachemak Bay oyster farms. In addition, PI Konar, post-doc Ulaski, and one graduate student (Sydney Wilkinson) also sampled benthic communities and oyster cage fouling communities at farms in Cordova for the first time. Here, we sampled one oyster and one kelp farm as well as the new relocation for the Noble Ocean's kelp farm site. We also selected and sampled control (non-farm) sites for each of these farms. As a methods comparison, we also conducted destructive scrapes of the biological communities within the photo-quadrats at the Kachemak Bay and Cordova oyster farms in September. We hope to determine if results differ between the photo-quadrats and destructive sampling. The Kodiak and Konar groups met to discuss sampling protocols to ensure methods between the groups were comparable.

In November and December PI Long and the Kodiak dive team visited and collected data from two Chiniak Bay Kelp farms and sent the data and/or samples to UAF as above. PI Long traveled to Larson Bay to examine the site and plan for potential field work in 2024.

Throughout the summer and fall, a sorting station was set up in the Konar Lab at UAF and an undergraduate hired (Samantha Allen) to help process the 2023 infaunal samples along with post-doc Ulaski. The epifaunal data have been QA/QC'ed to be submitted to the Axiom

workspace in 2024. We have been completing some preliminary analyses in order to present a poster at the Alaska Marine Science Symposium in 2024 and also submitted our first manuscript for publication.

Component 2C: Mariculture with Biological Communities, Pelagic Fish

The PIs have established methodology for imaging sonar sampling on farms, practiced these methods at the Native Village of Eyak (NVE) research farm (June 2023), and completed sampling and initial data analysis at the Royal Ocean Kelp Company (ROKC) seaweed farm (November 2023) in Prince William Sound. We are in the process of identifying the best methods for data analysis.

Our initial proposal included sampling farms in the fall (early season) and spring (late season) over a 24-hour time period for comparison with respective control sites. After establishment of the Mar ReCon farm sites and preliminary data collection at the NVE research farm, we modified this methodology to address dissimilarities between the farm sites (i.e., one is a horizontal seaweed farm, one is a vertical line seaweed farm, and one is an oyster farm) to address a lack of replication and data collection that is representative of farms. These changes will better address our stated objectives and allow for better comparison between farms through time. These changes include:

- removing control sites as they are arbitrary and less meaningful if farms are dissimilar -adding a summer time point (i.e., pre-season for seaweed farms and sampling during peak harvest for oyster farm)
- conducting mobile transects (x3-5 @ 1-2 knots/hr) on farms
- sampling at random stationary points within farms (x3-5 for 20 min each)

In addition, PI Cypher has proposed to the project team that a proportion of the Prince William Sound Science Center-allocated contractual budget line be allocated towards having short-term, smaller-scale agreements with other farms in Prince William Sound to allow for sampling of at least two additional farms with horizontal seaweed lines. The addition of farms would add replication to this project that would enhance comparability for how fish may aggregate and interact with farms. PI Cypher is working with the science lead and project team to determine if we can add farmer agreements.

We successfully sampled the ROKC farm in Windy Bay of Prince William Sound in November 2023 for the early season time point just after out-planting of sporophytes. We conducted 6 transects of the farm (3 for sugar kelp, 3 for ribbon kelp) and had 2 stationary sampling points (3 x 10 minutes). We found this method to be less data intensive as imaging sonar files are large. We will, however, lengthen the stationary sampling point times to 20 minutes each in the future. During sampling, we record location, depth, tidal period, sampling direction, and speed (if applicable), and sonar depth. We also confirm that any vessel echosounders are off prior to

sampling as they interfere with the sonar. The sonar is oriented towards the farm structure and the range of the sonar is kept between 10-15 m with grow lines visible in the sonar field. A GoPro was also mounted onto the sonar to determine whether fish identification could be made during sonar recording.

Data is analyzed manually by watching sonar recordings and using the echogram feature in ARISFish to identify when fish may have come into view. At this time, any fish-shaped object moving against visible currents and remaining within frame for >3 seconds is considered likely to be a fish. When a fish is observed, data is collected including a count, time stamp, range, whether the fish was interacting with the farm structure, and any observations (e.g., a small school, large vs. small). We are identifying ways to better characterize how to determine whether an object is a fish and how fish interact with the farm (e.g., distance from the grow line, interacting/not interacting with seaweed, etc.). Using these methods, we observed approximately 529 fish at the ROKC farm during a collective sampling time of 56 minutes and 11 seconds between transects and stationary time points. Approximately 70% of these fish were in small schools (Figure 3) that could be Pacific herring (*Clupea pallasii*). We have yet to compare GoPro video to respective sonar imaging to determine if cameras can be used for identification.

We will soon repeat these methods at the NVE research farm and Simpson Bay Oyster Co. to complete our early season sampling time point. We were unable to complete these farms due to complete loss of the seaweed growing on the NVE farm in the fall of 2023 and issues with farm access due to renovation of the Cordova harbor. Once NVE has out planted seaweed onto their farm, we will complete the early season sampling and stagger the later season time point to adjust to seaweed growth on the farm. As the Simpson Bay farm is an oyster farm, we are still evaluating whether the fall and spring time points are most appropriate for evaluating fish interactions with oyster farms. Addition of a summer sampling time point would allow for data

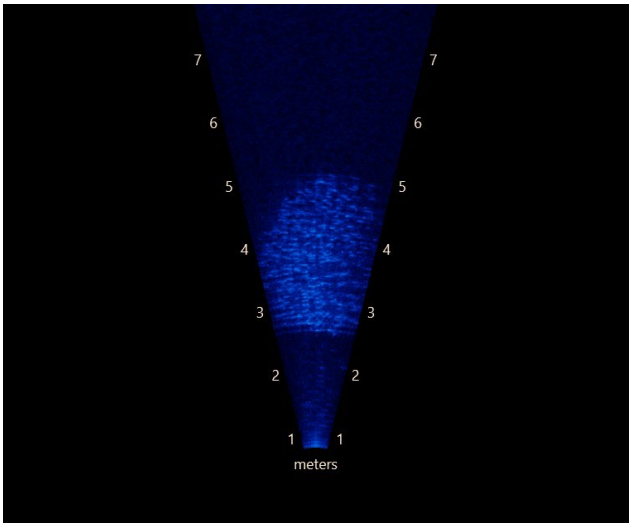


Figure 3. A school of fish swimming by the Royal Ocean Kelp Company ribbon kelp seeded lines during a 10 min stationary sampling point.

collection during a more productive time for the oyster farm and provide a pre-season (no kelp grow lines) for the seaweed farms.

Assessment of Prince William Sound walleye pollock with investigations into walleye pollock-Pacific herring interactions (EVOSTC Project 22220203), was cancelled because a vessel was not available to perform the proposed stock assessment. The project was divided into separate ADF&G, USGS and PWSSC components. Before PWSSC was notified of the potential termination of this project, equipment for fieldwork was acquired (Simrad EK80, 38kHz split-beam 7-degree transducer). This project requested to make use of that sounder, and the change was approved by the EVOSTC executive director.

To be used to survey forage fish it was necessary to order a new higher frequency transducer (120 kHz) appropriate for measuring smaller fish. Arrival of the transducer was delayed by many months due to supply chain issues. The transducer is now at PWSSC in Cordova and will be deployed during FY24 surveys and onward.

Component 2D: Mariculture with Biological Communities, Marine Birds

PI Schaefer conducted marine bird and mammal surveys in Prince William Sound in March, May, July, and November as planned. Surveys were conducted from the PWSSC research vessel, *M/V New Wave.* During the first full year-cycle of sampling (November 2022 – July 2023), we found that Simpson Bay consistently hosted the highest density of marine birds (Figure 4). Overall, the marine bird community was dominated by marbled murrelets (*Brachyramphus marmoratus*). Data have been QA/QC'ed and uploaded to the Research Workspace. Data summary and analysis are on-going.

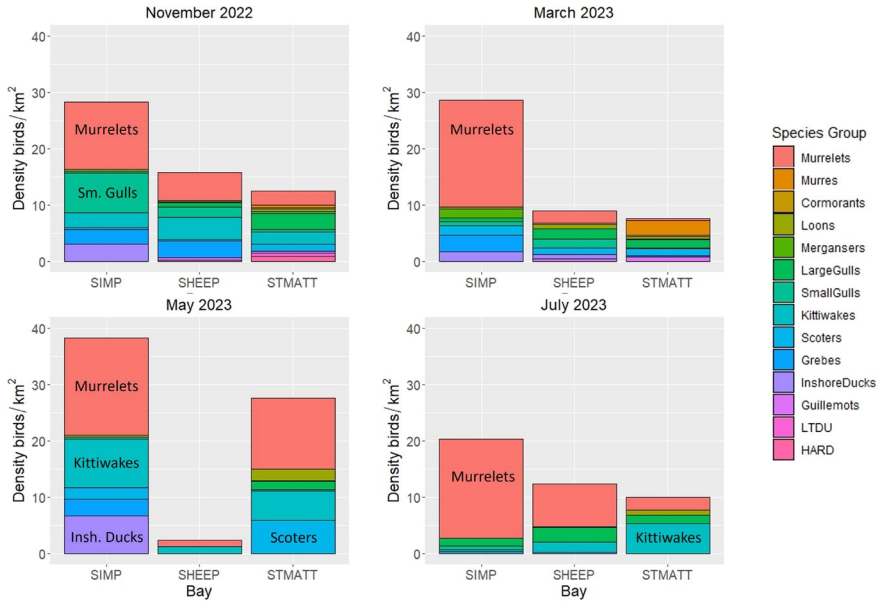


Figure 4. Marine bird community composition as recorded during at-sea strip transect surveys in Prince William Sound, Alaska, November 2022 – July 2023. LTDU = Long-tailed Duck; HARD = Harlequin Duck.

Surveys at the Kodiak and Kachemak Bay area farms were not begun by PI Rehberg during this reporting period due to the departure of a key position on the project. This delay is being resolved for FY24 by making changes to personnel allocations to this project. Challenges with equipment acquisition (ADF&G skiffs and driver availability) are being resolved in FY24 by switching to contracted skiff support. Surveys are planned for March, May, July, and November in the upcoming reporting period.

Component 2E: Mariculture with Biological Communities, Marine Mammals

Cooperatively design farmer surveys. Initial interviews with each farm are planned for February-March 2024 as preparation and planning aid for skiff-based marine mammal surveys. These interviews are based on a subset of questions used in a separately-funded ADF&G survey of farms in 2022. While this activity was not an objective in the original proposal, this should be useful assisting survey planning and communication with farms for FY24 onward. Farm attendance schedules compiled by the Mar ReCon project in January 2024 were reviewed to determine what frequency of farmer-based marine mammal observations will be realistic to request of farms. Completion of this survey design by the March 2024 surveys at Kachemak Bay and Kodiak will demonstrate whether this delay was resolved successfully.

Install time-lapse cameras. Time-lapse cameras were proposed to monitor haulout patterns at harbor seal haulouts near mariculture farms. To identify potential camera installation locations,

we reviewed the locations of harbor seal haulouts <10 km from study farms and their seal abundance estimates. Within the study area, harbor seal haulouts (n = 11) were 3.8 km (median, range 3.2 - 8.5) away from farms. Five of these haulouts were not presently occupied. This distance substantially exceeds the State of Alaska 0.5 km minimum distance required to prevent farms from disturbing adjacent harbor seals, and as such would not provide a useful test of this distance requirement. At this distance, it is unlikely harbor seal haulout patterns are influenced by farm operations. Given the harbor seal haulout distribution and locations of selected farms, it would not be productive to install time-lapse cameras to monitor changes in seal behavior caused by farm activity. This objective should be amended; we are exploring other options for passive monitoring of marine mammal presence near the study farms, following methods used at other installations such as aquaculture farms and wind energy installations. Possible methods include simple acoustic monitoring, in-water cameras, and pulling eDNA for sampling. The feasibility of each will depend on the post-processing time required for the data collected.

Skiff-based surveys at farms. Surveys at the Kodiak and Kachemak Bay area farms were not begun by PI Rehberg during this reporting period due to the departure of a key position on the project. This delay is being resolved for FY24 by making changes to personnel allocations to this project. Challenges with equipment acquisition (ADF&G skiffs and driver availability) are being resolved in FY24 by switching to contracted skiff support. Surveys are planned for March, May, July, and November in the upcoming reporting period.

PI Schaefer conducted at-sea strip transect surveys in PWS in March, May, July, and November. Data have been QA/QC'ed and uploaded to the Research Workspace. Data processing and summarizing is in progress.

Component 3A: Drivers of Regional Variation in Production

During summer 2023, a prototype of the production array was designed and deployed in Kodiak to ensure the design would be durable enough to last throughout the year. In July and August, researchers worked with DNR and ADF&G to obtain the proper permits to deploy kelp and oysters on the production arrays. Sources for the production array kelp sori were also secured. For the sake of simplicity in the first year, researchers chose to use the same hatchery and sori that partner farmers in each region were already planning to use: in Prince William Sound, seed was obtained from the Prince William Sound Science Center; in Kachemak Bay, seed was obtained from Alutiiq Pride Marine Institute; and in Kodiak, seed will be obtained from the Alaska Ocean Farms hatchery.

In October, researchers visited all sites in Kachemak Bay and Prince William Sound. They worked with farmers to deploy and/or attach the production arrays on the farms in a manner that worked for both the scientific data collection and the farmers' working needs. All sensors (YSI, MiniPAR, and HOBO loggers) and 4 dropper lines of sugar kelp (*Saccharina latissima*) were put

at each site in these two regions, except the Simpson Bay Oyster Co. site. This farm can experience large amounts of icing in the winter, so more information was needed on the site before deploying experimental kelp and expensive equipment for a long period of time. The seed source for the kelp in Kachemak Bay and PWS proved to be of varying quality. With the Kachemak Bay spool, algae took over in the hatchery and smothered out the kelp seed. Because of this, it is unlikely that there will be a large amount of cultivated kelp growth on the arrays this year.

Partnering farmers in Kodiak plan to seed their kelp lines in February. Researchers plan to visit Kodiak in February to deploy the production arrays to follow this schedule. The exception to this will be Kodiak Ocean Bounty in Larsen Bay. Because this site is greater than 50 km from the other two Kodiak sites, the same sori cannot be used to grow the array kelp, making equal comparison between the three sites not possible. For this reason, kelp will not be put out in Larsen Bay this year. In the upcoming year, researchers plan to appeal to ADF&G for an exemption from the "50/50 Rule" so that kelp at all sites in Kodiak will have the same genetic composition.

After much deliberation, we also decided to incorporate oyster cultivation cages into the array. Researchers plan to use OysterGro Low Pro cages, which each hold 3 bags. These cages are robust and will lessen the amount of bio-fouling on the oysters. Each cage will hold 1500 oyster spat, and there will be 2 or 4 cages at each site, depending on the location of the site and farmer participation.

The broader PI team has been meeting throughout the year to refine the scope and plan for this component and continues to discuss the proposed work in a collaborative Google document. PIs plan to begin work in the summer of 2024 once the arrays are fully operational.

Component 3B: Oyster Selective Breeding

To meet our objective of developing an Alaska-specific Pacific oyster broodstock for optimized growth in the EVOS region (Objective 3B.2) a large emphasis of 2023 has been to start and build collaborations and plan for deployment to implement and expand the oyster breeding portion of the EVOSTC project. As described within the EVOSTC proposal, distribution of oyster seed from a common Alaska oyster seed provider will take place in 2024. With this plan, we have also greatly expanded our seed distribution plan with leveraged funding and partnerships, all originating from Objective 3B.2 of this project.

In 2023, a new partnership with the USDA-ARS Pacific Shellfish Research Unit (PSRU) in Newport, Oregon was formed to involve their program in the EVOSTC mariculture project. In 2023, the necessary permitting required for the PSRU to become a "Alaska Certified Seed Source " was obtained. This permitting has subsequently allowed researchers to expand the

capabilities of the breeding portion of the EVOSTC project by leveraging the vast resources and oyster experts that the PSRU offers. In 2023, we have started planning for a deployment of oyster strains grown in the PSRU hatchery to the production arrays of the Mar ReCon project (Components 1 and 3A). The genetic pool for the oyster strains being tested in 2024 have a broad-based origin, with a mix of genetics from hatchery broodstock and wild-set oysters obtained in Oregon, Washington, California, and Japan over the past 30 years. To meet the oyster deployment timeline, PSRU has started the conditioning of broodstock in December of 2023, with a planned spawn date in February 2024, for distribution to Alaska FLUPSYs and the TSMRI oyster hatchery in May of 2024. Planning has taken place between numerous Mar ReCon researchers and farmers in 2023 and early 2024 to deploy the PSRU oysters on Mar ReCon production arrays and collect data throughout the Mar ReCon study. This detailed plan for oyster deployment and morphometric data collection was established with the necessary details and logistics set for a successful deployment of over 40,000 oysters to Mar ReCon production arrays and collaborating farmers in the EVOS region starting in May 2024.

Additional funding through Alaska Sea Grant has been obtained to support a quantitative genetic study of oysters at EVOSTC farms. These funds support a graduate research assistant from an underrepresented background in STEM at UAF Fairbanks for two years. The overall goal of this addition is to identify genetic factors contributing to variability and survival in the oyster aquaculture industry, and specifically at Mar ReCon farms. This addition to the Mar ReCon project provides the project with genetic expertise and resources provided by Dr. Jessica Glass' genetics lab in Fairbanks, AK. The study will include a comparison of genotypic and phenotypic responses of different oyster genetic strains deployed throughout the Mar ReCon project. Recruitment of the graduate research assistant started in late 2023, their expected start date is in Spring or Fall of 2024.

Broodstock for the Mar ReCon project is being grown through an additional collaboration between the AFSC mariculture team and Pacific Hybreed, a private shellfish breeding program, to begin crossbreeding of shellfish in 2024. Site selection and preparation for field deployment of 100 cage replicates of different Pacific oyster genetic groups started in 2023, with plans for deployment at the NOAA Little Port Walter Facility in April for 2024, and initial data collection expected in July 2023. This study will provide a broad-based broodstock repository for future production at the TSMRI hatchery, with their offspring being used during the last 6 years of the proposed Mar ReCon project.

Overall, the multiple fronts of progress in 2023 marks the first full-scale genetic selection effort in Alaska, and greatly expands the current Mar ReCon oyster breeding project to further engage researchers with EVOS-region farms to make progress towards more productive and sustainable shellfish farming in the EVOS region.

To meet our objective to develop methods for spawning and rearing Pacific oyster larvae (3B.3), a focus of 2023 has been to build capacity at the Ted Stevens Marine Research Institute (TSMRI) Hatchery. In March of 2023, the hatchery manager, Henry Fleener, was hired to start initial planning and installation of hatchery equipment. With this start, the TSMRI hatchery team applied for and received the necessary ADF&G commercial permitting for hatchery distribution of oyster seed in the state of Alaska. This was a crucial step for past and future distribution of oyster seed for broodstock use and field testing of oyster strains at EVOS-region farms.

In 2023, 30,000 juvenile Pacific oysters were deployed in waters near the TSMRI hatchery for future broodstock use. These seed were delivered from the USDA-ARS Pacific Shellfish Research Unit and included over 80 mixed groups of genetically distinct oysters with known pedigrees that have been tracked for over 25 years. Once grown to adults, these oysters will serve as a base population for future hatchery development for hatchery technology and breeding efforts.

A crucial component of all successful oyster hatcheries is the production of clean marine microalgae for feed. In 2023 a production room at the TSMRI hatchery was outfitted with necessary equipment for sterile microalgae production to feed and grow shellfish. Inoculations of marine microalgae of known strains were transported from the Alutiiq Pride Marine Institute's shellfish hatchery to the TSMRI hatchery to begin small-scale cultures of microalgae. After months of successful rearing, the TSMRI team is prepared for the installation and use of high-tech production-scale microalgae photobioreactors in 2024 for hatchery production.

Component 3C: Kelp Farming Method Development

As part of Objective 3C.1, experimental kelp farming arrays were deployed at the end of the previous reporting period (January 2023 at Kalsin Bay, Kodiak) by partner Alaska Ocean Farms. The kelp (ribbon kelp, *Alaria marginata*) and site characteristics (temperature, bulk nutrients, salinity, current) were monitored every two weeks into June 2023, when the final experimental biomass was harvested. For harvest, members of the Mariculture Lab from the College of Fisheries and Ocean Sciences at UAF traveled to Kodiak to assist with all arrays and data collection activities. The blade density, blade shape and size, total biomass, and the carbon and nitrogen content were determined across spacing treatments (1, 2, 3, 4, or 6 ft). By collecting these data, we aimed to understand the tradeoffs associated with different spacing configurations, yields, and phenotypic plasticity of farmed ribbon kelp. All data from 2022 is uploaded into the Axiom database for long-term management and storage. All field samples from 2023 are processed and data are undergoing QA/QC.

We have completed a preliminary analysis of the data from 2022 and are moving onto full analysis of data from 2022 and 2023. Preliminary key results are as follows:

1. Kelp yield increases as line spacing increases, may begin to plateau after 4-ft spacing.

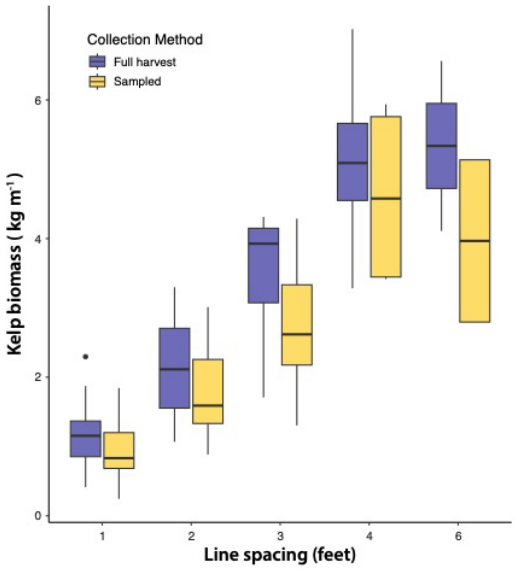


Figure 5. Mean kelp biomass (Alaria marginata) quantified via sampling (yellow boxes) and via full harvest (purple boxes) of the same biomass, from June 2022. The sampled biomass was collected from replicate 50-cm segments of line immediately before harvest, where the full harvest biomass represents removal of all kelp from each line and back calculating the respective biomass per meter of each line.

2. As line spacing increases, blade density on lines trends towards decreasing but blade length, blade width, and blade thickness trend towards increasing.

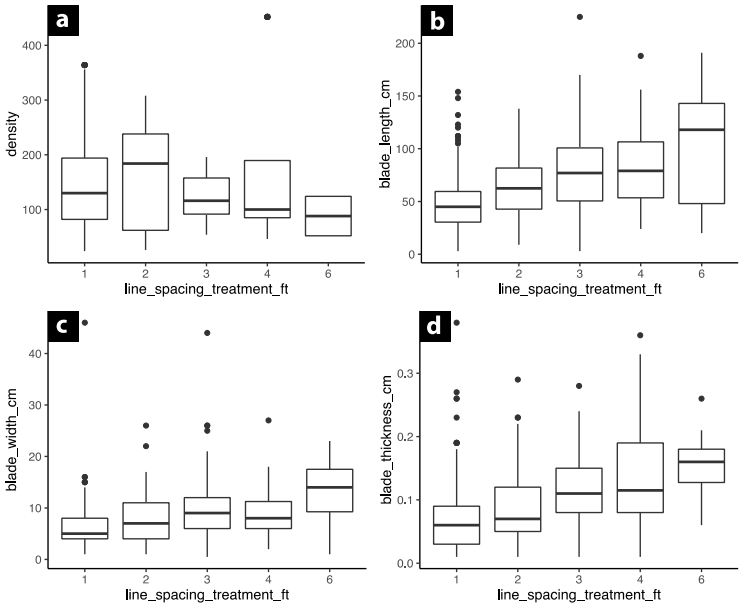


Figure 6. Mean kelp metrics immediately before harvest (June 2022). (a) Density of fronds/blades, (b) blade length, (c) blade width, and (d) blade thickness.

Component 4: Economic Feasibility Analysis

Activities in this component will initiate in Year 3 (FY24) of the project.

Component 5: Product Development

The PIs continue to conduct comprehensive literature reviews of both peer reviewed and non-peer reviewed publications and meetings with professional from all levels of the food and seafood value-adding chain to develop greater understanding of how farmed seaweed and shellfish contribute to the profitability of their businesses are ongoing. However, the University of Alaska Fairbanks has not moved forward in hiring a post-doc who will conduct the bulk of the product development research.

Component 6: Outreach

Alaska Sea Grant (ASG) has hired a postdoctoral researcher to lead the environmental research studies at the farms and control sites. They have begun communicating with farmers throughout the EVOS region and conducted site visits at two of the three farms in Kodiak. The postdoc worked with PI Good, ASG mariculture technician Arron Jones, and Kodiak farmers to build a sensor array prototype. This prototype will be trialed in Kodiak with design, implementation, and operation to be shared with other project farmers.

ASG published the Alaska Mariculture Research and Training Center website: https://amrtc.org/. The site is being actively updated and will soon include a publication library. Monthly emails with updates, and upcoming opportunities and deadlines are scheduled to start next month.

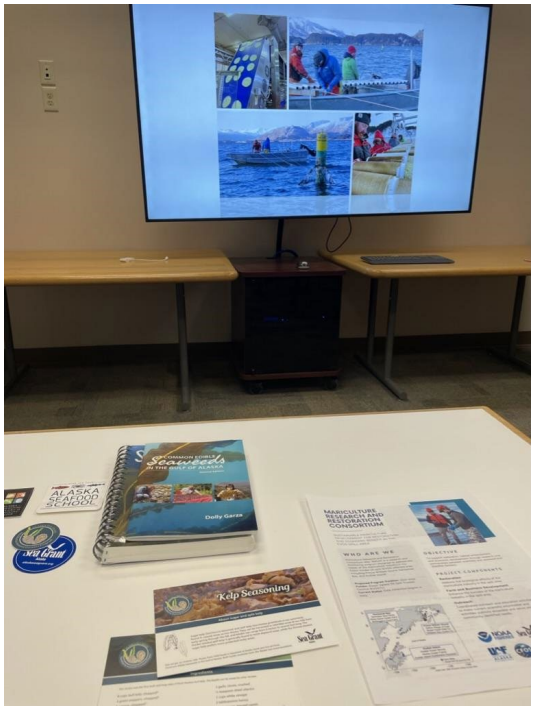
PI Good developed and conducted three workforce development training workshops: Foundations of Kelp Farming, Seaweed Handling and Processing, and Beginning Kelp Farmer Business Planning, Marketing, and Processing. Foundations of Kelp Farming was a hands-on workshop conducted at the Kodiak Seafood and Marine Science Center in Kodiak. Participants learned about how to start an aquatic farm in Alaska. Topics covered included identification of seaweed species, life cycles of seaweed, the hatchery process, site evaluation, use of the Mariculture Map, farm gear and equipment, business plan development, available farm loans, the state lease application process, gear deployment, seeding and harvesting techniques, quality handling, safety, and seaweed research programs and efforts. All participants learned about the Mar ReCon project and met with Kodiak partner farmers. There were 8 participants in this course, and they all received an accomplishment certificate.

The Seaweed Handling and Processing workshop was a hands-on workshop conducted at the Kodiak Seafood and Marine Science Center in Kodiak. Participants learned about how to handle seaweed and process so that Alaskan individuals and companies better understand what is involved in becoming a seaweed processor. Topics covered included those in the Seaweed Handling and Processing: Guidelines for Alaska, published by Alaska Sea Grant in 2021, as well as additional topics, such as state and federal rules and regulations, processing facilities, labeling, hazards, handling, primary processing techniques and equipment, business planning, and high-pressure processing. All participants learned about the Mar ReCon project and met with Kodiak partner farmers. There were 8 participants in this course, and they all received an accomplishment certificate.

The Beginning Kelp Farmer Business Planning, Marketing, and Processing Workshop covered kelp farm capital and operating costs to assist in developing a start-up and operating budget, farm's break-even price-per-pound, and an overview of processing methods and marketing strategies currently being used in Alaska. There were 17 participants.

PI Good hosted a Seaweed Cultivation and Product Development session during the Community Organized Restoration and Learning (CORaL) network (EVOSTC project 23220400) Community Coastal Experience program. This 5-week experience, funded through CORaL, was an opportunity for adults ages 18+ to explore career and internship pathways in: marine science, archaeology, cultural history, mariculture, and more. Participants traveled with program leaders to observe, learn, and practice new skills in Kachemak Bay, Seward, Cordova, and Kodiak. Participants learned about the monitoring and research efforts through Mar ReCon, got hands-on

with seaweed identification and collections, learned about seaweed handling and stabilization, and were able to develop and taste their own seaweed products. There were 9 participants.



ASG, along with the PIs with the Alaska Fisheries Development Foundation (AFDF), also hosted a vertical seaweed drying forum to hear from industry experts on seaweed drying equipment, processing and markets, community capacity and needs, and how seaweed processing can be supported in Alaska. There were 117 participants.

During the reporting period, PIs with AFDF finalized contracts with project farmers, and expert farmer Eric Wyatt, president of the Alaska Mariculture Association and industry leader. AFDF continues to manage farmer and expert farmer contracts, including paying quarterly invoices to participating farmers and supporting farmers in arranging travel to the annual project meeting.

AFDF also worked with researchers to procure, purchase and ship approximately $150,000 of supplies for conducting research at farm sites. AFDF assembled a small group of advisers and began preliminary discussions with advisers for planning a seaweed genetics workshop in Alaska.

ASG and AFDF are now planning a Seaweed Genetics Workshop to be held in Juneau April 1-2, 2024. The team has booked a venue, planned and secured contractors for a field trip to a local kelp farm, and started contacting speakers and participants.

PI Good is also working with the Social, Cultural and Economic Assessment of Kelp Mariculture Opportunities for Coastal Villages within the EVOS Spill Zone (EVOSTC-funded) project 23220301 and has begun planning for two community listening sessions to take place later this summer.

Component 7: Administration

During this reporting period, Component team members have processed invoices from subawardees. Staff planned and hosted the annual Mar ReCon PI meeting in Cordova, January 17-19, 2024. There were 45 attendees who participated in-person and virtually (Figure 7). Component team members submitted the annual EVOSTC report in March 2023 and semi-annual reports to NOAA in July 2023 and January 2024. PWSSC conducted an annual audit, the field work for which was performed in December 2023. This grant is part of the audited financials. Hoffman regularly engaged with other members of the leadership and administration team (Eckert, Whissel, Wilson, Schaefer) in communications and planning about the administrative aspects of the project.

Figure 7. Attendees of the annual Mar ReCon PI meeting in Cordova, January 17-19, 2024.

2. Products:

Peer-reviewed publications:

Ulaski, B. and B. Konar. *Submitted*. Seasonal and site-specific differences in biofouling communities on Pacific oyster mariculture farms. Journal of Experimental Marine Biology and Ecology.

Reports:

Decker, J., G. Eckert, K. Hoffman, and J. Whissel. 2023. Sustainable mariculture development for restoration and economic benefit in the EVOS spill area. FY22 Annual Report to the *Exxon Valdez* Oil Spill Trustee Council (project number 22220302).

Decker, J., G. Eckert, K. Hoffman, and J. Whissel. 2023. Sustainable mariculture development for restoration and economic benefit in the EVOS spill area. Semiannual Report to NOAA, July 2023 (project number 22220302).

Eckert, G., K. Hoffman, J. Whissel, and H. Wilson. 2024. Sustainable mariculture development for restoration and economic benefit in the EVOS spill area. Semiannual Report to NOAA, January 2024 (project number 22220302).

Popular articles:

Juneau Empire Newspaper Article, November 9, 2023: "Pushing to expand mariculture in Alaska (Part 2): The pearl in mariculture, for now, are the oysters. https://www.juneauempire.com/news/pushing-to-expand-mariculture-in-alaska-part-2-the-pearl-in-mariculture-for-now-are-the-oysters/

CICOES Magazine Article, 2023: "Creating the Alaska Oyster", page. 44-45. https://cicoes.uw.edu/wp-content/uploads/sites/21/2024/01/CICOES_Magazine_2023.pdf

NOAA Education Blog, 2023: "The case of the missing females: Channeling Nancy Drew during my summer internship". https://www.noaa.gov/office-education/hollings-scholarship/stories/case-of-missing-females-channeling-nancy-drew-during-my-summer-internship

Schaefer, A. and A. Cypher. 2023. Meet the Mar ReCon! Delta Sound Connections 2023-2024. Prince William Sound Science Center.

Schaefer, A. 2023. Examining interactions between Marine Birds and Mariculture Development. Delta Sound Connections 2023-2024. Prince William Sound Science Center.

Cypher, A. 2023. Kelp the Sound! Delta Sound Connections 2023-2024. Prince William Sound Science Center.

PWSSC Breakwater Newsletter Articles related to Mariculture and the Mar ReCon Project:
- February 2023: Keep on kelp'n on; It's mariculture month!
- March 2023: Kelp the Sound workshop a success!
- August 2023: Scouting Expedition for Kelp Nursery

PWSSC FieldNotes Interview: "Mariculture Research in PWS", https://pwssc.org/wp-content/uploads/2023/02/Field-Notes-No-invite.m4a

Conferences and workshops:

Cypher, A. 2023. Sustainable mariculture development for restoration and economic benefit in the EVOS spill area: an introduction to the ReCon. Poster presentation. 2nd Alaska Mariculture Conference, February 2023. Juneau, Alaska.

Haag, J., S. Mincks, J. Jossart, and A. Kelley. 2024. Resource use of the Pacific Oyster and the Pacific blue mussel in a macroalgae-dominated system. Oral presentation. Alaska Marine Science Symposium, January 2024. Anchorage, Alaska.

Meyer, L. 2023. Effects of line spacing on cultivated *Alaria marginata*, a methodology for determining line spacing. Presentation at the 2nd Alaska Mariculture Conference, February 2023. Juneau, Alaska.

Meyer, L and A. Pryor. 2023. Smart farming, the power of industry and research partnerships. Presentation at Seagriculture USA, September 2023. Portland, Maine.

Ulaski, B.P and Konar B. 2024. Seasonal and site-specific differences in biofouling communities on Pacific oyster mariculture farms. Poster presentation. Alaska Marine Science Symposium, January 2024. Anchorage, Alaska.

PI Hollarsmith and contractor Cates attended the OceansAlaska oyster hatchery workshop in Ketchikan, March 21-23.

Cates (contractor) attended a workshop at the Pacific Aquaculture & Coastal Resources Center at the University of Hawaii at Hilo to learn about strategies to cultivate microalgae in a hatchery setting, August 14-18, 2023.

Workshops developed and delivered by Mar ReCon PIs

Foundations to Kelp Farming: A Workshop Intensive; Kodiak Seafood and Marine Science Center, Kodiak, Alaska. March 21-24, 2023. 8 participants

Seaweed Handling and Processing; Kodiak Seafood and Marine Science Center, Kodiak, Alaska, April 19-21, 2023. 8 participants

Seaweed Cultivation and Product Development session during the Community Coastal Experience program through the Community Organized Restoration and Learning (CORaL) Network; Kodiak Seafood and Marine Science Center, Kodiak, Alaska, June 27, 2023. 9 participants

Beginning Kelp Farmer Business Planning, Marketing, and Processing Workshop. Kodiak, Alaska, October 30-31, 2023. 17 participants.

Kelp the Sound Workshop series. Cordova, Alaska, March 7, 2023. Provided technical, hands-on training for those interested in seaweed farming or supporting the industry and information about the Mar ReCon program. (Funding: NOAA Alaska Marine Education and Training Mini-Grant Program).

Public presentations:

Cates, R. 2023. Developing shellfish research hatchery capacity and technology development at the NOAA AFSC Ted Stevens Marine Research Institute in Juneau, Alaska. Presentation to 2023 CICOES Symposium, June 2023.

Cypher, A. 2023. Introduction to Mar ReCon. Presentation at the Gulf Watch Alaska Long-term Research and Monitoring Annual Meeting, November 2023. Anchorage, Alaska.

Cypher, A. 2023: Presentation about seaweed biology and Mar ReCon program to high school students on June 9th, 2023, who were participating in the T3 Ocean Science Summer Program.

Cypher, A and K. Hoffman. 2023. Prince William Sound Science Center: where we live and what we do. Two Presentations to Hurtigruten Cruise ship passengers, May 2023. Cordova, Alaska.

Fleener, H. 2023. Update on the NOAA-AFSC oyster hatchery and selective breeding efforts. Presentation to Pacific Coast Shellfish Growers annual conference, September 2023.

Good, M. 2023. Introduction to Mar ReCon. Presentation at the Social, cultural, and economic assessment of kelp mariculture opportunities for coastal villages within the EVOS spill zone (project 22220301) Annual Meeting. Kodiak, Alaska.

Greene, S. and A. Jones. 2023. Environmental drivers of growth on kelp and oyster farms. Tuesday Night Talk Community Lecture Series, Prince William Sound Science Center, Cordova, Alaska.

Meyer, L. 2024. Effects of farm line spacing on Cultivated *Alaria marginata*: a methodology for determining optimal line spacing. Tuesday Night Talk Community Lecture Series, Prince William Sound Science Center, Cordova, Alaska.

Data and/or information products developed during the reporting period:

Nothing to report.

Data sets and associated metadata:

PIs are collecting, QA/QC-ing, and uploading data to the Research Workspace in cooperation with Axiom Data Management. Most components are in the beginning stages of data collection, so data have not been made publicly available.

Schaefer, A. 2024. Mar ReCon: Interactions with Biological Communities, Marine Birds [Dataset]. Available at: https://gulf-of-alaska.portal.aoos.org/

Additional Products not listed above:

Nothing to report.

3. Coordination and Collaboration:

The Alaska SeaLife Center or Prince William Sound Science Center

Prince William Sound Science Center (PWSSC) staff are core participants in both the leadership and research aspects of PWSSC and Mar ReCon. PWSSC provides administrative, fiscal management, logistics, and coordination services to the overall project team, as well as employs scientists who conduct research to meet the goals of this project's approach.

PWSSC provided members of the Mariculture and Physicochemical Environment Team affordable housing while they were in Cordova to deploy the production arrays. The Benthic

Component also stayed at the PWSSC bunkhouse and used the lab facility to do preliminary processing of samples. The PWSSC staff were very helpful providing access to the facility and helping colleagues set up the lab. The lab specifically is ideal for being the home base for benthic field work. This collaboration was invaluable to getting the benthic component field work done and the samples processed.

The PWSSC hatchery provided the sugar kelp seed used on the arrays in Prince William Sound (Component 3A).

PWSSC has also provided multiple avenues for disseminating Mar ReCon work to the public. PWSSC hosts the Tuesday Night Talk seminar series at which members of the Physicochemical Environment Component and the Kelp Farming Method Development Component presented their work. PI Cypher participated in "Kelp Month" activities hosted by the PWSSC education department including providing content for social media and conducting an interview for Field Notes. PI Cypher also hosted a mariculture-themed trivia night in November 2023 at the Reluctant Fisherman in Cordova. PIs Cypher and Schaefer shared multiple articles in the PWSSC *Breakwater* newsletter and annual science and natural history periodical, *Delta Sound Connections*. PWSSC has developed a project website (www.pwssc.org/mar-recon) and is working with PIs to develop component-specific pages that will link from the main project page.

Mar ReCon PIs are in the beginning stages of collaborating with the CORaL Network, which is led by the Alaska SeaLife Center. PI Good (Outreach Component) hosted a Seaweed Cultivation and Product Development session during the CORaL Network's Community Coastal Experience program.

EVOSTC Long-Term Research and Monitoring Projects

There is direct overlap between members of the Mar ReCon team and the LTRM (PIs Campbell, Konar, Hoffman, Schaefer), and PI Hoffman also sits on the LTRM program management team. The LTRM team collects data and has knowledge of the ecosystems that will be useful to this team and vice versa. Multiple PIs from the Mar ReCon project attended the Gulf Watch Alaska PI meeting in Anchorage in November 2023, and PI Cypher presented an overview of the Mar ReCon project to facilitate opportunities for data sharing and collaboration. Similarly, PIs from Gulf Watch Alaska virtually attended the annual Mar ReCon PI meeting in January 2024 to provide an overview of Gulf Watch Alaska and continue communication between the projects. PIs also attended the Gulf Watch Alaska quarterly PI meeting held in January 2024 in Anchorage during the Alaska Marine Science Symposium.

LTRM Environmental Drivers Component: Campbell is PI of the Gulf Watch Alaska project 23120114-G (Oceanographic conditions in PWS) of which this project is an extension (stations were added near mariculture sites, using the same methods as are done by the Gulf Watch Alaska

project). Mar ReCon shares a PWSSC research vessel *(M/V New Wave*) and uses the equipment of the GWA project. LTRM environmental monitoring data will provide important spatial context for the data from the production arrays.

LTRM Pelagic Monitoring Component: The Mar ReCon marine bird and mammal components (Components 2D and 2E) will complement the PWS Marine Bird Summer Surveys conducted every two years by U.S. Fish and Wildlife Service (PI Kaler, 23120114-M), the Seward Line surveys (PI Hopcroft, 23120114-L), and the Humpback Whale project (PI Moran, 23120114-O). The Mar ReCon marine bird and mammal surveys use the same methods for recording and processing data as the marine bird projects listed above, facilitating region-wide comparisons.

LTRM Nearshore Monitoring Component: LTRM Nearshore co-PI Konar is also a co-PI of Mar ReCon Component 2B, Benthic Communities. Because most mariculture efforts occur in nearshore waters, the conceptual link and information exchange between the two projects is natural. Nearshore monitoring in the vicinity of eDNA sampling sites across the three regions will be used to contextualize eDNA findings. Mar ReCon data will complement the marine bird and mammal data collected as part of the nearshore surveys in Kenai, Katmai, and PWS (PI Coletti; 23120114-H) which use the same methods for recording and processing data, facilitating region-wide comparisons of marine bird and mammal survey data. Additionally, in May 2023, shared logistics with the Nearshore Component enabled the Mar ReCon Benthic Component (Component 2B) to deploy surface drifters to track water movement out of the farms to confirm that the control sites we selected were not "downstream" of the farms.

LTRM Herring Research and Monitoring (HRM): The monitoring efforts of the Mar ReCon project will complement several HRM projects that will be operating in the same bays and at similar times during the FY22-31 program. Mar ReCon will use data from aerial forage fish surveys conducted annually in June to assess the number and size of forage fish schools in Simpson, Sheep, and St. Matthews Bays. Our fish, marine bird, and marine mammal observations will also inform data synthesis projects within the HRM program by quantifying abundance of potential predators in relation to herring rearing bays and spawning areas. We will share our results of benthic fish sampling with the HRM component to ascertain if any of our results may be of interest to them. Herring monitoring data will be compared to the eDNA and zooplankton analyses.

EVOSTC Mariculture Projects

Members of the Mar ReCon Outreach Component are working with the Social, Cultural and Economic Assessment of Kelp Mariculture Opportunities for Coastal Villages within the EVOS Spill Zone project 23220301 to make connections and coordinate community listening sessions. PI Good presented at the annual meeting in 2023 and has begun planning for two community

listening sessions to take place later this summer. A representative from this project attended and presented at the Mar ReCon annual PI meeting held January 2024.

Representatives from the Chugach Regional Resource Commission (CRRC) who are involved with the PWS Kelp Mariculture Development for Habitat Restoration and Local Economy project 23220300 attended and presented at the Mar ReCon annual PI meeting held in Cordova in January 2024. Additionally, PI Cypher met with CRRC hatchery technicians in August 2023 to discuss seaweed hatchery methods and potential areas for collaboration which included joining future "Kelp the Sound" workshops and outreach.

EVOSTC Education and Outreach Projects

The Mar ReCon team has integrated our education and outreach activities with the Community Organized Restoration and Learning (CORaL) Network. The outreach framework as defined by the CORaL Network will connect scientists with educators and community members with our proposed EVOSTC-funded mariculture projects happening across the region. Alaska Sea Grant is fulfilling the role of liaison between Mar ReCon and the CORaL Network. Alaska Sea Grant will coordinate with mariculture component leads during the building phases of these two projects to develop network pathways that will continue to be available to EVOSTC-funded mariculture projects over the life of the projects. Mariculture component leads will be members of the network and will actively participate in online resources and discussions, use of the online data portal, community events, cultural and communication learning opportunities, the intern institute, new and existing community science resources, and/or the collaborative mini-grants projects.

Representatives from the CORaL Network attended the Mar ReCon annual PI meeting in January 2024 to discuss ways we can work together to disseminate information about the project to target audiences. Additionally, PI Good (Outreach Component) hosted a Seaweed Cultivation and Product Development session during the CORaL Network's Community Coastal Experience program during summer 2023 and PI Cypher met with participants at PWSSC while they were in Cordova.

Individual EVOSTC Projects

Nothing to report.

Trustee or Management Agencies

Project funding is routed from the EVOSTC via a Trustee Agency (NOAA) to the PWSSC to administer non-Trustee agency awards. PWSSC streamlines and simplifies the Trustee Council's grantsmanship needs by serving as a central node between the sponsoring agency and many

subawardees. This reduces administrative burden on the Trustee Council and the agency through which funds are delivered. NOAA staff are also members of the Mar ReCon project (e.g., Hollarsmith, Long).

ADF&G, an EVOSTC trustee agency, is leading the evaluation of marine mammal interactions and mitigation measures. The need for this work is informed by: the ADF&G Marine Mammal Program's previous experience responding to farm permit application review requests; direct requests by NOAA Fisheries to ADF&G for new marine mammal - mariculture research, marine mammal management agency questions and community feedback to our project regarding mariculture and marine mammals, knowledge of marine mammal species' conservation status, and our ongoing research projects in the regions covered by this proposal.

Project data and outcomes from all components will be made available to other agencies for data synthesis and/or collaboration to support EVOSTC Trustee agency work.

Native and Local Communities

The Native Village of Eyak (NVE) is a core participant in this project, serving the role of Community Lead. John Whissel of the NVE Department of the Environment and Natural Resources serves on the Mar ReCon leadership team, and the NVE's kelp farm is one of the study areas for the farmer-led research component. Project funds for NVE's role as Community Lead are disbursed via the Prince William Sound Science Center, and project funds to NVE as a farmer partner are disbursed by the Alaska Fisheries Development Foundation. As a place-based community benefit organization, PWSSC is deeply embedded in Cordova. The Native Village of Eyak is Cordova's federally recognized Alaska Native Tribe. PWSSC and NVE have a mutually beneficial relationship. While the two entities operate autonomously, lines of communication are open, and NVE Department of the Environment and Natural Resources staff and PWSSC science and education staff are accustomed to supporting each other when possible. Historically, this has occurred via partnering on research proposals and research logistics; by trading technical staff; and by promulgating community programming. In the Mar ReCon project, it occurs via fiscal administration, project co-leadership, and research collaboration.

Further, key Alaska Native entities in the spill affected region are members of the CORaL Network core team: specifically, the Alutiiq Museum and the Chugach Regional Resources Commission. Mar ReCon has initiated collaborations with the CORaL Network, whose core team members help direct information exchanges between Alaska Native communities and EVOSTC-funded programs as necessary and appropriate. We are also exchanging information with other EVOSTC funded mariculture projects, such as by having project representatives attend their meetings, and inviting them to present and share at the Mar ReCon annual PI meeting (January 2024). Those projects have an Alaska Native community focus. Additionally,

the Oyster Selective Breeding component collaborated with the Alutiiq Pride Marine Institute (Chugach Regional Resources Commission) for microalgae culturing.

We have also communicated with LTRM Gulf Watch Alaska, a program that will be engaging Tribal communities via CRRC. Working with the CORaL Network and Gulf Watch Alaska to identify nodes for engagement with Alaska Native communities will help decrease the potential for burdensome, high-volume requests for participation or information exchanges with small villages. Rather, we will coordinate between and among EVOSTC-funded projects and programs to ensure preferred communication channels and frequencies in villages in the region are not overwhelmed. EVOS had long-lasting effects on subsistence resources upon which Alaska Native community members depend, and the Mar ReCon project has the potential to document outcomes and practices that may offer cultural, social, and economic benefits to Alaska Native communities in the wake of goods and services that were lost to the spill.

Additionally, the integration of farmers as research partners ensures direct local involvement (and benefit) as a result of the Trustee Council's investment in mariculture, and this will happen throughout the spill affected region as our farmer partner locations are geographically distributed among PWS, Kachemak Bay, and Kodiak. Lastly, CORaL Network partners budgeted for kiosks in which to display information such as data visualizations and videos about EVOSTC-funded research. PWSSC will host one of these kiosks in Cordova; other kiosks will be in Seward, Homer, Kodiak, and possibly even Valdez in the future. These kiosks will provide an informal learning opportunity about Mar ReCon that local community members can pursue on their own time, in addition to more formal stakeholder engagement activities in which the project will participate.

During this reporting period, Benthic Component members have had multiple informal meetings with farmers and community members to discuss research and research progress. During each of their field sampling events, the team tries to connect with farming and community partners. At various times during the summer, the team met with Larry Olson, Lindsey Olsen, Sean Crosby, Stephen Payton (Kachemak Bay); and Thea Thomas and Seawan Gehlbach (Cordova). The team also had conversations with Weatherly Bates (Kachemak Bay), Skye Steritz (Cordova), and Erik Obrien (Kodiak).

4. Response to EVOSTC Review, Recommendations and Comments:

Nothing to report.

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	$696,746	$1,072,885	$1,106,563	$1,145,540	$1,188,305	$2,086,697	$607,801
Travel	$86,787	$172,078	$150,180	$138,395	$112,654	$315,486	$53,781
Contractual	$506,081	$625,474	$678,937	$711,199	$701,371	$2,283,520	$409,258
Commodities	$368,606	$193,834	$179,074	$123,078	$150,487	$650,028	$426,542
Equipment	$591,993	$165,860	$121,758	$112,718	$68,253	$335,650	$428,348
Indirect Costs (rate will vary by project)	$169,780	$189,801	$183,472	$188,785	$198,458	$568,986	$122,849
SUBTOTAL	$2,419,993	$2,419,932	$2,419,984	$2,419,714	$2,419,528	$12,099,151	$2,048,579
General Administration (9% of subtotal)	$217,799	$217,794	$217,799	$217,774	$217,757	$1,088,924	NA
PROGRAM TOTAL	**$2,637,792**	**$2,637,726**	**$2,637,783**	**$2,637,489**	**$2,637,285**	**$13,188,075**	**$2,048,579**
Other Resources (In-Kind Funds)	**$60,239**	**$62,333**	**$53,622**	**$67,787**	**$111,360**	**$355,341**	**$33,111**

COMMENTS: Due to the delay in funding inititation, many projects within the component are underspent. We anticipate catching up on spending in the subsequent years of the project.

Due to the delay in funding initiation, many components within the project are underspent on personnel salaries, equipment purchasing, and field activities. We anticipate catching up on spending in the subsequent years of the project. The summary budget by category is provided above. Component summaries by category are provided below. Additional detail has been provided in accompanying tabs on the spreadsheet submitted to the EVOSTC.

PWS Restoration (Cypher): Components 1, 2A, 2C, 2D

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$109,793	$211,380	$217,690	$224,258	$230,940	$994,061	$137,430
Travel	$1,610	$7,370	$8,430	$8,460	$9,620	$35,490	$7,971
Contractual	$21,780	$78,680	$81,980	$81,280	$84,580	$348,300	$27,345
Commodities	$17,000	$5,750	$7,750	$5,750	$5,750	$42,000	$6,706
Equipment	$160,000	$20,000	$0	$0	$0	$180,000	$145,816
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0	
Indirect waived							
SUBTOTAL	$310,183	$323,180	$315,850	$319,748	$330,890	$1,599,851	$325,267
General Administration (9% of subtotal)	$27,916	$29,086	$28,427	$28,777	$29,780	$143,987	N/A
PROJECT TOTAL	$338,099	$352,266	$344,277	$348,525	$360,670	$1,743,838	$325,267
Other Resources (In-Kind Funds)							

Farm Sampling & Outreach (Wilson): Components 3, 6

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$37,000	$37,740	$38,495	$39,265	$40,050	$192,550	$46,435
Travel	$4,200	$29,305	$29,413	$4,523	$4,636	$72,077	$1,982
Contractual	$309,000	$373,920	$361,376	$378,279	$352,053	$1,774,628	$252,696
Commodities	$186,056	$134,084	$109,909	$55,650	$79,579	$565,278	$199,935
Equipment	$0	$0	$0	$0	$0	$0	
Indirect Costs Rate = 10% MTDC	$47,726	$23,705	$20,119	$13,972	$13,832	$119,354	$45,944
Indirect waived							
SUBTOTAL	$583,982	$598,754	$559,312	$491,689	$490,150	$2,723,887	$546,992
General Administration (9% of subtotal)	$52,558	$53,888	$50,338	$44,252	$44,114	$245,150	N/A
PROJECT TOTAL	$636,540	$652,642	$609,650	$535,941	$534,264	$2,969,037	$546,992
Other Resources (In-Kind Funds)							

Farm Sampling, Economics, Production & Outreach (Eckert): Components 1, 3, 4, 5, 6

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$167,650	$253,965	$299,590	$302,580	$337,495	$1,361,279	$0
Travel	$33,514	$49,103	$46,995	$48,044	$51,493	$229,150	$6,748
Contractual	$9,400	$14,900	$10,850	$36,400	$61,400	$132,950	$1,987
Commodities	$143,300	$12,500	$12,500	$12,500	$12,500	$193,300	$134,241
Equipment & F&A Exempt	$129,949	$28,350	$15,000	$13,000	$0	$186,299	$129,949
Indirect Costs Rate = 25%	$90,128	$82,617	$92,484	$99,881	$115,722	$480,832	$35,559
(non-equipment)							
SUBTOTAL	$573,942	$441,435	$477,419	$512,405	$578,609	$2,583,810	$308,484
General Administration (9% of subtotal)	$0	$0	$0	$0	$0	$0	NA
PROJECT TOTAL	$573,942	$441,435	$477,419	$512,405	$578,609	$2,583,810	$308,484
Other Resources (In-Kind Funds)						$0	$0

Pelagic Interactions (Hollarsmith): Component 1

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$0	$0	$0	$0	$0	$0	$0
Travel	$0	$8,807	$5,620	$8,495	$2,887	$25,808	$2,998
Contractual	$0	$0	$69,002	$72,262	$74,636	$215,900	$0
Commodities	$18,000	$0	$9,665	$9,928	$18,408	$56,001	$0
Equipment	$0	$15,000	$0	$0	$0	$15,000	$15,000
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0	$0
Indirect waived							
SUBTOTAL	$18,000	$23,807	$84,287	$90,685	$95,931	$312,709	$17,998
General Administration (9% of subtotal)	$1,620	$2,143	$7,586	$8,162	$8,634	$28,144	N/A
PROJECT TOTAL	$19,620	$25,950	$91,872	$98,846	$104,565	$340,853	$17,998
Other Resources (In-Kind Funds)	$21,836	$22,569	$23,332	$36,565	$75,280	$179,582	

Pelagic Interactions (Kelley): Component 1

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$28,317	$115,284	$88,523	$106,366	$109,342	$447,831	$23,139
Travel	$0	$25,273	$20,178	$26,424	$0	$71,874	$16,700
Contractual	$35,000	$22,500	$17,500	$2,500	$0	$77,500	$12,115
Commodities	$65,500	$7,000	$4,500	$7,000	$6,000	$90,000	$40,430
Equipment & F&A Exempt	$95,000	$48,005	$49,914	$40,418	$41,168	$274,505	$106,438
Indirect Costs Rate = 25%	$32,204	$42,514	$32,675	$35,572	$28,835	$171,801	$23,013
(non-equipment)							
SUBTOTAL	$256,021	$260,576	$213,290	$218,280	$185,345	$1,133,512	$221,835
General Administration (9% of subtotal)	$0	$0	$0	$0	$0	$0	$0
PROJECT TOTAL	$256,021	$260,576	$213,290	$218,280	$185,345	$1,133,512	$221,835
Other Resources (In-Kind Funds)						$0	

Oyster Breeding (Hollarsmith): Component 3

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$60,960	$121,920	$176,342	$180,387	$156,952	$696,561	$112,197
Travel	$2,488	$4,976	$4,976	$4,976	$4,976	$22,392	$4,440
Contractual	$49,000	$50,470	$0	$0	$0	$99,470	$37,501
Commodities	$25,250	$4,000	$4,750	$2,000	$6,250	$42,250	$14,721
Equipment	$0	$0	$0	$0	$0	$0	$0
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0	$0
SUBTOTAL	$137,698	$181,366	$186,068	$187,363	$168,178	$860,673	$168,859
General Administration (9% of subtotal)	$12,393	$16,323	$16,746	$16,863	$15,136	$77,461	N/A
PROJECT TOTAL	$150,091	$197,689	$202,815	$204,226	$183,314	$938,134	$168,859
Other Resources (In-Kind Funds)	$19,758	$20,746	$10,892	$11,436	$24,016	$86,848	

Oyster Breeding (Kelley): Component 3 - this component is scheduled to begin in FY29.

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$0	$0	$0	$0	$0	$0	$0
Travel	$0	$0	$0	$0	$0	$0	$0
Contractual	$0	$0	$0	$0	$0	$0	$0
Commodities	$0	$0	$0	$0	$0	$0	$0
Equipment & F&A Exempt	$0	$0	$0	$0	$0	$0	$0
Indirect Costs Rate = 25% (non-equipment)	$0	$0	$0	$0	$0	$0	$0
SUBTOTAL	$0	$0	$0	$0	$0	$0	$0
General Administration (9% of subtotal)	$0	$0	$0	$0	$0	$0	$0
PROJECT TOTAL	$0	$0	$0	$0	$0	$0	$0
Other Resources (In-Kind Funds)						$0	$0

Benthic Ecosystem (Konar): Component 2B

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$68,115	$69,948	$71,835	$73,779	$75,782	$359,459	$1,009
Travel	$15,730	$23,207	$10,369	$10,543	$10,447	$70,296	$4,440
Contractual	$3,300	$4,350	$3,300	$3,300	$8,500	$22,750	$2,893
Commodities	$13,500	$11,500	$11,500	$11,500	$5,500	$53,500	$1,329
Equipment & F&A Exempt	$29,993	$31,107	$32,277	$33,505	$27,085	$153,967	$0
Indirect Costs Rate = 25% (non-equipment)	$25,161	$27,251	$24,251	$24,781	$25,057	$126,501	$2,264
SUBTOTAL	$155,799	$167,363	$153,532	$157,408	$152,371	$786,473	$11,935
General Administration (9% of subtotal)	$0	$0	$0	$0	$0	$0	N/A
PROJECT TOTAL	$155,799	$167,363	$153,532	$157,408	$152,371	$786,473	$11,935
Other Resources (In-Kind Funds)						$0	

Benthic Ecosystem (Long): Component 2B

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$8,000	$8,000	$8,000	$8,000	$0	$32,000	$4,484
Travel	$4,916	$1,666	$1,666	$1,666	$3,078	$12,992	$4,779
Contractual	$0	$0	$0	$0	$0	$0	$2,507
Commodities	$4,000	$4,000	$4,000	$4,000	$0	$16,000	$8,255
Equipment	$0	$0	$0	$0	$0	$0	$0
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0	$0
SUBTOTAL	$16,916	$13,666	$13,666	$13,666	$3,078	$60,992	$20,025
General Administration (9% of subtotal)	$1,522	$1,230	$1,230	$1,230	$277	$5,489	N/A
PROJECT TOTAL	$18,438	$14,896	$14,896	$14,896	$3,355	$66,481	$20,025
Other Resources (In-Kind Funds)	$18,645	$19,018	$19,398	$19,786	$12,064	$88,911	$33,111

Marine Mammals (Rehberg): Component 2E

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$102,734	$105,817	$104,851	$108,326	$104,947	$526,675	$63,090
Travel	$15,480	$16,100	$16,100	$16,100	$16,100	$79,880	$780
Contractual	$9,401	$5,698	$6,664	$3,188	$6,568	$31,519	$200
Commodities	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000	$2,663
Equipment	$0	$0	$0	$0	$0	$0	$0
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0	$0
Indirect waived							
SUBTOTAL	$137,614	$137,615	$137,615	$137,614	$137,615	$688,073	$66,732
General Administration (9% of subtotal)	$12,385	$12,385	$12,385	$12,385	$12,385	$61,927	N/A
PROJECT TOTAL	$150,000	$150,000	$150,000	$150,000	$150,000	$750,000	$66,732
Other Resources (In-Kind Funds)							

Kelp (Umanzor): Component 3C

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$14,240	$45,889	$47,176	$47,017	$45,535	$199,857	$47,123
Travel	$0	$4,966	$5,098	$7,799	$8,012	$25,875	$0
Contractual	$0	$2,000	$2,000	$2,000	$5,000	$11,000	$2,027
Commodities	$8,800	$2,000	$1,500	$1,500	$1,500	$15,300	$15,125
Equipment & F&A Exempt	$27,700	$23,398	$24,567	$25,795	$0	$101,460	$31,145
Indirect Costs Rate = 25%	$5,760	$13,714	$13,943	$14,579	$15,012	$63,008	$16,069
(non-equipment)							
SUBTOTAL	$56,500	$91,966	$94,284	$98,690	$75,059	$416,500	$111,489
General Administration (9% of subtotal)	$0	$0	$0	$0	$0	$0	
PROJECT TOTAL	$56,500	$91,966	$94,284	$98,690	$75,059	$416,500	$111,489
Other Resources (In-Kind Funds)						$0	

Program Administration (Hoffman): Component 7

Budget Category:	Proposed FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$99,937	$102,944	$106,045	$109,105	$114,838	$532,868	$172,894
Travel	$2,200	$1,305	$1,335	$1,365	$1,405	$7,610	$2,943
Contractual	$69,200	$72,956	$74,281	$78,446	$81,059	$375,942	$69,988
Commodities	$2,000	$3,000	$3,000	$3,250	$5,000	$16,250	$3,138
Equipment	$0	$0	$0	$0	$0	$0	$0
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0	$0
Indirect waived							
SUBTOTAL	$173,337	$180,205	$184,661	$192,166	$202,302	$932,670	$248,963
General Administration (9% of subtotal)	$15,600	$16,218	$16,619	$17,295	$18,207	$83,940	N/A
PROJECT TOTAL	$188,937	$196,423	$201,280	$209,461	$220,509	$1,016,610	$248,963
Other Resources (In-Kind Funds)							

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2018-2020: Natural Resource Policy Teaching Assistant, *University of Montana*
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SELECT PUBLICATIONS & PRODUCTS

Bishop, A., **Wilson, H.**, Morris, M., Pryor, G., Budnik, R., Brady, C., Miller, A., and B. Smith. 2021. *A Guide to Aquaculture Permitting in Alaska*. Alaska Sea Grant. Juneau, AK. http://akaquaculturepermitting.org/

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