***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: 22220302

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

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

Reporting Period: Feb 1, 2022 – January 31, 2023

Submission Date (Due March 1 immediately following the reporting period): March 1, 2023

Project Website:

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

☐ **Project progress is on schedule.**

☒ **Project progress is delayed.**

We anticipated receiving the grant award on or around February 2022. However, the grant award was delayed by several months and was initiated on July 1, 2022. The delay in award funding affected the timing of subawards and the initiation of all components, including the execution of field work and data collection activities, purchasing of supplies, and the development of farmer collaborations. Most of the summer field activities were not possible because of these delays.

PIs in the Plankton Component were scheduled to purchase supplies in FY22. Due to the delay in the receipt of project funds, supplies will be purchased in FY23. This should not cause overall project delays as the fieldwork and data collection for this section of the component is scheduled for FY27-29.

The initiation of activities in the Benthic Component was delayed, and PIs spent their time meeting with other component leads, working on sampling design, and hiring a post-doc.

PIs in the Physiochemical Environment, Plankton, Marine Bird, and Marine Mammal components were unable to conduct some of the earlier planned surveys in Prince William Sound. They spent the time coordinating among PIs, developing protocols, and training.

Final design and start of the ADF&G-led marine bird and marine mammal surveys was pending final selection of the Mar ReCon farm sites and initial meetings with farm operators in order to

coordinate surveys at their facilities. Farm selections were finalized December 15, 2022 and the PIs met with participating farmers on January 13, 2023.

The Drivers of Regional Variation Component is currently on schedule, but delays are expected as of January 2023 due to delays in equipment purchasing. Equipment has been purchased and is on its way to UAF in Juneau.

Progress is slightly delayed for the Oyster Selective Breeding Component, which impacted the timing of hiring the FTE who will work on the hatchery and therefore the modifications of the existing infrastructure to meet the hatchery needs.

The Product Development Component is delayed and is making progress in hiring a post-doctoral student who will be responsible for conducting the bulk of the product development work.

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		D	D	D																
Carbonate system deployment					X															
Sensor data/bottle sampling							X		X		X		X			X				
Carbonate chemistry data analysis								X		X		X		X		X	X		X	-
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						X	X	X	X	X	X	X	X	X	X				
Sample processing							X	X			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					X				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	X				X				X							
Recruit Graduate Student (changed to post-doc)			C																	C
Supplies Purchasing			D	C																

Sampling – Field Work			D	D		X	X			X	X			X	X				
Sample Processing			D	D			X	X			X	X			X	X	X		
Analyses				D				X				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					X				X				X				X		
Website updates					X				X				X				X		
Data Upload					X				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	X	X		X	X	X		X	X	X		X	X	X		X
Sample processing/data analysis				D		X		X		X		X		X		X				X
Fish imaging sonar (2C.2, 2C.3)																				
Equipment purchasing				C																
Imaging sonar cruise (2C.2)					X			X	X			X	X			X	X			X

Data analysis					X			X	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	X															
Data compilation							X	X	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					X				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			
Website updates					X				X				X				X			
Data Upload					X				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					X	X														

Data processing and analysis						X	X	X												
Objective 3C.2 - sugar kelp																C				
Measure photosynthetic activity and morphometrics					X	X			X	X										
Sample processing							X	X			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.

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
Objective 2E.2																				

Cooperatively design farmer surveys	D	D	D																	
Obtain farmer survey data				D				X				X				X				X
Summarize survey data					X	X			X	X			X	X			X	X		
Objective 2E.3																				
Install time-lapse cameras		D	D																	
Service cameras and retrieve data						X				X				X				X		
Analyze camera data							X	X			X	X			X	X			X	X
Objective 2E.4																				
Focused mitigation discussion and planning																X	X	X	X	X
Reporting																				
Annual reports					X				X				X				X			
Final Report																				
Deliverables																				
Interim results to study participants					X				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**, **Decker**, **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					X	C														

Spawn and rear larvae								X	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
Milestone: Physiology																			
Growth model												X				X				X
Reporting																			
Annual reports					X				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					X	X	X													
Seed Market Research							X	X												
Conceptual Hatchery Development								X	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				X				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	X	X	X													
Phase 4. Dissemination of Results and Outreach Activities							X	X												
Reporting																				
*Annual reports				C				X												
Final report								X												
Deliverables																				
Peer reviewed paper									X											
Data posted online									X											
Outreach Activities and Extension Publication								X	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, Decker,** 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			X	X			X	X			X	X			X	X	
Task 2: Create and update information clearinghouse	D				X				X				X				X			
Task 3: Farmer extension and support	C	C	C	C	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Task 4: Training workshops - exact timing TBD	C			C	X			X	X			X	X			X	X			
Task 5: Annual meetings	D				X				X				X				X			
Milestone: Objective 2																				
Task 1: Create videos and outreach materials			C				X				X				X				X	
Task 2: Host listening sessions			D				X				X				X				X	
Task 3: Create FAQs or other docs				D				X				X				X				X

Milestone: Objective 3																			C
Task 1: Host workshops								X				X							
Reporting																			
*Annual reports					X				X				X				X		
Deliverables																			
Videos and outreach materials				D				X				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		X				X				X				X			
Circulate annual PI mtg. notes				C				X				X				X				X
Milestone: **Fiscal administration**																				
Issue subaward contracts		C			X				X				X				X			
Annual audit field testing				C				X				X				X				X
Milestone: Reporting																				
Annual reports					X				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.

☐ **Personnel changes.**

There were no PI changes during FY22.

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.

This report comes at the seven-month mark of a five-year grant award of a newly funded project. So far, the majority of the work performed has included developing partnerships with nine farms across the spill-affect region, the initiation of fieldwork to monitor impacts of mariculture on the environment and biological communities, development of kelp cultivation methods, and planning and purchasing in preparation for the upcoming field season. As a result of the first few months of this project, kelp and oyster farmers are preparing to take on new roles as research collaborators.

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

Component 1: Mariculture and the Physiochemical Environment

The Physiochemical Environment purchased a DIC analyzer to use for measuring inorganic carbon in seawater for the purpose of calculating CO2 flux at one farm from each region. A PhD student has been recruited to work on this subcomponent, and she received a fellowship to support her this year as the graduate student funding for this project does not commence until July 1, 2023.

PI Campbell conducted oceanographic surveys in July and November in Prince William Sound (PWS). The next survey is scheduled for early March 2023.

Component 2A: Mariculture with Biological Communities, Plankton

PI Campbell completed plankton and oceanographic surveys in July and November 2022 in Prince William Sound. The next survey is scheduled for early March 2023.

The Plankton Component PIs are purchasing field supplies in FY23 for fieldwork occurring FY27-29.

Component 2B: Mariculture with Biological Communities, Benthic Communities

The Benthic Component PIs had numerous project meetings between the UAF and NOAA team members (that included the post-doc once that person was identified). We met with other PIs within the Mar ReCon project to discuss collaborations and also recently assisted with the second round of site selection.

Over the summer, we opportunistically visited oyster farm sites in Kachemak Bay and informally met with farmers. During these visits, we primarily examined depth profiles, slope, substrate, and general biological communities to help inform our sampling design. In Kachemak Bay, a graduate student, Maddi McArthur, produced illustrative profiles as part of a 2-credit independent study. These images (example in Figure 1) have already come in handy in our discussions.

In Kodiak, initial benthic surveys were conducted at a subset of the kelp farm sites and surveys to identify control sites were also performed. Notably, 'before' samples at a projected farm site were able to be collected and will allow for a full before-after-control-impact (BACI) analysis at that site. All other farms in the Kodiak region are already established.

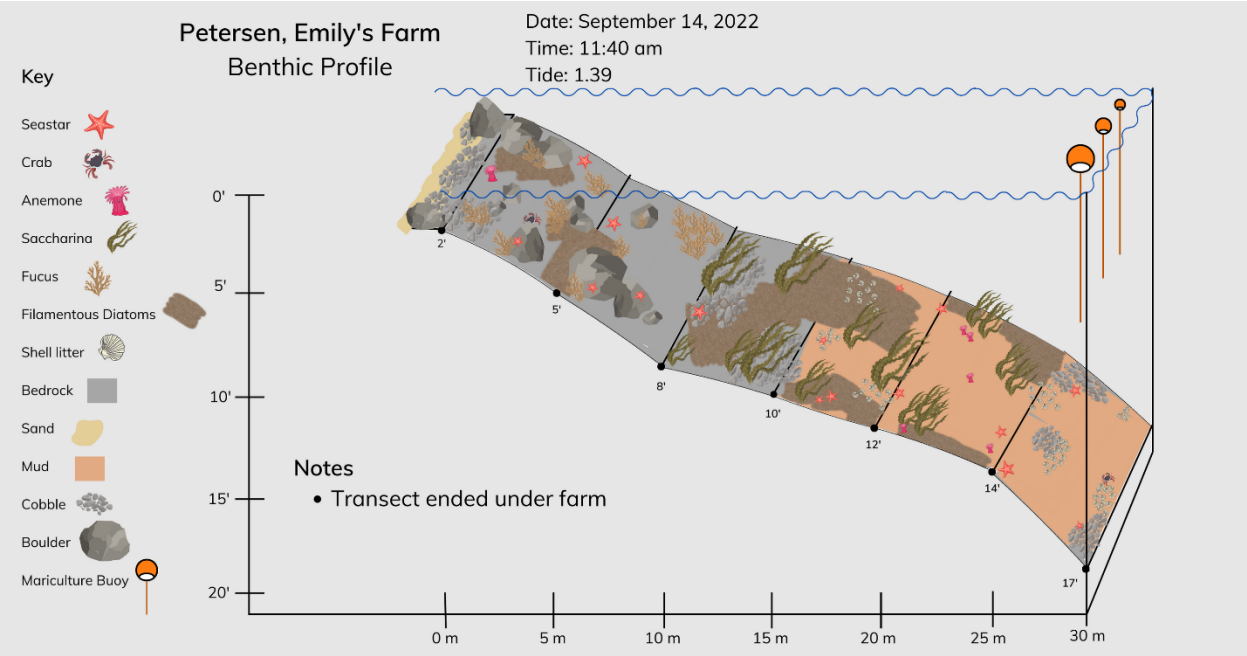

Figure 1. Example profile from shore to the edge of an oyster farm in Peterson Bay.

Component 2C: Mariculture with Biological Communities, Pelagic Fish

The Pelagic Fish Component purchased a DIDSON 1800 imaging sonar that was shipped to Cordova in December 2022. We received quotes for an echosounder and will purchase in early 2023. We also attended a Mar Recon PI meeting in Anchorage on January 13th for project planning.

Component 2D: Mariculture with Biological Communities, Marine Birds

The Marine Bird Component PIs held multiple meetings, as well as a meeting with external marine bird researchers in coastal Alaska (USFWS and NPS), to establish survey protocols and priorities and ensure consistent data collection method. We also held an on-water strip-transect and marine bird identification training in Cordova, Alaska during November 2022.

We conducted the first marine bird and mammal survey of the project during October 31 – November 1, 2022, in PWS. Surveys were conducted from the PWSSC's research vessel, the *R/V New Wave*. We recorded 240 birds of 18 species over 48 km of survey effort in Simpson Bay, Sheep Bay, and St. Matthews Bay. Marbled murrelet (*Brachyramphus marmoratus*) was the most abundant species (25% of observations), followed by black-legged kittiwake (*Rissa*

tridactyla; 17% of observations), and glaucous-winged gull (*Larus glaucescens*; 9% of observations). The encounter rate (birds/km) was highest in Simpson Bay (7.3 birds/km), followed by Sheep Bay (4.5 birds/km), and St. Matthews Bay (4.1 birds/km). Further data processing and analysis is underway, as well as development of project metadata. The next survey is scheduled for early March 2023.

Survey transects are in development for Kachemak Bay and Kodiak. PIs began discussions with other subcomponents and the Gulf Watch Alaska program to best identify survey routes for each farm. We aim to coordinate with existing survey work in the bays and lagoons containing our study farms to avoid duplicating efforts.

Component 2E: Mariculture with Biological Communities, Marine Mammals

During this reporting period, the Marine Mammal Component participated in Mar ReCon planning meetings, received training in boat-based strip-transect techniques, and helped select the final farm selections at Kachemak Bay. Several tasks launched near the end of this reporting period after the January 2023 meeting organized by the Mar ReCon project were to talk with the study farmers, the other Mar ReCon subcomponents, and LTRM Gulf Watch Alaska researchers.

We initiated discussions with other subprojects and the Gulf Watch Alaska program in order to best identify survey routes for each farm. We aim to coordinate with existing survey work in the bays and lagoons containing our study farms to avoid duplicating efforts.

We also began coordinating with other Mar ReCon subcomponents to specify the most straightforward method for farmers to record and report data. However, it is likely farmer-driven marine mammal data collection will begin with simpler collection methodology that can be incorporated into a more general Mar ReCon data collection system once it is up and running. We began planning the instructions and equipment to provide farmers in order to collect these farm-based data, and this planning and gearing-up step should be complete during February - May 2023. We are aiming for data collection to be operational during Summer 2023.

During this reporting period, we conducted marine mammal surveys in conjunction with marine bird surveys in three bays of PWS (October 31 – November 1, 2022). Sea otters were the most abundant marine mammal during the surveys (n = 87) followed by harbor seals (n = 47). Similar to marine birds, encounter rates for both sea otters and harbor seals were highest in Simpson Bay (3.1 and 3.7 individuals/km, respectively). No other marine mammals were observed during the survey. Further data processing and summarizing is in progress.

Component 3A: Drivers of Regional Variation in Production

Team members for this component established three-year contracts with the farmers that are participating as farmer-researchers. Three farms in each of three regions will serve as the main

study sites for this project. A contract was also established with an expert farmer, Eric Wyatt from Blue Starr Oysters, who works with an oyster hatchery and nursery.

Table 1. Shellfish and seaweed farms participating in this research project.

Region	Farmer	Farm
Prince William Sound	Seawan Gehlbach	Simpson Bay Oyster Co
Prince William Sound	Thea Thomas	Royal Ocean Kelp Co
Prince William Sound	Caitlin McKinstry	Native Village of Eyak
Kachemak Bay	Sean Crosby	Moss Island Oyster Farm
Kachemak Bay	Sean Crosby	Bootleggers Cove Farm
Kachemak Bay	Lindsay Olsen	Spinnaker Sea Farms
Kodiak	Nick Mangini	Kodiak Island Sustainable Seaweed
Kodiak	Alf Pyror	Alaska Ocean Farms
Kodiak	Erik Obrien	Kodiak Ocean Bounty

Scientists and farmers met in person to discuss the characteristics of each farm site and to discuss which components will happen in each region. This discussion was the first to bring together scientists and farmers, which is a unique feature of this project. These discussions are critical to for scientists to develop protocols that are adapted to each of these study sites.

Experimental-related equipment has been purchased and is on its way to UAF in Juneau. This includes one dissecting scope, one microscope, and one zebra fish husbandry system for kelp and oyster rearing and assessments.

Recruitment is completed for a graduate student to work on this component and discussions about project goals and expectations were initiated. We began identifying project advisors to assist the graduate student in developing a sampling plan and outline what specifically will be needed from farmers.

Recruitment is underway for a postdoctoral student who will conduct much of the on-site training and field sampling for this component.

Component 3B: Oyster Selective Breeding

The Oyster Selective Breeding Component hired a technician at 50% time who started in October 2022. We improved the infrastructure of the space that will be used as the hatchery in preparation for the project beginning. We recruited a highly qualified candidate to serve as the oyster hatchery and breeding expert, who is scheduled to start in March 2023. We received

quotes for various pieces of equipment that we will purchase for the hatchery. PIs attended the project kick-off meeting and then met in Anchorage at the Alaska Marine Science Symposium to discuss project logistics.

Component 3C: Kelp Farming Method Development

A test farm at Kalsin Bay, Kodiak, was seeded with the kelp *Alaria marginata*, used as a model to optimize seeding density as a function of line spacing. Year 1 data was collected successfully, and analysis will be conducted in the following months.

Component 4: Economic Feasibility Analysis

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

Component 5: Product Development

Project members drafted a list of potential Advisory Committee members from both industry and academia including seaweed processors, seafood processors, the Alaska Seafood Marketing Institute, and retail markets. The Advisory Committee will be established to advise on all phases of the study and will be engaged in an iterative process and began soliciting participation. The project team initiated comprehensive literature reviews of peer reviewed and non-peer reviewed publications and started scheduling and meeting with professionals 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. The bulk of the product development work will be conducted by a UAF postdoctoral student and recruitment is underway.

Component 6: Outreach

During FY22, the Outreach Component team had numerous meetings to identify important characteristics of farm sites and then to solicit interested farmers via an RFP, and subsequently select which farms to invite to participate in the project (described above in Component 3A and Table 1). We then created a contract and Scope of Work for the nine Partner Farmers as well as one Expert Farmer. We worked with farmers to make sure they were comfortable with the contents of the contract and SOW and fully executed the contracts.

The Outreach Component conducted three farm site visits, one in Kachemak Bay and two in Kodiak, to become familiar with farm operations to set the stage in identifying technological advances and needs. An expert farmer has been identified and is under contract to assist the project.

We began coordinating with the EVOSTC-funded Community Organized Restoration and Learning (CORaL) network to develop plans to make current scientific information and activities from this project publicly available. Outreach Component members presented during the CORaL

kick-off meeting which was attended by all CORaL network leads. Component members attend monthly CORaL planning meetings in the development of outreach components. A website designer was identified and a draft layout of website content was written. This site will host blog posts, story maps, videos, informational pieces and more and will be updated regularly throughout the project. A website for the Alaska Mariculture Research and Training Center, housed by Alaska Sea Grant, is in development and will host a farmers' informational clearinghouse for existing relevant global research on shellfish and seaweed relevant to Alaska farmers.

Project team members attended the kick-off meeting for the "Social, cultural and economic assessment of kelp mariculture opportunities for coastal villages within the EVOS spill zone", an EVOSTC-funded project, to make connections and to begin coordinating community listening sessions. PI Good continues to attend monthly meetings with this group.

Finally, the project team is in the process of developing two training workshops (Foundations of Kelp Farming and Seaweed Processing and Handling) and attended the first in-person Mar ReCon PI meeting in January 2023 to bring PIs and farmers together. This meeting was held subsequent to a kick-off meeting for the EDA-funded Alaska Mariculture Cluster, in an effort to further collaboration between the two projects with similar constituencies and farmer participants.

Component 7: Administration

Component team members provided all necessary information to NOAA to initiate this grant, including budgets, budget justifications, and the project narrative. Once the grant was awarded, staff worked with all subawardees to set up and process grant agreements (subawards) and establish expectations around accounting practices. The component team processed invoices from subawardees during the reporting period. Staff planned and facilitated a virtual team meeting in early December and an in-person meeting held in January 2023 in Anchorage. Component team members solicited input to and submitted the NOAA semi-annual report. Component members also provided information to the project about annual reporting requirements for the EVOSTC. PWSSC conducted an annual audit, the field work for which was performed in December 2022. This grant is part of the audited financials. Hoffman regularly engaged other members of the leadership and administration team (Eckert, Whissel, Decker, Schaefer) in communications and planning about the administrative aspects of the project.

2. Products:

Peer-reviewed publications:

Nothing to report.

Reports:

NOAA semi-annual report (July 1, 2022 – December 31, 2022).

Popular articles:

Nothing to report.

Conferences and workshops:

Cypher, A., K. Hoffman, G. Eckert, J. Decker, J. Whissel, R. Campbell, Q. Fong, M. Good, J. Hollarsmith, A. Kelley, B. Konar, C. Long, A. Pinchuk, M. Rehberg, A. Schaefer, S. Umanzor, R. Bochenek. 2023. Sustainable mariculture development for restoration and economic benefit in the EVOS spill area: An Introduction to the Mar ReCon. **Poster.** Alaska Marine Science Symposium. Anchorage, Alaska, January 2023.

Ulaski, B. 2023. Glacial influence on oyster farm fouling communities **Poster.** Alaska Marine Science Symposium. Anchorage, Alaska, January 2023.

PIs Campbell, Copeman, Cypher, Eckert, Hoffman, Hollarsmith, Schaefer, and Rehberg attended the Alaska Marine Science Symposium, January 23-27, Anchorage, AK.

Public presentations:

Nothing to report.

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

Nothing to report.

Data sets and associated metadata:

Nothing to report.

Additional Products not listed above:

The Outreach Component developed farmer contracts and affiliated Scope of Work descriptions.

3. Coordination and Collaboration:

The Alaska SeaLife Center or Prince William Sound Science Center

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

Mar ReCon PIs are in the beginning stages of collaborating with the CORaL Network, which is led by the Alaska SeaLife Center.

EVOSTC Long-Term Research and Monitoring Projects

There is direct overlap between members of the Mar ReCon team and the LTRM (PIs Campbell, Konar, and Hoffman), 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 at the Alaska Marine Science Symposium on 1/26/2023 to introduce the project and discuss opportunities for data sharing and collaboration.

LTRM Environmental Drivers Component: During late-fall and late-winter surveys, Mar ReCon will share a PWSSC research vessel (*M/V New Wave*) with the Monitoring of Oceanographic Conditions in PWS project (PI Campbell, 22120114-G) and use the equipment of this project. LTRM environmental monitoring data will provide important spatial context for the data from the production arrays. Some buoys used in the LTRM program will be used as non-farm "control" sites, allowing us to compare water column parameters inside and far outside from mariculture operations.

LTRM Pelagic Monitoring Component: The Mar ReCon marine bird and mammal components will complement the PWS Marine Bird Summer Surveys conducted every two years by U.S. Fish and Wildlife Service (PI Kaler, 22120114-M), the Seward Line Surveys (PI Hopcroft, 22120114-L), and the Humpback Whale project (PI Moran, 22120114-O).

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; 22120114-H) which use the same methods for recording and processing data, facilitating region-wide comparisons of marine bird and mammal survey data.

LTRM Herring Research and Monitoring: 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 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 Herring Research and Monitoring 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 attended a meeting of the Social, Cultural and Economic Assessment of Kelp Mariculture Opportunities for Coastal Villages within the EVOS Spill Zone (EVOSTC-funded) project to make connections and to begin coordinating community listening sessions. PI Good continues to attend monthly meetings with that group. As our project progresses, we will share information with other EVOSTC-funded mariculture projects through various channels.

PI Whissel (NVE) met with members of the Chugach Regional Resource Commission (CRRC) who are involved with the PWS Kelp Mariculture Development for Habitat Restoration and Local Economy (EVOSTC-funded) project to discuss opportunities for efficiencies and collaboration across projects, particularly with respect to the public survey efforts. NVE and CCRC will serve as the primary conduits for communication between the two projects.

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.

During FY22, Mar ReCon Outreach Component members presented during the CORaL kick-off meeting which was attended by all CORaL network leads. Component members attend monthly CORaL planning meetings in the development of outreach components. PIs in the Mar ReCon project met with the CORaL Network at the Gulf Watch Alaska meeting at the Alaska Marine Science Symposium to discuss opportunities for education and outreach.

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. John Whissel serves on the Mar ReCon leadership team, and the Native Village of Eyak's kelp farm will be one of the study areas for the farmer-led research component. Project funds for NVE's role as Community Lead will be disbursed via the Prince William Sound Science Center, and project funds to NVE as a farmer partner will be 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 will occur via fiscal administration, project 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 stated our plan to collaborate with the CORaL Network, whose core team members can 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 PI Good attend their monthly meetings. Those projects have an Alaska Native community focus.

We have stated our intent to communicate with LTRM Gulf Watch Alaska, a program that will be engaging Tribal leaders. 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.

4. Response to EVOSTC Review, Recommendations and Comments:

Science Panel Comments, September 2021

Component 1 seeks to test two hypotheses. The second hypothesis, concerning whether water biogeochemistry and nutrient concentrations differ throughout the region, can be tested with existing LTRM observations. Tests of the first hypothesis, whether mariculture impacts on water biogeochemistry and nutrient concentrations are context dependent, may produce some interesting results, however it is not clear how the findings would lead to actionable decisions by regulatory agencies concerning mariculture. We also were not completely satisfied with the explanation about the positioning of monitoring outside the farm to be compared with inside the

farm. The PIs indicated that "outside" refers to a site that is in similar water depth to that "inside" the farm, roughly ~200-400 m from the farm, similarly distanced from shore. If the farm affects water properties in some measurable way, those effects may be expected to be carried downstream away from the farm in the direction of prevailing ocean currents. Thus, ability to detect differences inside vs. outside the farm may depend on whether the outside station is positioned downstream or upstream of the farm. Tidal currents are likely to be most important. Perhaps a case can be made that the outside site is far enough away from the mariculture site that any farm effect would be diluted by surrounding waters. However, this case was not made.

PI Responses: The reviewers make a good point regarding the distance of the outside, or control site, relative to the experimental site. As each region, and likely each farm, will vary with respect to flow regimes, we will rely on our farmer partners to help us better understand the physical characteristics of the test farm prior to selection of our control site. We can also use our SeapHOx sensor (pH, salinity, temperature and oxygen concentration) to measure the spatial differences in conditions on the incoming and outgoing tide to select a control site that is outside of the "halo" of the farm but still experiences the same water mass. Ongoing LTRM observations provide a historical context to compare to observations made within the farms and were only slightly expanded to encompass areas with nascent farming activity.

The original solicitation for this project did not mention regulation, rather focusing on habitat restoration and enhancement and the development of mariculture. That may have been intentional on the part of the trustees given that EVOSTC funds are specifically prohibited to be used for activities that fall within the mandate of state and federal agencies and departments. That said, we hope that the information collected may be of use to regulators in time, it is difficult to project the outcome of this project until we see the data.

We had similar concerns with Component 2 as Component 1. Mariculture may or may not affect zooplankton communities, but again how would a change in some zooplankton species matter to mariculture regulators? For the benthic community subcomponent, it is unclear why fouling communities on mariculture structures would be compared to natural benthic communities on rocky substrates and how the findings would apply to management. Likewise, for the marine bird subcomponent, the third hypothesis concerning variability in marine bird density, distribution, and community composition can be tested with the existing GWA program. In summary, while some good science may result from successful completion of Components 1 and 2, their utility for mariculture management has not been made clear.

PI Responses: We appreciate the science panel's comments to improve this project. Fouling communities on oyster farm gear are being examined because these are a nuisance to farmers. We want to determine if the same species are fouling gear regardless of site/bay/region or if each farm site has unique species. These communities are being compared to rocky substrates in the same area to determine if the fouling communities are composed of species that naturally

occur on the benthos or if species are targeting farming structures. We will also compare densities of fouling species on farms and on the benthos to see if these species are preferentially selecting the farms.

Although it was part of the original proposal, the GWA LTRM program no longer includes marine bird surveys in PWS during winter, and there are no non-breeding season surveys in Kodiak or Kachemak Bay. Targeted surveys in bays with varying levels of mariculture and at time periods that are relevant for both marine birds and mariculture farm operations will enable us to evaluate if and how mariculture operations impact marine habitat use. This information is needed for industry and state/federal management agencies to inform sustainable expansion of the industry in the spill-affected area and in coastal Alaska and evaluate the restoration potential of mariculture.

This project includes a postdoctoral researcher (TBD hire) who will gather data from Components 1 and 2 and use this data to estimate the 'carrying capacity' of bays for mariculture. The inputs for modeling will include oceanographic and ecological data to determine if/how mariculture farms alter the adjacent biological communities (in comparison to control areas). While mariculture may not have an effect on zooplankton communities, they may influence the biological community as a whole which may have an indirect effect on zooplankton. In other words, if farms provide structural habitat for planktivorous fish, they may consume more zooplankton near farms and attract fish predators, marine birds, and mammals. This could lead to conflicts with farmers, alter habitat usage around farms, or alter local biogeochemistry. These are relevant considerations for permitting individual farms but more so for managing farm expansion in the spill area.

Component 3A considers drivers of regional variation in production and examines growth rates of cultivated kelp and oysters relative to environmental conditions. The proposed data summarizations and stated statistical analyses do not appear to be sufficient to determine the set of environmental conditions associated with higher growth rates. This component will also consider whether attributes of kelp and oysters will be improved by using polyculture. Finally, Component 3A will also evaluate heavy metal contaminants in farmed and wild seaweeds, their variation, and whether they pose a risk to human health. We have concerns about the work on contaminants. As the FDA or USDA have not set acceptable levels of contaminants for the sale of seaweed, it is not clear how these levels will be put in context or lead to actionable recommendations k. The PIs indicated that their contaminant data for seaweeds will inform the development of safe seafood operations and contribute to ensuring the safety and quality of cultured seafood products. As setting safe levels of contaminants requires a study of human health, we are not convinced how measurements of contaminants in farmed products will inform what is safe or not safe for human consumption. The PIs should reconsider this aspect of the proposed work and its justification. This SP also found the statistical analysis of contaminants to be vague.

PI Responses: We are measuring temperature, salinity, DO, nutrients, chlorophyll a, and the carbonate system at participating farms across the study area, as well as metrics of oyster and kelp production, including morphometrics and fatty acid concentrations. Our proposed analyses using ordination and linear models will effectively characterize variation in production and environmental variables across the large geographic area. Little information has been collected at shellfish and seaweed farms in Alaska, so this information is very informative to the industry, who will be able to improve production by better understanding seasonal and spatial variation in environmental parameters. This information will also help address public concerns with regards to mariculture in Alaska. For example, criticisms have been raised about phytoplankton depletion near farms. We will be able to examine this dynamic with our proposed research plan. Similarly, we will be able to better understand how seasonal phytoplankton dynamics are associated with shellfish and seaweed growth. GAM models will be used to better understand the influence of the abiotic conditions on morphometrics and growth of the target species from a multivariate perspective.

Because the FDA and USDA have not yet established safe levels of heavy metals in commercially produced seaweeds, our work is that much more important to characterize baseline levels and geographic variation. The reviewers are correct that we will not be able to examine human health impacts.

Component 3B involves an evaluation of diploid and triploid oysters and how performance varies with temperature, as well as selective breeding to develop strains of oysters with high growth and high survival. We had considerable discussion about this component and hoped to see more citation to previous work, given the amount of research conducted elsewhere, but agrees that performance of oysters in the EVOS region is meritorious. We were uncertain about the fate of any new oyster strains, as neither of the proposed NOAA laboratories are a likely facility to maintain the brood stock over the long term. We wondered about the merits of partnering with a commercial entity that can keep the broodstock alive. As Alaska lacks facilities to produce oyster seed for local mariculture farms, it is also unclear how results from this component would be operationalized.

PI Response: Oyster selective breeding research will all be done in close partnership with entities that are also undertaking this work, including the USDA-ARS POGS group from the Hatfield Marine Science Center and the private group Pacific Hybreed. The research oyster hatchery in Juneau will be able to facilitate these partnerships through communication. The NOAA facility in Juneau is being built out to allow the ability to hold, spawn, and rear larvae for broodstock strains. The NOAA facility will also be used to optimize hatchery methods for Alaska conditions and train students on hatchery methods. The idea is that this NOAA facility will do this on a research scale and transfer this technology and share successful strains with commercial entities that can then scale them up. OceansAlaska is a hatchery in Ketchikan that is

currently working on a project to spawn Alaskan oysters and grow larvae and likely partner in this work.

Component 3C explores a few very practical methods to improve kelp yields. First, to test the effects of spacing on yield, kelp will be seeded at two different densities (i.e., 500, 5000, current seeding density). While the choice of two densities of different orders of magnitude are likely to demonstrate an effect, if one exists, it is not clear how optimal seeding density will be determined from just two divergent values. Second, pre-harvest trimming of distal-end portions of kelp blades will be tested to see if this practice increases farm yields. Third, the temperature and salinity tolerances of juvenile kelps sourced from different locations will be tested. Once the maximum and minimum limits are obtained, the PIs will conduct full factorial assessments consisting of three salinities and temperature treatments to measure their interactive effect in kelp development, which will inform decisions about sources of kelp for farming. We recognize that results from these three sets of experiments will lead to practical advice to farmers to help maximize their yields.

PI Response: Thank you for the accurate summary and question about our approach to seeding density. As the idea matured, we realized that controlling the actual seeding identity onto growout lines is not feasible for a variety of reasons, including inherent variation while quantifying the number spores per recruitment from the environment once outplanting occurs. To address this, density will be assessed per area and different densities will be achieved by placing growout lines closer or farther away from each other. The seeding density at the hatchery level will remain constant, according to commercial seeding densities. Understanding the effect of density on kelp performance will allow us to inform farmers of the tradeoffs associated with line spacing (typical farming approach).

Component 4 will conduct an economic feasibility analysis of an oyster hatchery in Alaska to determine what components are needed to produce economically viable oyster seed. It will answer such questions as (1) what will it cost to raise oyster seed to market size?, (2) for what price can oyster seed be sold to provide an adequate return?, (3) what is the break-even price for culturing oyster seed?, and (4) what is the optimal size of a commercial oyster hatchery production facility to supply current and future needs in Alaska, with the possibility of exporting to other states? We view this as an important component of this proposal as it will produce information relative to potential local sourcing of oyster seed – a key hurdle to growth in this industry. We are pleased to see that an advisory committee from the mariculture industry and academia will be formed to provide critical advice for this project.

PI Response: Thank you for your support of this research.

Component 5 intends to develop industry-driven proof-of-concept product forms for seaweed and shellfish that consumers may favor through five 2-year product development cycles over the

10-year research period. If successful, seaweed and shellfish prototype products will be adopted by industry to be further developed for large-scale commercial production. The PIs have considerable experience in conducting this type of work, which follows well-established market research and food product development procedures. The PIs will engage industry to gather preliminary information, use focus groups to define product attributes, and utilize consumer taste panels and surveys. We view the development of new, innovative product forms as a key ingredient to boost market demand for kelp and oysters farmed in Alaska.

PI Response: Thank you for your support of this research.

Components 6, 7 and 8 involve outreach, administration, and data management. For outreach, the PIs plan to coordinate with the Community Organized Restoration and Learning (CORaL) Network to make current scientific information and activities publicly accessible and serve ongoing, community- identified needs. Project administration would be handled by the PWSSC and data management would be handled by Axiom Data Science. We felt that all three of these components were put together well. However, the outreach component would need to be revised, if the CORaL Network is not funded.

PI Response: Thank you for your support.

There were some aspects of siting mariculture farms that were not addressed by the proposal. For instance, the interactions of competing uses of the shoreline. Establishment of mariculture sites has the potential to conflict with existing subsistence uses, commercial fishing activity (e.g., setnet sites), and sewage outfalls. Some background information about this would have been helpful for context.

PI Response: The State of Alaska grants aquatic farm-site leases and issues operating permits for mariculture farms. During the lease and permitting process, farm applications are reviewed by the Alaska Department of Fish and Game Divisions of Commercial Fisheries, Subsistence, Sport Fish, Habitat and Wildlife. Agency personnel call out potential conflicts with activities, such as subsistence harvest areas, sportfishing and commercial fishing, anadromous streams, spawning habitat, marine and terrestrial birds and mammals, and others that are known to them.

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	$140,844
Travel	$86,787	$172,078	$150,180	$138,395	$112,654	$315,486	$12,405
Contractual	$506,081	$625,474	$678,937	$711,199	$701,371	$2,283,520	$84,686
Commodities	$368,606	$193,834	$179,074	$123,078	$150,487	$650,028	$16,248
Equipment	$591,993	$165,860	$121,758	$112,718	$68,253	$335,650	$229,256
Indirect Costs (rate will vary by project)	$169,780	$189,801	$183,472	$188,785	$198,458	$568,986	$32,034
SUBTOTAL	$2,419,993	$2,419,932	$2,419,984	$2,419,714	$2,419,528	$12,099,151	$515,473
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**	**$515,473**
Other Resources (In-Kind Funds)	**$60,239**	**$62,333**	**$53,622**	**$67,787**	**$111,360**	**$355,341**	**$49,221**

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	$35,973
Travel	$1,610	$7,370	$8,430	$8,460	$9,620	$35,490	$3,605
Contractual	$21,780	$78,680	$81,980	$81,280	$84,580	$348,300	$6,034
Commodities	$17,000	$5,750	$7,750	$5,750	$5,750	$42,000	$34
Equipment	$160,000	$20,000	$0	$0	$0	$180,000	$117,684
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	$163,330
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	$163,330
Other Resources (In-Kind Funds)							

Farm Sampling & Outreach (Decker): 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	$21,583
Travel	$4,200	$29,305	$29,413	$4,523	$4,636	$72,077	$1,381
Contractual	$309,000	$373,920	$361,376	$378,279	$352,053	$1,774,628	$5,546
Commodities	$186,056	$134,084	$109,909	$55,650	$79,579	$565,278	$0
Equipment	$0	$0	$0	$0	$0	$0	$0
Indirect Costs Rate = 10% MTDC	$47,726	$23,705	$20,119	$13,972	$13,832	$119,354	$27,840
Indirect waived							
SUBTOTAL	$583,982	$598,754	$559,312	$491,689	$490,150	$2,723,887	$56,350
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	$56,350
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	$40,163	$49,103	$46,995	$48,044	$51,493	$235,799	$0
Contractual	$9,400	$14,900	$10,850	$36,400	$61,400	$132,950	$0
Commodities	$18,500	$12,500	$12,500	$12,500	$12,500	$68,500	$0
Equipment & F&A Exempt	$279,300	$28,350	$15,000	$13,000	$0	$335,650	$0
Indirect Costs Rate = 25%	$58,928	$82,617	$92,484	$99,881	$115,722	$449,632	$0
(non-equipment)							
SUBTOTAL	$573,942	$441,435	$477,419	$512,405	$578,609	$2,583,810	$0
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	$0
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	$1,698
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	$0
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	$1,698
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	$1,698
Other Resources (In-Kind Funds)	$21,836	$22,569	$23,332	$36,565	$75,280	$179,582	$21,836

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	$21,715
Travel	$0	$25,273	$20,178	$26,424	$0	$71,874	$0
Contractual	$35,000	$22,500	$17,500	$2,500	$0	$77,500	$5,089
Commodities	$65,500	$7,000	$4,500	$7,000	$6,000	$90,000	$3,124
Equipment & F&A Exempt	$95,000	$48,005	$49,914	$40,418	$41,168	$274,505	$96,072
Indirect Costs Rate = 25%	$32,204	$42,514	$32,675	$35,572	$28,835	$171,801	$2,053
(non-equipment)							
SUBTOTAL	$256,021	$260,576	$213,290	$218,280	$185,345	$1,133,512	$128,053
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	$128,053
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	$124,358	$126,843	$129,377	$563,458	$0
Travel	$2,488	$4,976	$4,976	$4,976	$4,976	$22,392	$0
Contractual	$49,000	$50,470	$51,984	$53,544	$27,575	$232,573	$49,000
Commodities	$25,250	$4,000	$4,750	$2,000	$6,250	$42,250	$0
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	$49,000
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	$49,000
Other Resources (In-Kind Funds)	$19,758	$20,746	$10,892	$11,436	$24,016	$86,848	$19,758

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

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	$0
Travel	$15,730	$23,207	$10,369	$10,543	$10,447	$70,296	$0
Contractual	$3,300	$4,350	$3,300	$3,300	$8,500	$22,750	$0
Commodities	$13,500	$11,500	$11,500	$11,500	$5,500	$53,500	$0
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	$0
SUBTOTAL	$155,799	$167,363	$153,532	$157,408	$152,371	$786,473	$0
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	$0
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	$326
Travel	$4,916	$1,666	$1,666	$1,666	$3,078	$12,992	$2,774
Contractual	$0	$0	$0	$0	$0	$0	$0
Commodities	$4,000	$4,000	$4,000	$4,000	$0	$16,000	$4,527
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	$7,627
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	$7,627
Other Resources (In-Kind Funds)	$18,645	$19,018	$19,398	$19,786	$12,064	$88,911	$7,627

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	$14,175
Travel	$15,480	$16,100	$16,100	$16,100	$16,100	$79,880	$0
Contractual	$9,401	$5,698	$6,664	$3,188	$6,568	$31,519	$0
Commodities	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000	$0
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	$14,175
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	$14,175
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	$0
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	$0
Commodities	$8,800	$2,000	$1,500	$1,500	$1,500	$15,300	$8,563
Equipment & F&A Exempt	$27,700	$23,398	$24,567	$25,795	$0	$101,460	$15,500
Indirect Costs Rate = 25%	$5,760	$13,714	$13,943	$14,579	$15,012	$63,008	$2,141
(non-equipment)							
SUBTOTAL	$56,500	$91,966	$94,284	$98,690	$75,059	$416,500	$26,204
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	$26,204
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	$47,072
Travel	$2,200	$1,305	$1,335	$1,365	$1,405	$7,610	$2,947
Contractual	$69,200	$72,956	$74,281	$78,446	$81,059	$375,942	$19,017
Commodities	$2,000	$3,000	$3,000	$3,250	$5,000	$16,250	$0
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	$69,036
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	$69,036
Other Resources (In-Kind Funds)							