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: 25220302

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), Caitlin McKinstry (Native Village of Eyak), Alex Huller (Alaska Fisheries Development Foundation),

Reporting Period: February 1, 2025 – January 31, 2026

Submission Date (Due March 1 immediately following the reporting period): March 31, 2026

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

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

☒ **Project progress is on schedule.**

Most components within the project are on schedule and proceeding as planned. See Project Timeline, Milestones, and Tasks tables and the Summary of Work Performed sections below.

☒ **Project progress is delayed.**

Project initiation was delayed due to the delay in release of funds from EVOSTC in the first year. As such, the timing of many activities shifted forward a year. With that shift in mind, the overall project is on track and making excellent progress.

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	C	C					
Carbonate system deployment					C				C				C							
Sensor data/bottle sampling							C		C		C		C		C					
Carbonate chemistry data analysis								C		C		C		C		C				
Carbonate chemistry model prep										C		C		C		C				
Milestone Objective 1b																				
Purchasing/testing equipment			C	C																
Zooplankton and eDNA sampling			C	C	C	C	C	C	C	C	C	C								
Sample processing			C	C	C	C	C	C	C	C	C	C								
Data analysis and synthesis			C	C	C	C	C	C	C	C	C	C								
Milestone Objective 3A																				
Coordination/training with farmers						C	C		C	C	C	C								
Kelp and oyster sampling						C	C	C	C	C	C	C	C	C	C					
Sample processing							C	C			C	C			C	C				
Data analysis																C	X	X	X	X
Fatty acid analyses									D	D	D	D	C	C	C	D				
Isotope analyses									D	D	D	D	C	C	C	D				
Polyculture kelp/oyster sampling																				
Reporting																				
Annual reports					C				C				C				X			
Final report																		X	X	X
Deliverables																				
Peer reviewed papers																	X	X	X	X
Data posted online												D				C				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				C				C							
Recruit Graduate Student (changed to 2 masters students)											C									X
Supplies Purchasing	C	C			C	C														
Sampling – Field Work			C	C		C	C			C	C			C	C					
Sample Processing			C	C			C	C			C	C			C	C	X			
Analyses				C				C				C				C	X	X		
Reporting																				
Annual reports					C				C				C				X			
Final report																				
Deliverables																				
Manuscript publications								C											X	X
Contribute to data synthesis									C								X			
Present at conferences					C				C				C				X			
Website updates					C				C				C				X			
Data Upload					C				C				C				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	C	C		C	C	C		C	X	X		X
Sample processing/data analysis				D		C		C		C		C		C		C				X
Fish imaging sonar (2C.2, 2C.3)																				
Equipment purchasing																				
Imaging sonar cruise (2C.2)					D			C	C			C	C			C	X			X
Data analysis					D			C	C			C	C			C	X			X
Compare sonar data to eDNA (2C.3)									D				D				X			
EcoPath modeling (2C.4)																				
Hiring of postdoctoral researcher				D	D									C						
Data compilation							D	D	D								X			

Data processing and model prep										D	D	D		C	D	D	X			
EcoPath modeling																D	X	X	X	X
Model adaptation to other regions																				
Reporting																				
Annual reports					C				C				C				X			
Final Report																				
Deliverables																				
Manuscript publication																	X			
Contribute to Data synthesis									D							C	X	X	X	X
Present at conferences									C								X			
Delta Sound Connections		X				X			C				C				X			
Website updates					D				C				C				X			
Data Upload					C				C				C				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 - ribbon kelp																				X
Measure the effect of trimming on kelp performance									C	C							X	X		
Sample processing											C	C								
Data processing and analysis													C	C						
Objective 3C.3 – sugar kelp																				X
Salinity and temp effect on juvenile sporophytes														C	C	C	X	X		
Data processing and analysis																	X	X	X	
Reporting																				
Annual reports									C				C				X			
Final report																				
Deliverables																				
Peer-reviewed paper																				X
Data posted online									D				C				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 designed farmer surveys	C	C	C							C	C	C								
Obtain farmer survey data				C				C				C				C				X
Summarize survey data					C	C			C	C			C	C			X	X		
Objective 2E.3																				
Install time-lapse cameras		C	C																	
Service cameras and retrieve data						C				C				C				X		
Analyze camera data							C	C			C	C			C	C			X	X
Objective 2E.4																				
Focused mitigation discussion and planning																C	X	X	X	X
Reporting																				
Annual reports					C				C				C				X			
Final Report																				
Deliverables																				
Interim results to study participants					C				C				C				X			
Marine mammal interaction workshop																D				X
Present at conferences									C							C				
Lay audience article or presentation												C	C							

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											C					
Obtain broodstock					C	C														
Spawn and rear larvae					C	C		C	C			C	C			C	X			
Milestone: Grow-out on farms																				
Grow juvenile oysters in FLUPSY									C				C				X			
Grow-out on farms							C			C	C	C	C	C	C	C	X	X	X	X
Milestone: Physiology																				
Growth model												C				C				X
Reporting																				
Annual reports					C				C				C				X			

Final report																				
Deliverables																				
Peer reviewed paper																	X	X	X	X
Data posted online													C				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											C	C								
Expert Opinion Solicitation											C	C	C	C	C	C				
Seed Market Research													C	C	C	C				
Conceptual Hatchery Development																D	X	X		
Data Gatherings														C	C	C				
Baseline Bioeconomic Model Established																D	X	X		
Economic Model Simulation																D	X	X		
Final Report and Recommendations Preparations																		X	X	X
Reporting																				
Annual reports				C				C				C				C				
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. This project component is being rescoped with a budget revision because of the lack of experts in product development available for hire and consultants will be brought in.

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 Cycles																				
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													X	X		
Phase 3. Consumer taste Panels and/or Value Chain Intermediary Product Evaluation				D	D	D	D										X			
Phase 4. Dissemination of Results and Outreach Activities							D	D									X	X		
Reporting																				

Annual reports				C				C				C				C				
Final report																				
Deliverables																				
Peer reviewed paper									D								X	X	X	X
Data posted online									D								X	X	X	
Outreach Activities and Extension Publication								C				C				C			X	X

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			C	C			C	C			X	X	
Task 2: Create and update information clearinghouse					C				C				C				X			
Task 3: Farmer extension and support	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	X	X	X	X
Task 4: Training workshops - exact timing TBD	C			C	C			C	C			C	C			C	X			
Task 5: Annual meetings					C				C				C				X			
Milestone: Objective 2																				
Task 1: Create videos and outreach materials			C				C				C				C				X	
Task 2: Host listening sessions							C				C				C				X	
Task 3: Create FAQs or other docs												C				C				X
Milestone: Objective 3																				?
Task 1: Host workshops												C								
Reporting																				
Annual reports					C				C			C	C				X			
Deliverables																				
Videos and outreach materials								C				C	C			C				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		C				C				X			
Circulate annual PI mtg. notes				C				C				C				C				X
Milestone: **Fiscal administration**																				
Issue subaward contracts		C			C				C				C				X			
Annual audit field testing				C				C				C				C				X
Milestone: Reporting																				
Annual reports					C				C				C				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 May 8, 2025.

One component within the Mar ReCon project submitted a budget reallocation request during FY25. On March 12, PI Hollarsmith (Oyster) requested a budget reallocation, which was approved on March 19, 2025.

☒ **No-cost extension request.**
EVOSTC funds for the Mar ReCon Project were initially released later than expected in FY22, the first year of funding for this project. The delay resulted in subsequent delays in Trustee Agencies releasing funds to agency-led projects and NOAA's ability to initiate a grant for non-trustee organizations through Prince William Sound Science Center as the fiscal agent. As a result, the NOAA grant's fiscal year now runs from July 1 – June 30, a five-month offset from the EVOSTC fiscal year of February 1 to January 30. The delay in award funding affected the initiation of all project components, including the execution of fieldwork and data collection activities, purchasing of supplies and equipment, and the development of farmer collaborations. In other words, for many parts of the project, an entire field season was lost and project activities were pushed back a full year. There were also delays in the hiring of post-docs and personnel to work on the project. The federal hiring freeze and freeze on federal partners' abilities to spend funds has also impacted some aspects of the project's spending progress.

Because of the cascading effects of funding delays and freezes, the Mar ReCon project has substantial funds to carry over from FY25 to FY26. This issue will likely ripple through all years of the current funding cycle.

Will the requested budget adjustment change the original scope or objectives of the project?
☒No ☐Yes

Amount requested to carry over to the next fiscal year: $4,291,817.
See budget snapshot below which shows cumulative spending by January 31, 2026.

How will the requested carryover be spent in the next fiscal year: Carryover funds will be spent as planned in the original proposal. Funds are allocated to salaries of current personnel as well as recently hired personnel (e.g., new graduate students and post-doctoral students), purchasing equipment and supplies, field and data collection activities, sample and data analysis, conference attendance, publication fees, and associated fiscal management. PI Kelley has recently hired a student to conduct a multi-year analysis of carbon flux, the Benthic component has hired a post-doc, and the Kelp Farming Methods component has a new PhD student starting in the fall semester. The latter component also plans to hire a full-time technician. Additionally, the

Benthic Component plans to visit farms 2-3 times in Kodiak and Kachemak Bay this summer. The Marine Mammal Component will use carryover funds to support camera maintenance, travel, and boat expenses in all three study areas. This component will also use funds to engage a recent hire within the ADF&G marine mammal program who specializes in image processing using AI to review and better automate their species identification processes. PI Eckert plans to use carryover funds on personnel and a rebudget request that will incorporate additional famers into the project, shift previously allocated personnel funds to a contract to advance the goals of the product development component (the three searches to hire an expert in this area were unsuccessful), and purchase upgraded environmental sensors and new pCO2 environmental sensors. AFDF funds will be used to contract additional farmers to participate in sample and survey collection. This will strengthen data coverage in priority areas where increased sampling will support more accurate data interpretation AFDF is also conducting more comprehensive seaweed contaminant testing, which includes analysis of kelp and water samples from participating farms to assess heavy metals. The budget adjustment will not impact the scope and objectives of the project.

Budget Category:	AMENDED FY 22	AMENDED FY 23	AMENDED FY 24	Proposed FY 25	ACTUAL CUMULATIVE
Personnel	$686,255	$957,602	$1,269,245	$1,209,194	$2,050,269.16
Travel	$80,138	$146,805	$185,453	$138,395	$226,431.60
Contractual	$471,081	$586,542	$634,453	$657,655	$1,556,357.46
Commodities	$427,906	$186,834	$283,006	$123,078	$647,395.50
Equipment	$325,359	$117,855	$304,763	$112,718	$522,446.68
Indirect Costs	$173,232	$147,287	$243,940	$188,785	$362,863.81
(rate will vary by project)					
SUBTOTAL	$2,163,971	$2,142,925	$2,920,861	$2,429,824	$5,365,764.21
General Administration (9% of subtotal)	$194,757	$192,863	$262,877	$218,684	NA
PROGRAM TOTAL	$2,358,729	$2,335,788	$3,183,738	$2,648,508	$5,365,764.21

☐ **Personnel changes.**

Nothing to report.

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 among 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 includes multiple interconnected subcomponents that align to support the Consortium's overall objectives.

During the reporting period, the project made substantial progress toward achieving project objectives. Key accomplishments include the continuation of fieldwork to monitor the impact of mariculture on the environment and biological communities (and vice-versa), along with initial data compilation and analysis. The development of the Mariculture Research Hatchery at the NOAA Ted Stevens Marine Research Institute, including the installation of a seawater heat pump, was completed. The team also conducted a comprehensive assessment of the relationship between kelp seeding spool density and biomass yield at harvest. In addition, the project continued to provide technical support to the industry through direct consultation, delivery of training workshops and outreach materials, and development of information summaries for each partner farmer. Researchers also submitted papers for peer-review, presented at professional and community meetings, and participated in community outreach events.

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

During this reporting period, the production array team coordinated with farmers, conducted field sampling, and analyzed data. The responsibility structure of the production array team was organized this year to designate a liaison for each region. This structure improved communication between researchers and farmers for all the project components and provides a single point of contact for each farmer. Arron Jones is leading Kodiak fieldwork and communication, and James Crimp and Sierra Greene are doing the same for Homer and Prince William Sound, respectively. Field visits to each region were conducted at approximately 4-month intervals. During field visits, team members offloaded data from deployed sensors and replaced them with freshly calibrated ones. Additionally, they checked the structures of the production array to ensure that there were no issues. Farmers became more comfortable using their CTDs throughout the year, recording more frequent and higher quality CTD profiles on each farm throughout this sampling period. Additionally, we implemented a chlorophyll sampling protocol for farmers to collect filtered chlorophyll samples at monthly and bi-monthly intervals throughout the year. These samples are being analyzed at UAF's facility in Juneau and will be used to calibrate the in-situ chlorophyll fluorescence data from sensors. All CTD and in-situ data from 2024 was QAQC'd, uploaded to Research Workspace, and analyzed for regional and within-region trends. The 2025 data is currently being run through QAQC processes and analyzed. Summary reports and figures for each farm and region were created and shared with all partner farmers in the project. Sierra presented a poster on these data at the 2025 Alaska Marine

Science Symposium and the Alaska Mariculture Conference, as well as a talk at the Western Society of Naturalists meeting in San Diego. James presented a talk at the 2025 Aquaculture America in New Orleans. Additionally, in January 2026, Sierra successfully defended her master's thesis work using these data.

To date, we have focused on understanding the oceanographic variability across and within regions. We found that in 2024, sites in Prince William Sound were warmer and fresher across all seasons than those in Kachemak Bay and Kodiak (Figure 1A, B). All regions recorded well oxygenated waters and similar trends across seasons (Figure 1D), and the magnitude of turbidity was similar across sites; however, the seasonal patterns varied (Figure 1C). Additionally, we recorded a difference in chlorophyll patterns across regions. The onset of the spring phytoplankton bloom was nearly a month earlier in Prince William Sound than in Kachemak Bay. Additionally, Prince William Sound was the only region to record elevated chlorophyll levels throughout the fall (Figure 1E).

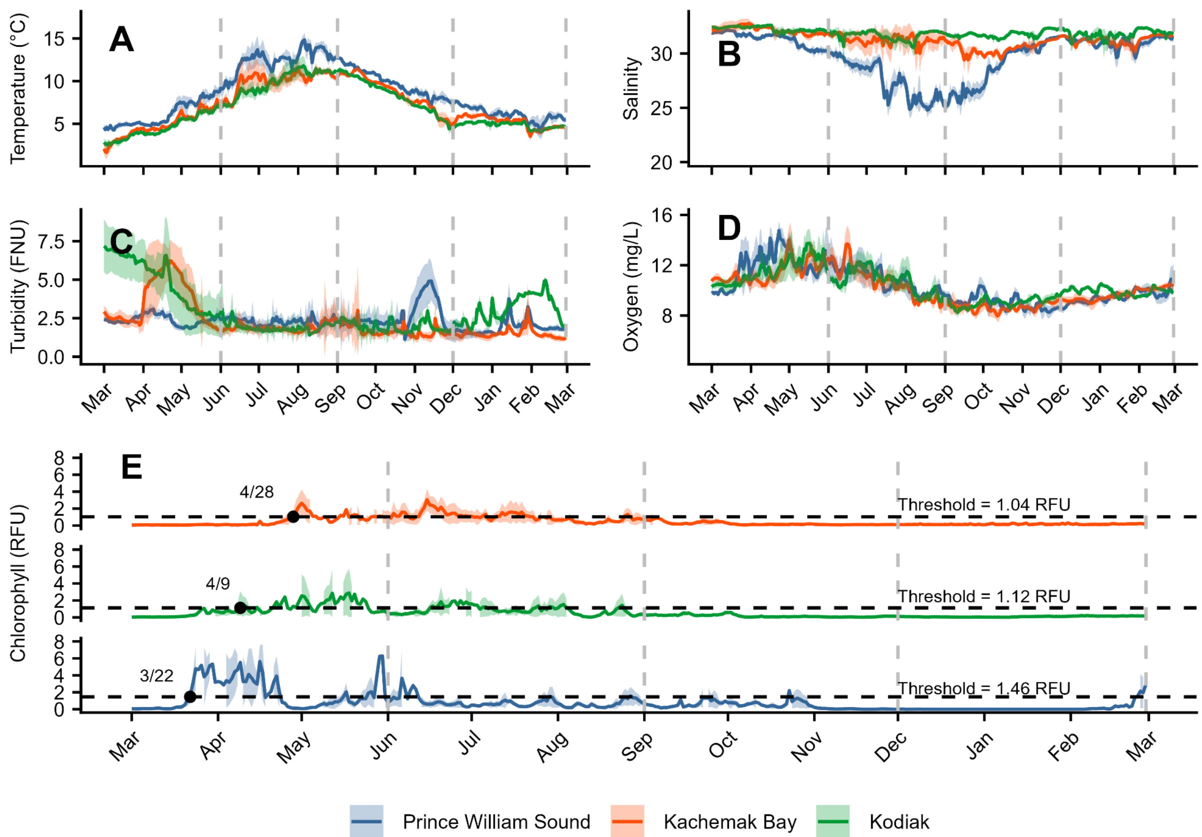

Figure 1. Daily mean (lines) ± 1 SD (shading) for A) temperature, B) salinity, C) turbidity, D) oxygen, and E) chlorophyll for each region from March 2024 through February 2025. Dashed horizontal lines in (E) show the regional bloom threshold (x2 the regional annual chlorophyll mean) with the threshold value above them. Black points indicate the onset of the spring bloom (date the regional daily mean surpassed the threshold), with the onset date above them. Data recorded at 3 - 4 m depth. Dashed vertical lines represent seasonal breaks.

Through the use of principal component analysis (PCA) and analysis of similarities (ANOSIM), we determined environmental conditions at Kachemak Bay and Kodiak sites were more similar than Prince William Sound (Figure 2). Higher temperatures and lower salinities in Prince William Sound, resulting from higher freshwater input and lower oceanic influence, drove this separation year-round, with other variables contributing seasonally. The influence of fresh water was also recorded as stratified water columns through farmer-collected CTD profiles in Prince William Sound, and some sites in Kachemak Bay. Sites in Kodiak were well mixed and did not show signs of stratification at any point throughout the year. Multivariate analyses indicated seasonal and geographic oceanographic variability across sites within regions. At each site, daily chlorophyll patterns were analyzed through power spectral density, revealing that sites had shifting frequency in chlorophyll corresponding to seasonal shifts.

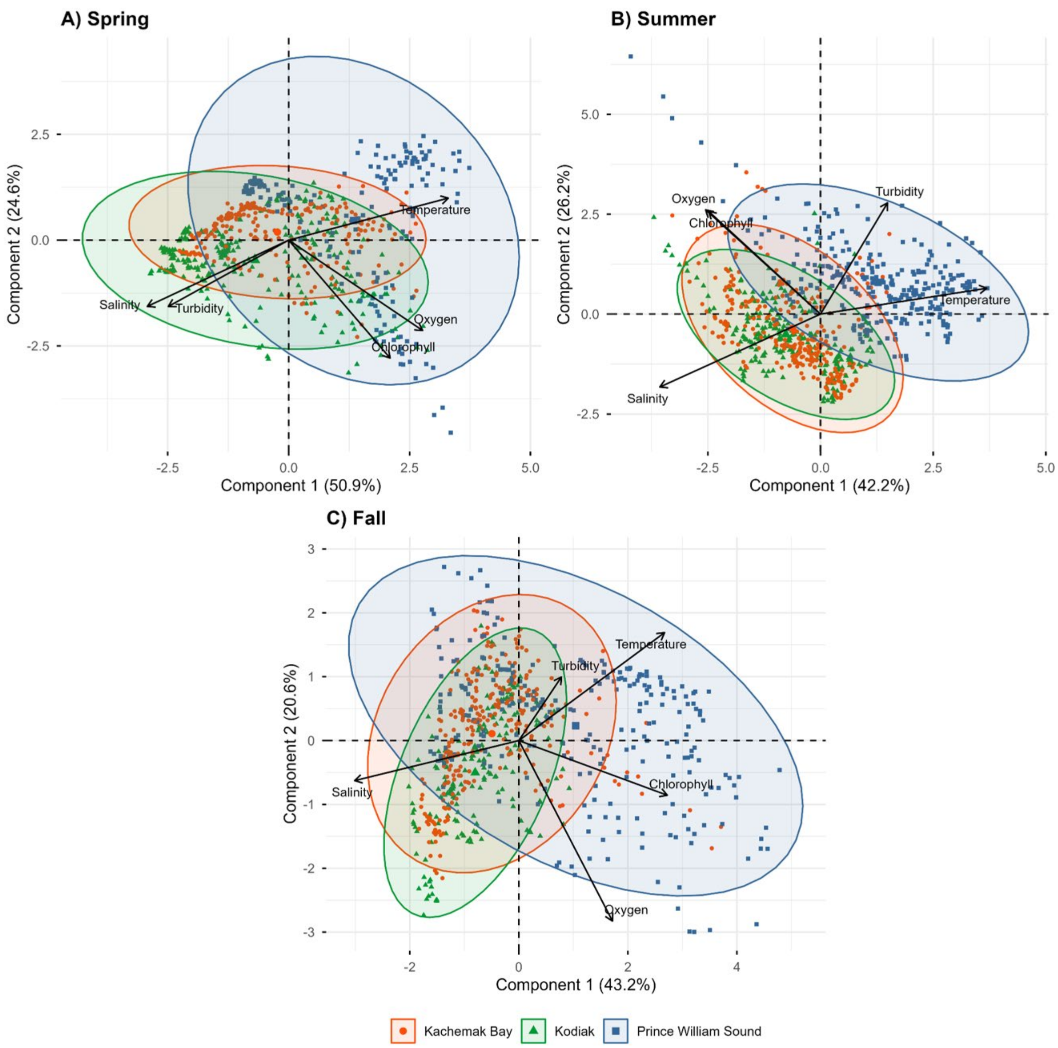

Figure 2. PCA plots across regions by season using regionally daily mean anomaly data. Parameters of the PCA include temperature, salinity, chlorophyll, oxygen, and turbidity. Points and ellipses are colored by region and ellipses surround 95% of the points for that region. The Y axis for each plot is PC1 and the x axis is PC2. Arrows indicate the nature of the relationship, with arrows in the same direction positively correlated, opposite direction, negatively correlated, and no relationship if they are perpendicular. Winter data is not included in PCA analysis due to lack of data points from the Kodiak region.

As the project has progressed, we have learned and slightly modified our approach toward the production array in-situ sampling. We discontinued using the photosynthetically active radiation (PAR) sensors on the production arrays, because the data being collected was not high enough quality for use. We suspect the sensors are being shaded and suffering from persistent biofouling despite many efforts to control and remove fouling. We are exploring the use of satellite-derived PAR data to fill this information need. Another challenge this year was sensor failures at two locations from January - July at a site in Kodiak and August - November at a site in Kachemak Bay. We isolated the issues causing these failures and implemented a check system with farmers to reduce the risk of sensor failures in the future. All oceanographic sensors were sent in for service and calibration in February 2026 in preparation for field deployment in the spring.

The first year of kelp farm-associated CO_2 flux data (2023-2024) was analyzed and written up as a manuscript, submitted to the journal Ocean Science (https://doi.org/10.5194/egusphere-2025-2914). The manuscript is currently under review. Year two of CO_2 flux data (2024-2025) was collected from all three kelp farms, completing two of the three years of data collection associated with this portion of the Mar ReCon project. These data have been uploaded to the Research Workspace. Josie Haag, the PhD student working on this project, graduated with a PhD in Oceanography from the University of Alaska in spring of 2025. A new PhD student, Rylie Neeley, joined the project in January 2026 to analyze the multi-year time series of kelp farm-associated CO_2 flux.

Component 2A: Mariculture with Biological Communities, Plankton

Zooplankton were collected at all the standard stations in Simpson, Sheep and St. Matthews Bay. Examination of the zooplankton collected to present as a corpus shows patterns in species assemblages PWS-wide (Figure 3; Campbell 2026). Briefly, the zooplankton assemblages seen in PWS shifted following the “Blob” marine heatwave of 2013-14 and a second heat wave in 2019, from the more canonical cool water taxa typical of subarctic assemblages, towards warmer water species more characteristic of the northern California Current off Washington and Oregon. In more recent years zooplankton abundances were below average, in part likely due to the marine heatwaves, but also due to prolonged shallowing of the surface mixed layer caused by enhanced freshwater inputs. The mechanism is discussed in detail in the annual report for EVOSTC project 25120114-G.

Extracted chlorophyll-a concentrations from filtered water samples were collected at all of the standard stations in Simpson, Sheep and St. Matthews Bay and a fairly long time series now exists for Simpson Bay, which was sampled by the Gulf Watch project and its predecessors (Figure 4). Integrated chlorophyll-a was near the climatological average at the start of the time series in 2009, and for the most part increased during the years of the “Blob” anomaly. Integrated chlorophyll was below average 2020-2024, and more recently has returned to the climatological average.

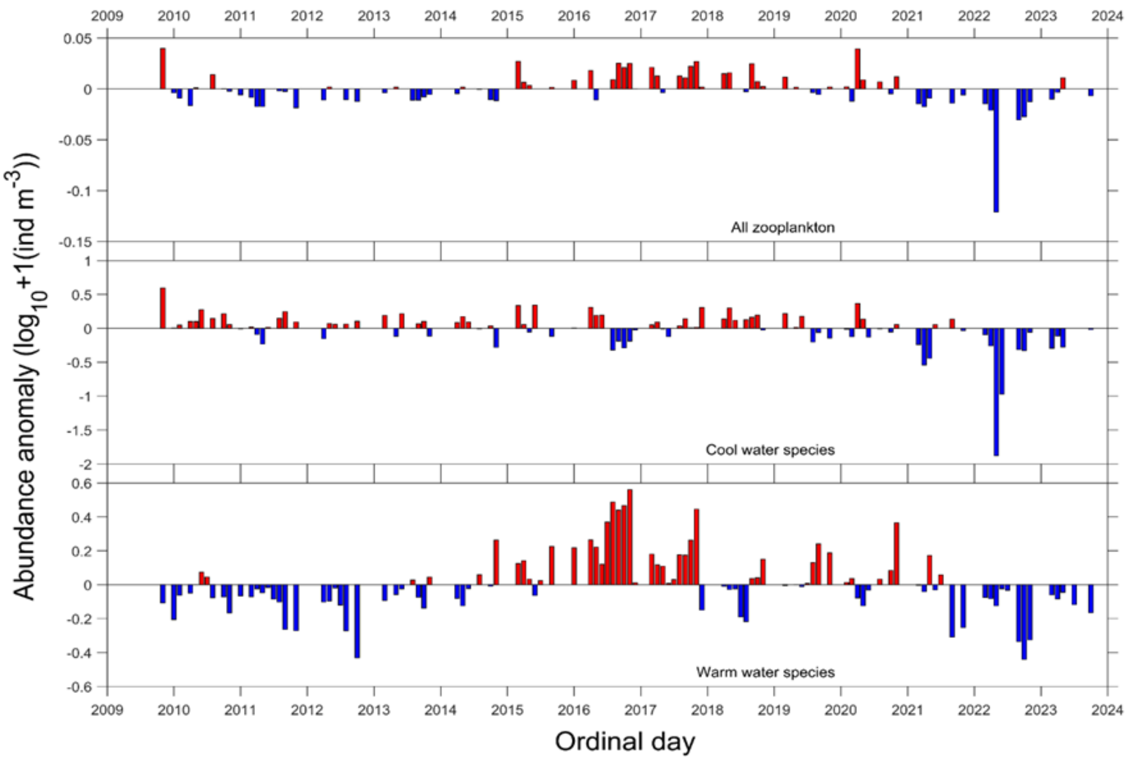

Figure 4. Time series of zooplankton anomalies in Prince William Sound, 2010-2024. Zooplankton were divided into "warm" and "cool" water copepod species per Peterson et al. (2017) and average anomalies calculated across groups per Fisher et al. (2015). Warm water species were Calanus pacificus, Clausocalanus sp., Corycaeus anglicus, Ctenocalanus vanus, Mesocalanus tenuicornis, and Paracalanus parvus. Cool water species were Acartia longiremis, Calanus marshallae, Oithona similus, and Pseudocalanus sp. Abundances were log10+1 transformed prior to calculating anomalies. Note that the scaling of the ordinate varies among panels.

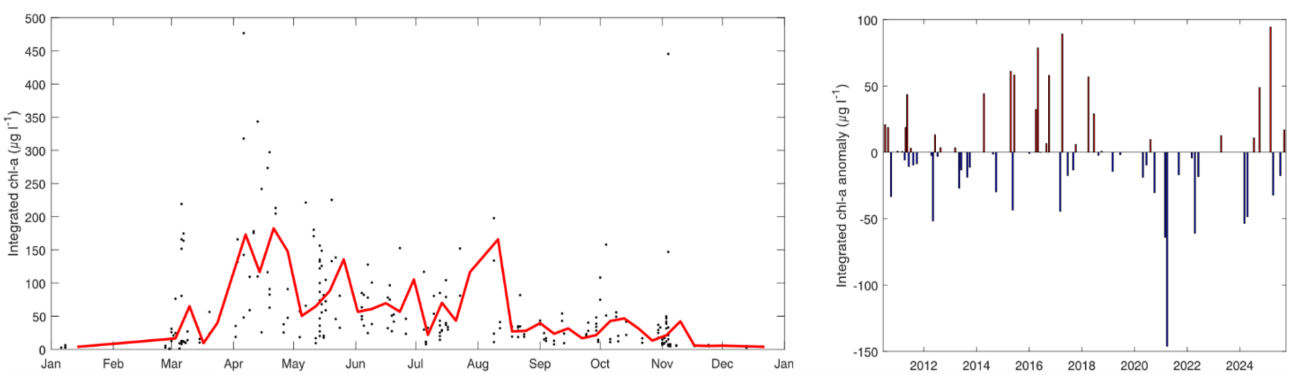

Figure 3. Seasonal cycles of depth integrated chlorophyll-a (left panel), and monthly anomalies (right panel; i.e. departures from the average red line in the left panel).

Component 2B: Mariculture with Biological Communities, Benthic Communities

During this reporting period, the Benthic Component team members (co-PI Konar and students, co-PI Long) had multiple informal meetings with oyster farmers. Graduate student Emily Nicholson assisted with a field trip organized by the Center for Alaskan Coastal Studies in Seldovia. Graduate student Riley O'Neil talked about benthic communities under oyster farms at the UAF Arctic Research Open House and during the community outreach event in Homer (January 7, 2026). Both students and the PI gave presentations at the Alaska Marine Science Symposium, the Alaska Mariculture Conference, and to the Kachemak Bay and Lower Cook Inlet Marine Ecosystem Workgroup.

Benthic Component team members sampled the benthic and cage biofouling communities at the three Kachemak Bay oyster farms (and their associated control sites) in July and September. This sampling was done in conjunction with the Alaska EPSCoR project. The team sampled benthic and cage fouling communities at farms in Cordova in September, including one oyster farm and one kelp farm and associated control site. All benthic samples and photoquadrats from these collections were processed. The team is working on data analyses (including correlative analyses with environmental characteristics) and manuscript preparation. Both graduate students are on track to complete their MS degrees in summer 2026.

The Benthic Component completed two surveys of the benthic communities at each of three Kodiak farms and corresponding control sites. Fall sampling was disrupted by the federal shutdown in October/November. Benthic infaunal samples collected from Kodiak kelp sites in 2025 and are currently being processed by graduate student Riley O'Neil and an undergraduate student McKenna Shook.

Lastly, we are planning logistics for a summer 2026 study to determine if sea urchins can be used to mediate biofouling while producing market-ready gonads. This will be done at multiple farms in the Gulf of Alaska. We recruited a post-doc to start working on this and other benthic component elements in summer 2026.

Component 2C: Mariculture with Biological Communities, Pelagic Fish

PI Cypher completed imaging sonar surveys in the spring and fall of 2025 at five mariculture farms (Figure 5) including Native Village of Eyak (NVE) in Sheep Bay, Royal Ocean Kelp Company (ROKC) in Windy Bay, and Simpson Bay Oyster Farm (SBO), Wild Blue Mariculture (WBM) and Noble Ocean Farms (NOF) in Simpson Bay. Sampling also occurred at respective control sites that were at least 100 m from farm sites and chosen based on similar bottom depth and distance from shore as farm sites. For each farm, the imaging sonar with a mounted GoPro camera was deployed off the side of farmer-operated vessels to a depth of 5-10 ft, depending on the depth of the farm. This occurred at two sampling points within each farm which were consistent between fall and spring. Once positioned, the sonar was oriented using an AR3 rotator to include part of the farm infrastructure in the viewing area. The position of the sonar viewing area was monitored throughout recording. After a 15-min acclimation period, the imaging sonar recorded 20-min files over the course of 2 hours (96 beams, 10-15 range, 6-9 frame rate).

Data processing and statistics: Data processing of each sonar video file was completed using ARISFish (Sound Metrics) software. Fish encounters were identified using the echogram feature that generated a visual representation of an entire video file so that each pixel represented a single frame. When a fish swam into the sonar field of view, a track was visible in the echogram (Figure 6 for example). Each echogram was assessed for fish tracks and each fish was marked. After marking each fish, the length and thickness of each fish in addition to their distance from farm infrastructure was recorded. For larger (<50 fish) schools, fish were subsampled for length and thickness measurements randomly throughout the school. Screenshots were taken of each school and processed in Image J using the 'analyze particles' tool to count fish. GoPro videos were used to confirm fish encounters and attempt to identify species, however, visibility was often a barrier due to storms in the fall and bloom cloudiness in spring.

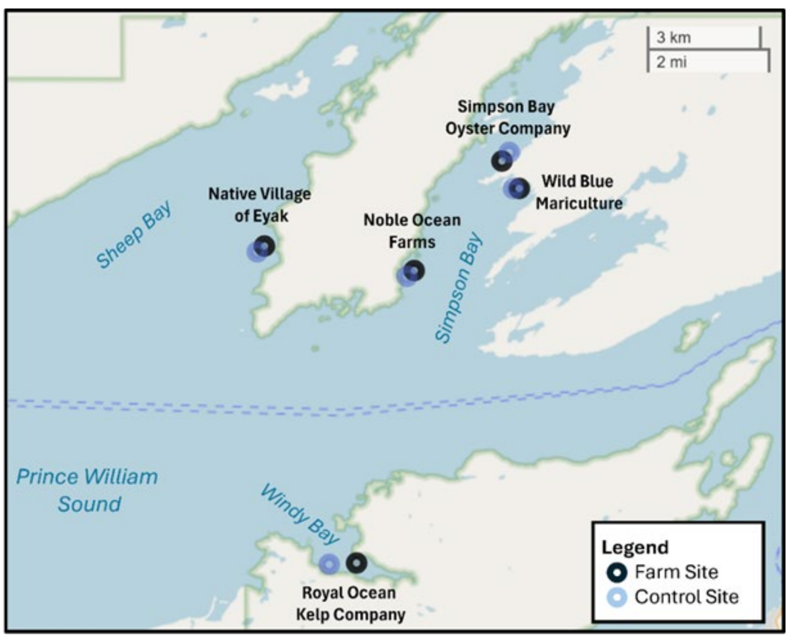

Figure 5. Map of eastern PWS showing the locations of five farms surveyed by imagining sonar. Noble Ocean Farms, Wild Blue Mariculture, and Royal Ocean Kelp Company are multi-array seaweed farms while the Native Village of Eyak Farm is a vertical line array and Simpson Bay Oyster Company is an oyster farm. Control sites are at least 100 meters from farm sites and have similar bottom depth and distance from shore.

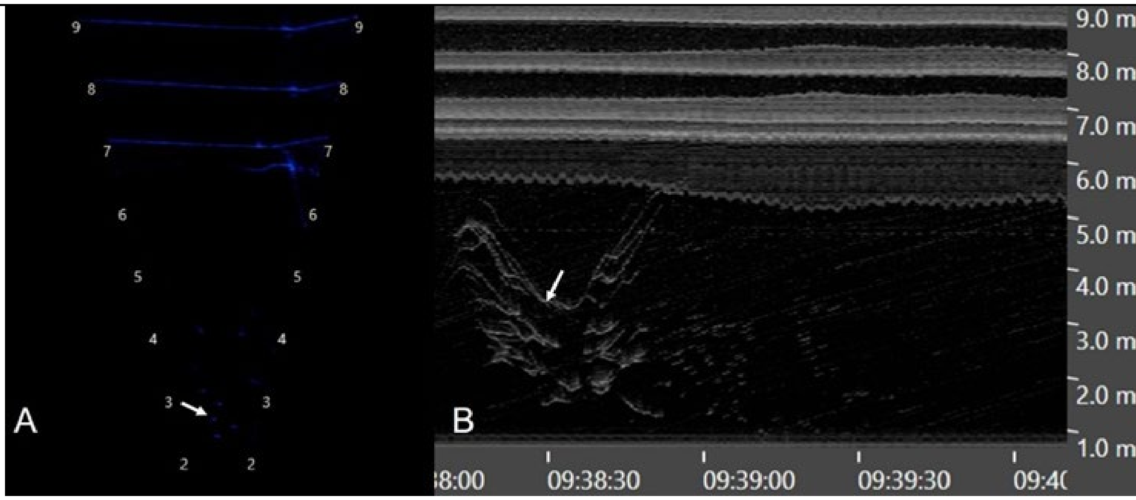

Figure 6. Example of a fish encounter when A) observed in the sonar field of view and B) as a fish track on the echogram. White arrows indicate fish or fish track.

Results: In 2024, 2219 fish were detected by imaging sonar (0 in control) while 502 were detected in 2025 (226 in control). In 2024, more fish were encountered in the fall (1399) than in the spring (295) and in 2025, more fish were encountered in the spring (318) than in the fall (184; Figure 7). Fish encounters at control sites in 2025 were high due to two single-event encounters with large schools (>50) of small forage fish at two sites, ROKC and NOF. Most fish encountered at farms and control sites were small (<25 cm) schooling forage fish with similar sizes observed between year and season (Figure 8). Most fish encounters (92%) were less than 100 seconds in duration (Figure 9). The distance between each fish encounter and the closest farm structure was also measured, but little pattern is observed (Figure 9). Behavioral patterns have not yet been incorporated due to few observations of fish interacting with farm structures. On March 28th, 2025, at the Nobel Ocean Farms farm site, the first mammal encounter was recorded by these surveys when a sea otter swam through the grow lines (https://youtu.be/wjCsRUxNp3M). No negative interactions of the sea otter were observed.

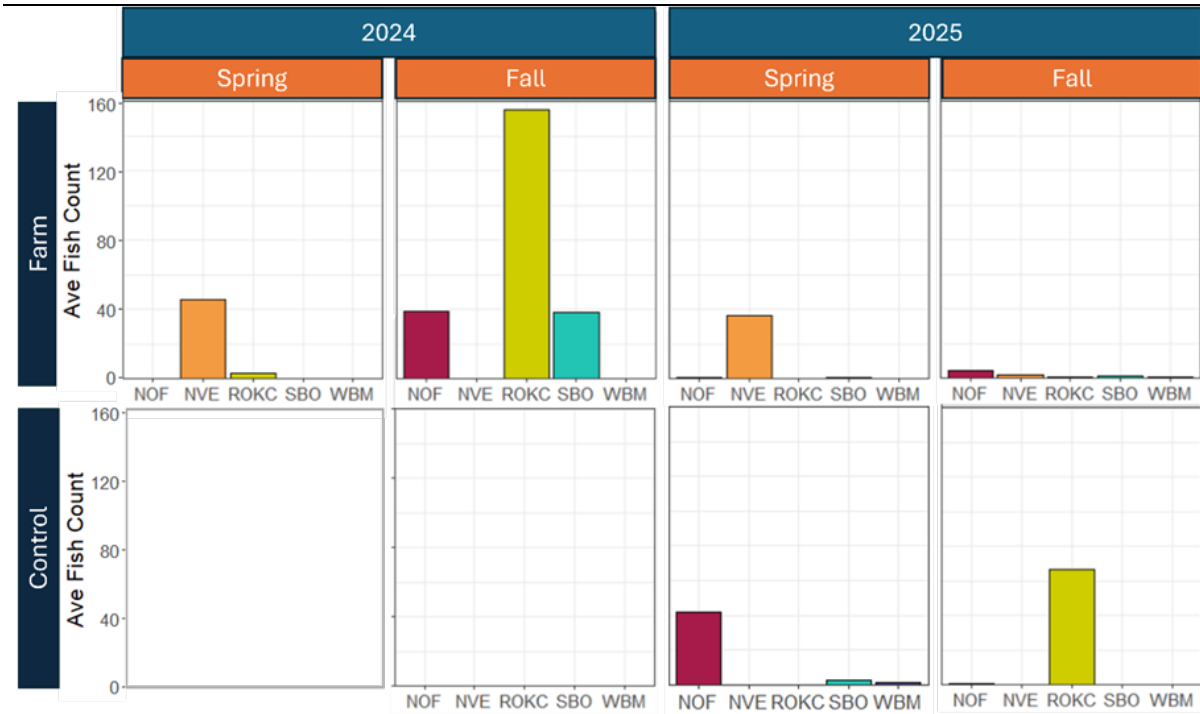

Figure 7. Average fish counts for farms and control sites between spring and fall in 2024 and 2025 at five farms in Prince William Sound, AK including Noble Ocean Farms (NOF), Native Village of Eyak (NVE), Royal Ocean Kelp Company (ROKC), Simpson Bay Oyster Farm (SBO), and Wild Blue Mariculture (WBM).

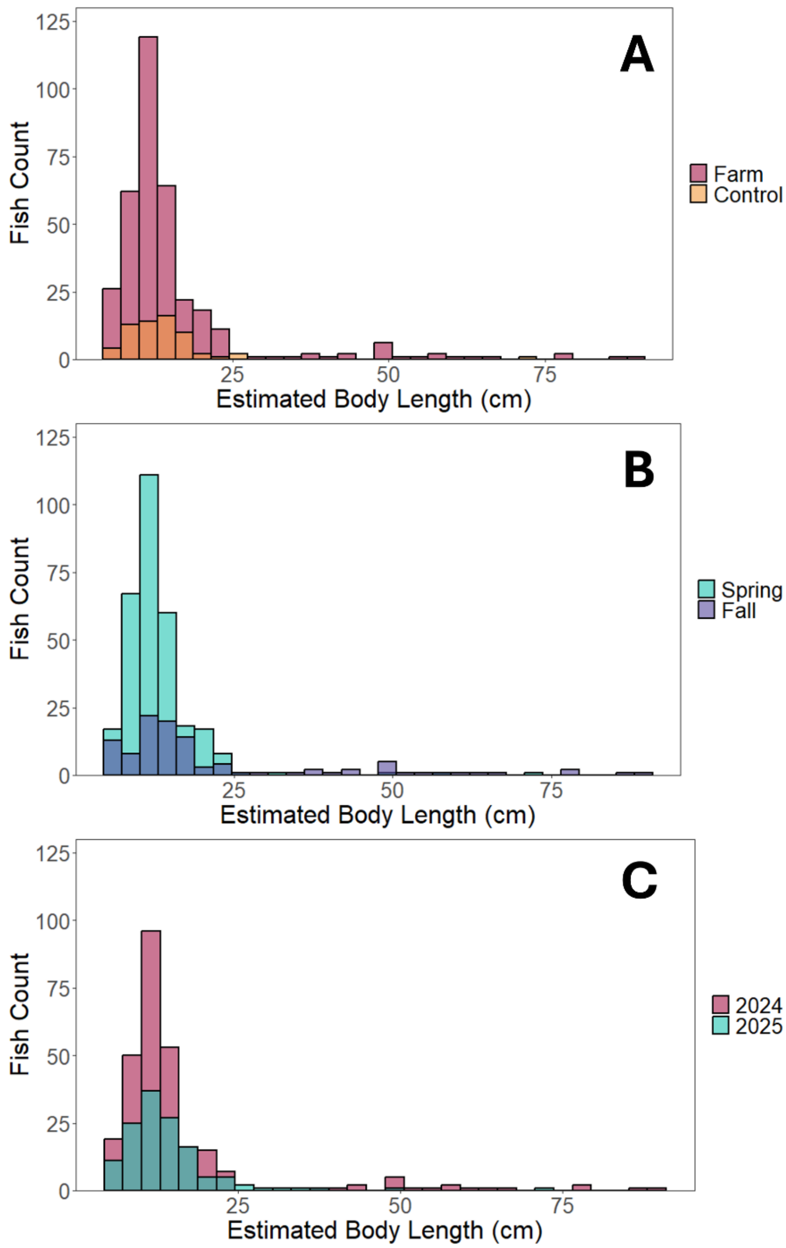

Figure 8. Frequency distributions of estimated body length for fish observed at farms A) in comparison to control sites, B) in spring and fall, and C) in 2024 and 2025.

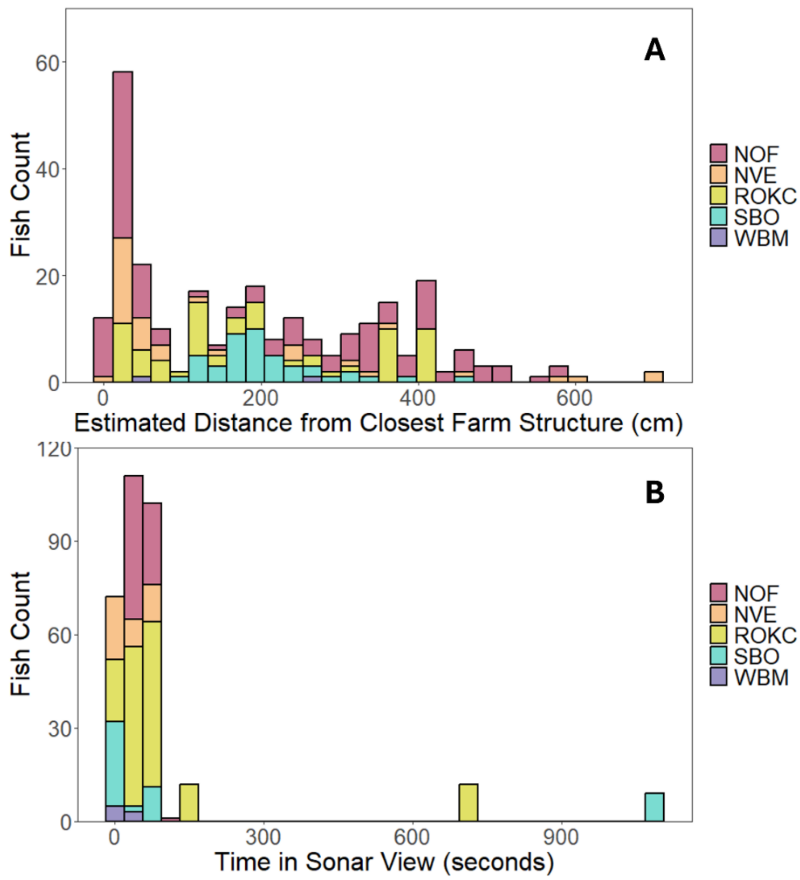

Figure 9. Frequency distributions of A) estimated distance of observed fish from the closest farm structure and B) the amount of time observed fish spent within view of the sonar.

Fish encounter data for 2024 and 2025 were assessed using a size-spectra analysis as described in Olsen et al. (2023). This analysis offers a means to describe fish community structure when identification of fish species is difficult or not possible. Body sizes and abundances are used to produce spectra from linear regressions of log-transformed counts which are centered on the midpoint of total length bins. The slope of the resulting regression represents size structure of the observed fish with negative slopes indicating a greater abundance of small fish. A positive slope indicates a greater abundance of larger fish, indicative of higher predation risk in the observed habitat. The size spectra analysis (Figure 10) indicated that the assemblage of fish observed for farms during the fall was represented by smaller fish species and a lower risk of predation. With the addition of 2025 data, this pattern is also seen in the spring but is primarily represented by fish encounters at the NVE farm site (Figure 10A). The negative slope of the regressions is primarily driven by the fish encountered in 2024, which was substantially higher than in 2025 (Figure 10B).

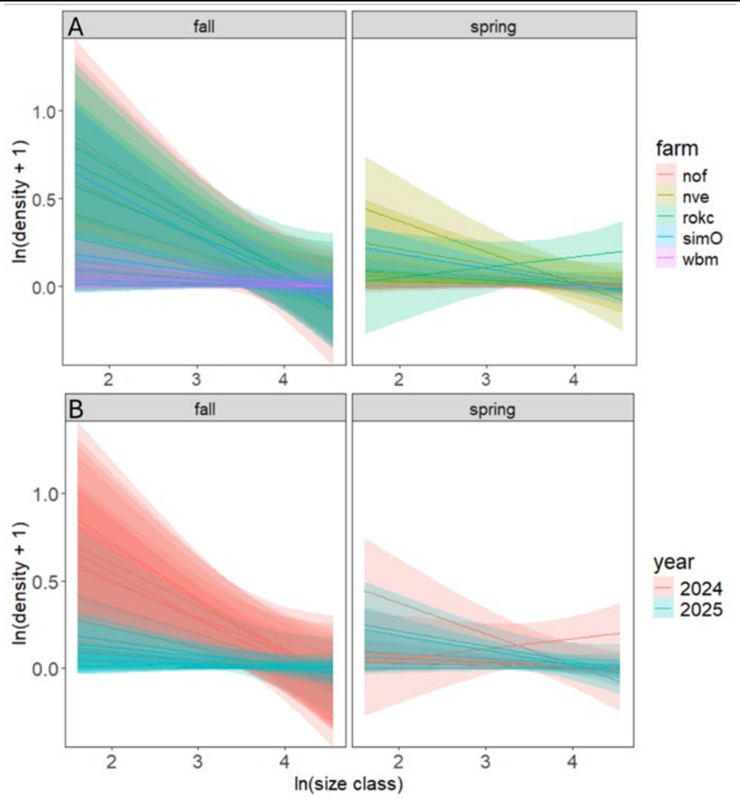

Figure 10 . Size Spectra Analysis of the distribution of individual fish body lengths colored by A) farm and B) year in the fall and spring. Data was collected at five farms in Prince William Sound, AK including Noble Ocean Farms (NOF), Native Village of Eyak (NVE), Royal Ocean Kelp Company (ROKC), Simpson Bay Oyster Farm (SBO), and Wild Blue Mariculture (WBM).

We hired a post-doc, Angela Korabik, in April 2025 to lead the EcoPath modelling and data synthesis efforts. Progress in EcoPath modelling and data synthesis efforts was delayed this year due to an extended personal leave of absence of supervisor Cypher during the Fall of 2025. During Cypher's leave of absence, Korabik was fully focused on running the Prince William Sound Science Center's commercial kelp hatchery, which is responsible for providing kelp seed string to farmers in the Cordova region, including Noble Ocean Farms, Royal Ocean Kelp Company, and Wild Blue Mariculture. Korabik met with Mar ReCon PIs to assess data availability and status of each project component to inform modeling and data synthesis approaches. Korabik is currently in the process of assessing the data available and creating an analysis plan for carrying capacity assessment and other synthesis and forecasting efforts. Korabik met with Gulf Watch Alaska researchers to learn about existing EcoPath models for Prince William Sound. These Gulf Watch Alaska researchers agreed to collaborate with Korabik and provide access to long-term existing data so that Korabik may expand existing EcoPath models and data to include the Mar ReCon project data.

Component 2D: Mariculture with Biological Communities, Marine Birds

PI Schaefer conducted marine bird and mammal surveys in eastern Prince William Sound in March, May, July, and November as planned. Surveys were conducted from the PWSSC research vessel, M/V *New Wave*, in three bays with varying levels of mariculture development. Simpson Bay has the highest level of mariculture development, with numerous kelp and oyster farms currently operating. Sheep Bay has an intermediate level of mariculture development, with one research farm (kelp) currently in operation. St. Matthews Bay has the lowest level of mariculture development, with no farms currently operating and no pending leases or permits.

We now have over three years of marine bird and marine mammal observations within these bays (November 2022-November 2025) as part of the Mar ReCon project. In all survey months, Simpson Bay hosted the highest mean density of marine birds (Figure 11). Within each bay, the highest mean densities of marine birds were observed in May for Simpson and St. Matthews bays, and in November for Sheep Bay. In Simpson Bay, *Brachyramphus* murrelets were the dominant species in the marine bird community across all months (Figure 11). However, grebes were also prominent in March, kittiwakes in May, and large gulls in July. In Sheep and St. Matthews bays, the communities were much more mixed overall, with no overwhelmingly dominant species. The marine bird community across all bays was slightly more diverse in November and March (11 and 10 species groups observed, respectively) compared to May and July (9 and 7 species groups observed, respectively), emphasizing how important these protected, nearshore habitats are for overwintering marine birds.

PI Rehberg and the ADF&G team (leading the Marine Mammal component) conducted 24 marine bird and mammal strip transect surveys at Kodiak Island and Kachemak Bay for 38.8 hours on-effort along 304.5 km during 2025. Data summaries similar to those described above for PWS are underway. Further details focused on marine mammals are discussed below.

In the coming months, we plan to begin formal analysis to examine marine bird distribution relative to mariculture operations. To that end, the Marine Bird and Marine Mammal components have exchanged their independently collected field data sets for their respective analysis, and we have begun compiling a database of farm attributes. All data have been QAQC'd and uploaded to the Research Workspace. Finally, PI Schaefer shared these results during the community outreach event in Homer (January 7, 2026).

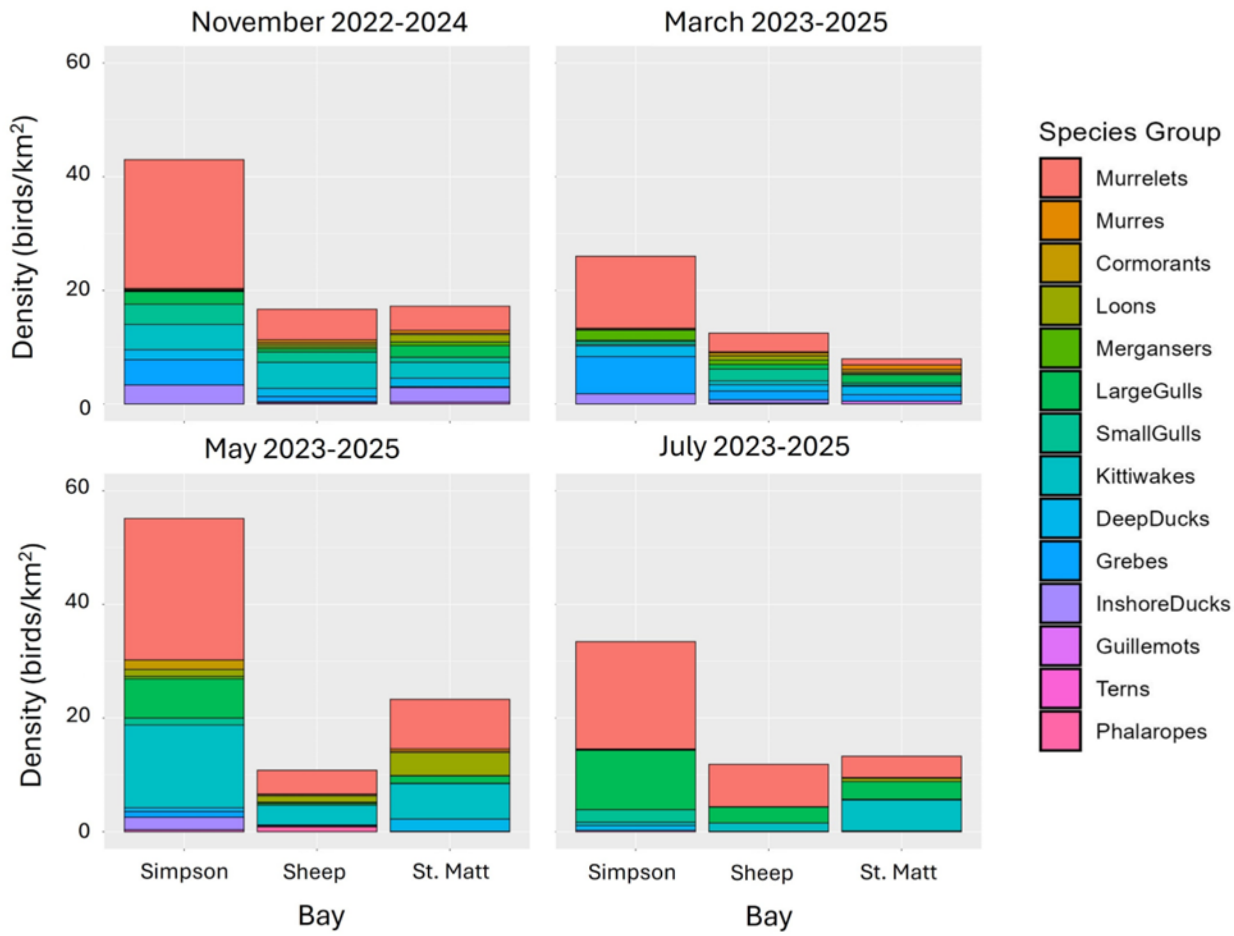

Figure 11. Marine bird community composition recorded during at-sea strip-transect surveys in Prince William Sound, Alaska, November 2022- July 2025.

<u>*Component 2E: Mariculture with Biological Communities, Marine Mammals*</u>

PI Schaefer conducted at-sea strip transect marine bird and mammal surveys in Prince William Sound in March, May, July, and November. The Marine Mammal team led by PI Rehberg conducted 24 marine bird and mammal strip transect surveys in March, May, July, and November at Kodiak Island and Kachemak Bay for 38.8 hours on-effort along 304.5 km during 2025. The team established and maintained remote time-lapse cameras in five farms at Kodiak, Kachemak Bay, and Prince William Sound, and introduced the farmer- and scientist-driven wildlife observations app. An application for a NOAA Fisheries *Letter of Confirmation* permit allowing time-lapse camera deployment near harbor seal haul-outs is in review. PI Rehberg presented the time-lapse camera work to date at the Alaska Marine Science Symposium (January 2026) and will present the camera work and wildlife observations app at the 2026 Alaska Mariculture Conference. All survey data are edited, QAQC'd, documented, and uploaded to the

Research Workspace. A protocol for uploading relevant photo data to the Research Workspace was agreed upon with the Axiom data librarian, and a conversation on best practices for uploading and storing wildlife observation app data is scheduled. The *Marine Mammal Interaction Workshop*, originally scheduled for FY25, is now planned for FY26 to coincide with planning for an amended approach to the 2027-2032 portion of the Mariculture ReCon Project.

Marine Mammal Transect Survey Results: In Kodiak and Kachemak Bay, Northern sea otters were most common marine mammal observed (n=767, Table 1), followed by harbor seals (n=13) and harbor porpoise (n=6). Excepting little-used Monashka Bay, sea otter density (Figures 12, 13, 14) tended to be highest interior to bays, particularly at choke points (e.g., Jakolof Bay) or locations holding kelp beds in eddies (e.g., Eldred Passage, narrows in Kalsin Bay). Because transect surveys are a snapshot in time, with additional years of data collection, regional and seasonal trends may become more apparent. While the highest farm densities along transects were inside Jakolof Bay (oyster farming) and through the narrows in Kalsin Bay (kelp), these results are as-yet unclear whether or not oyster and kelp farm density affect sea otter distribution. Among sea otter observations, 30 individuals were observed swimming or foraging inside kelp and oyster farms. One female, observed on survey resting supine on an oyster cage, was reported by farmer two days later with a freshly birthed pup swimming in the farm. In Prince William sound, sea otters were the most frequently observed marine mammal, followed by harbor seals (Table 2). Other marine mammals, including harbor seals, harbor porpoise, humpback whales and orca (Figure 15), occurred sporadically along transects and conclusions from limited distributions may be difficult to draw.

Table 1. Marine mammal observations on Kodiak and Kachemak Bay transects during 2025, indicating total count of individuals per survey and the number of encounters (individual observation events with ≥1 individual).

		Individuals Counted (Number of Encounters)			
Taxon[1]	Transect	November	March	May	July
N. sea otter	Kalsin Bay	17(16)	74(29)	69(13)	114(20)
	Near Island	2(1)	22(14)	11(10)	7(3)
	Monashka Bay	4(4)	6(6)	3(3)	4(3)
	Jakolof Bay	50(28)	62(28)	31(20)	16(15)
	Little Tutka Bay	56(22)	6(5)	89(14)	57(13)
	Peterson Bay	23(15)	34(19)	7(7)	3(3)
Harbor Seal	Kalsin Bay		1(1)		1(1)
	Near Island	2(2)			
	Monashka Bay	2(2)			1(1)
	Jakolof Bay				1(1)
	Little Tutka Bay			1(1)	2(2)
	Peterson Bay				2(2)
Harbor Porpoise	Kalsin Bay				
	Near Island				
	Monashka Bay				
	Jakolof Bay				3(3)
	Little Tutka Bay				2(2)
	Peterson Bay				1(1)

[1] Other mammal observations on-transect were rare: humpback whale, Peterson Bay, November, 1(1), unknown whale, Near Island, March, 1(1), Steller sea lion, Monashka Bay, March, 1(1). Additionally, sightings made on-transect but off-effort included orca, Jakolof Bay, May, 3(1), and harbor porpoise, Peterson Bay, May, 1(1).

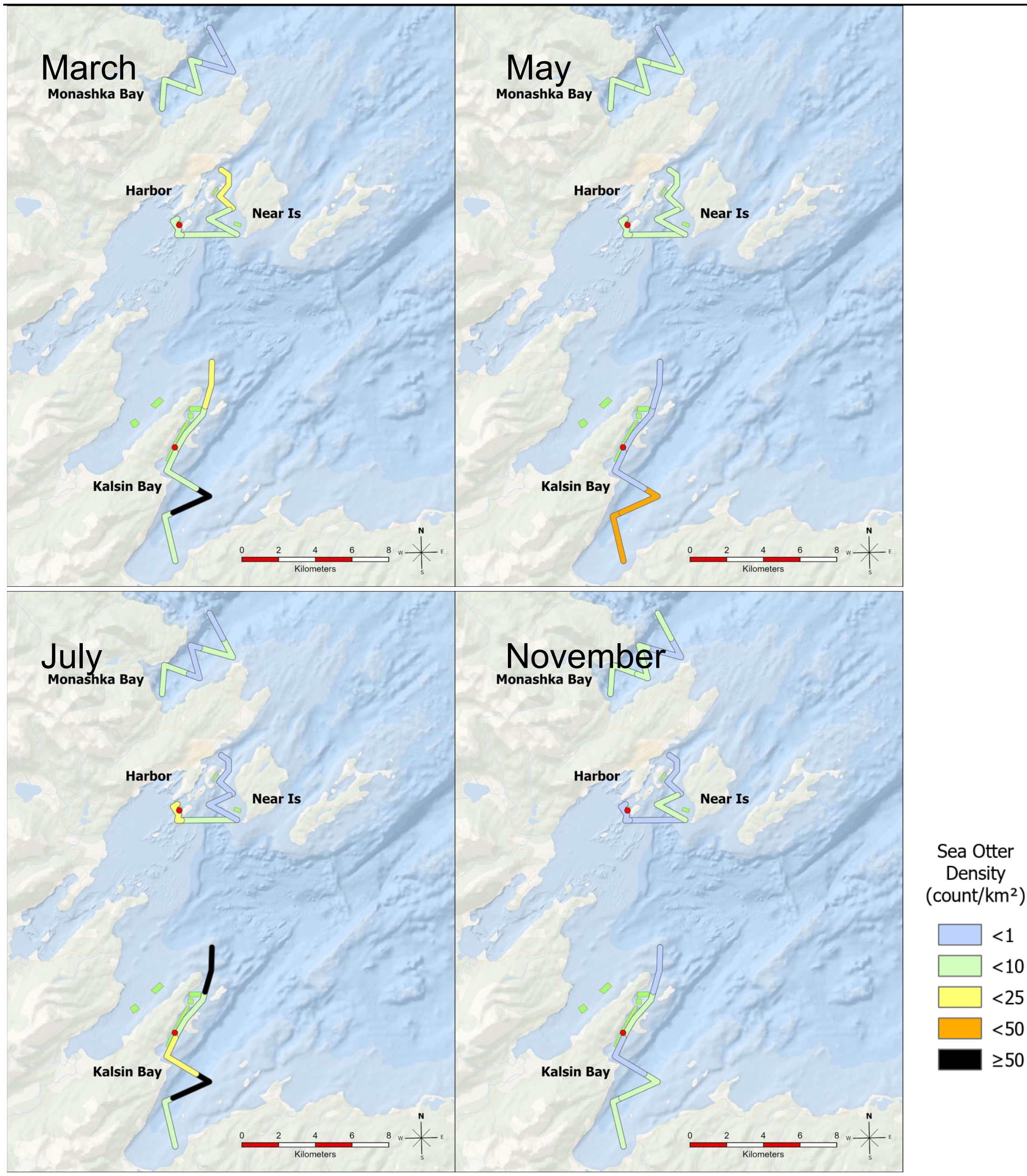

Figure 12. Northern sea otter density (individuals/km^2) along transects near Kodiak Island, March, May, July, and November 2025.

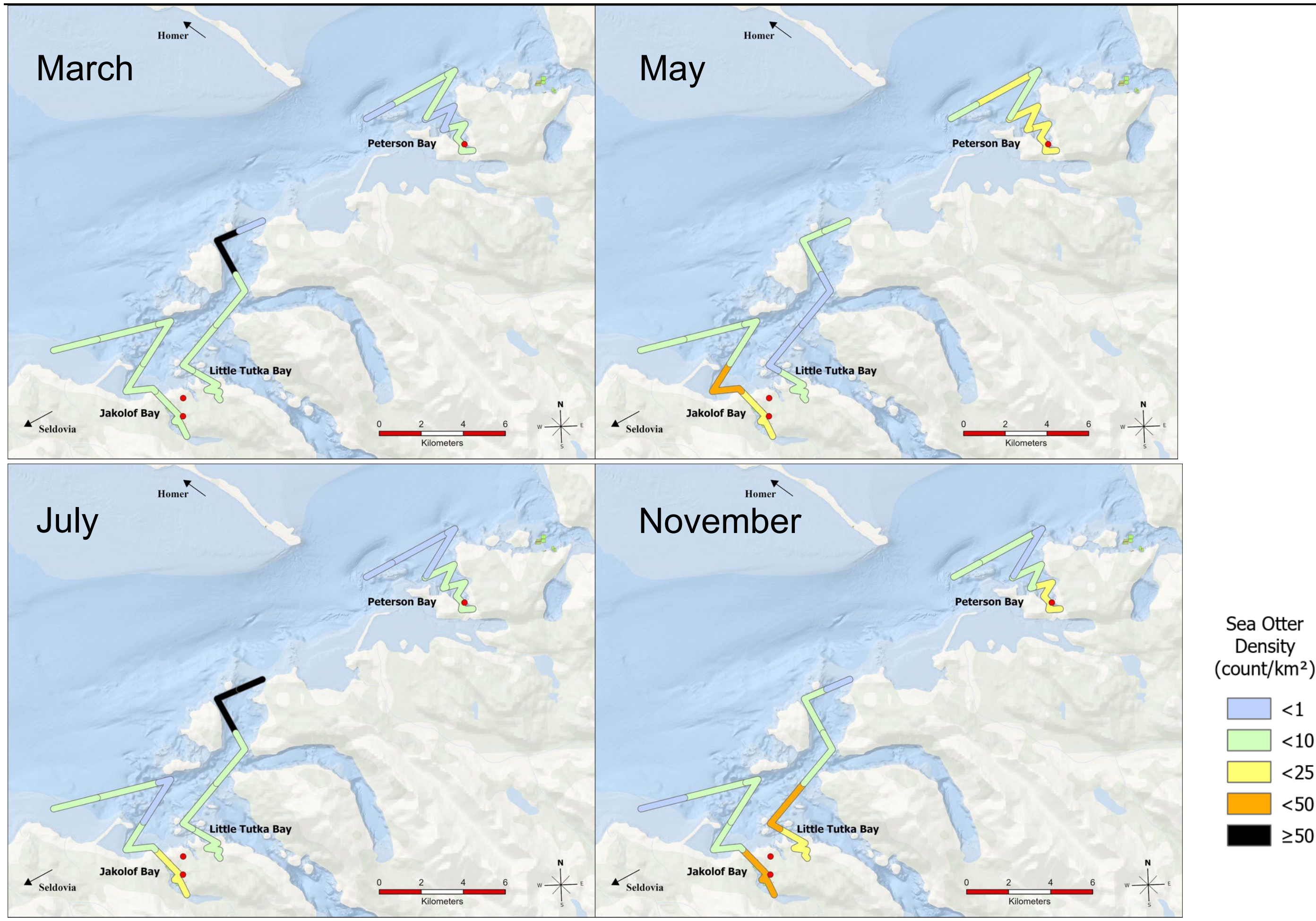

Figure 13. Northern sea otter density (individuals/km^2) along transects in Kachemak Bay, March, May, July, and November 2025.

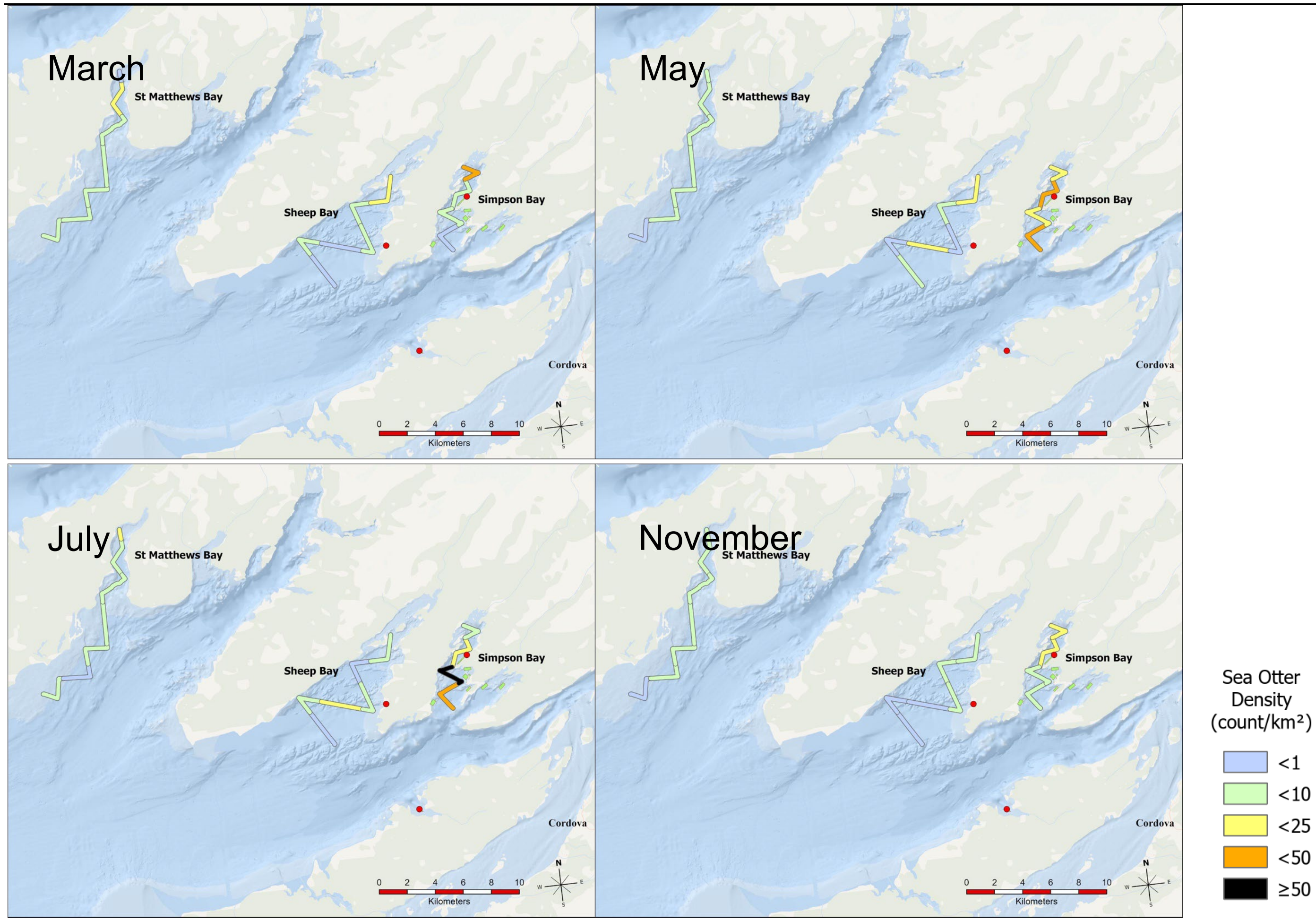

Figure 14. Northern sea otter density (individuals/km²) along transects in Prince William Sound, March, May, July, and Nov. 2025.

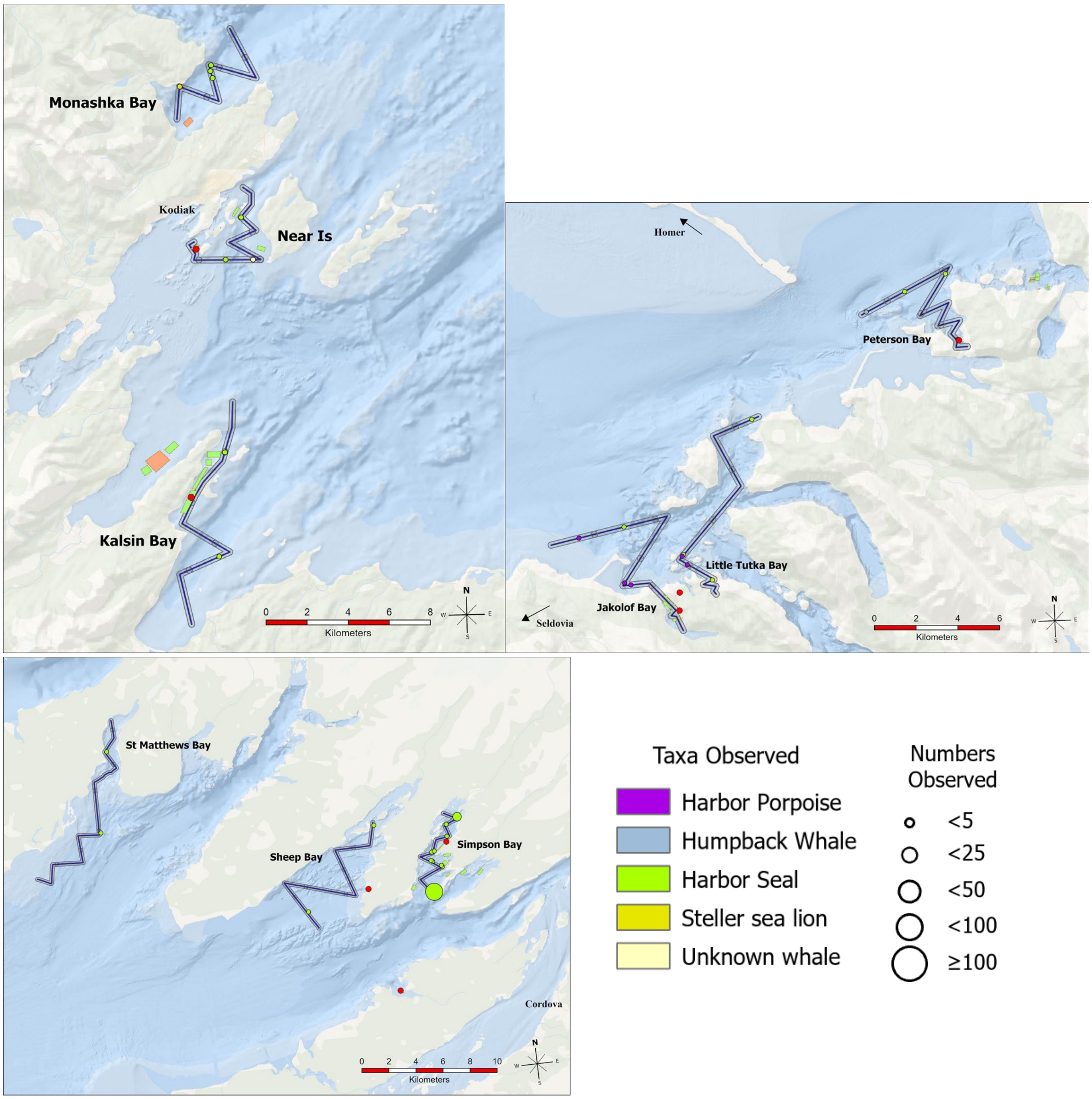

Figure 15. Marine mammal sighting locations (excepting sea otters) during March, May, July, and November 2025 transect surveys combined off Kodiak Island, in Kachemak Bay and in Prince William Sound. Individual observations are indicated by shaded symbols and size indicates count during that observation event.

Table 2. Count of marine mammals observed within the 300 m strip during Mar ReCon Surveys, November 2022 – July 2025, Prince William Sound, AK. Blank spaces indicate no observation of that species during the survey.

Species	Year	November	March	May	July
Harbor Seal	2022	4	--	--	--
	2023	7	2	2	2
	2024	6	3		5
	2025	**	1	21	1
Humpback Whale	2022				
	2023			1	
	2024				
	2025	**		1	
Killer Whale	2022				
	2023				4
	2024				
	2025	**			
Sea Otter	2022	51			
	2023	47	37	47	67
	2024	35	30	66	72
	2025	**	46	99	110

-- No surveys occurred
**Data summary not yet completed

Time-Lapse Camera Monitoring: The Marine Mammal component installed 12 time-lapse cameras (Figure 16) at farms in Near Island, Jakolof Bay, Peterson Bay, Simpson Bay, and Sheep Bay between August and October 2025. One farmer at Windy Bay requested an installation at their location, which will occur spring 2026. While each site has >1 camera installed, only one camera will provide the data of record with additional camera(s) serving as running backups. One camera at each farm, where available, is linked by commercial cell network providing imagery to researchers and farmers remotely, on-demand. At each maintenance visit, cameras are checked, memory cards are swapped, and backup batteries are replaced so the cameras continue operating after departure.

Cameras were initially programmed to record four "image events" per hour, consisting of 5 still-photos and one 60-second video clip each. This intentionally high-frequency sampling was intended to provide a baseline of data and has been analyzed to determine the minimal set of photos and video required to adequately capture the presence-absence of marine wildlife at mariculture farms. Human observers have the advantage of context and time when observing and identifying marine mammals that individual still images do not possess. Thus, video capture was enabled after each imagery event to determine whether it could salvage an otherwise unusable still image where mammal presence appears possible (e.g., water disturbance) but identification is not. These first deployment periods informed our expectations for the quality (Figure 17) and frequency (Table 3) of mammal observations. This imagery schedule exceeded the capacity of the internal 1 Tb SD memory cards installed, despite manufacturer advice and our own calculations showing sufficient space. Operation during darkness also exceeded battery and solar panel capacity to retain sufficient charge within several weeks of winter solstice, due to the power demand of the camera's internal IR spotlight. Very few verifiable wildlife observations have been made in darkness regardless. Based on our realized data from the first few months of deployments, and the storage and power demands of our programming scheme, we have implemented changes to all cameras on our next visits (during March 2026 transect surveys): eliminating night operation, reducing 4 image events per hour to 2 image events per hour, and daisy-chaining additional solar cells to better sustain power around winter solstice.

To improve analysis time, we are studying AI approaches after discussions with other practitioners using AI-aided analysis with these cameras (California Department of Fish and Wildlife, ADF&G) and other AI imagery efforts (PWSSC). Our goal for AI-aided imagery analysis is to reduce the set of images demanding human review by flagging photos that contain unusual objects not otherwise explained by pre-existing infrastructure (e.g., farm buoys, docks, boats). This is among the first deployments of this type of camera to identify mammals by taxon in the water in a marine environment, and accounting for the fact the substrate is constantly in motion is a key difference from more typical terrestrial applications (see video [Time-Lapse of a Peterson Bay Farm]). Other issues related to working in this environment including variable installation methods, corrosion, and storm protection, are more tractable and often solved with assistance of project farmers. ADF&G technicians are presently fabricating improved aluminum tripod mounting rigs to better attach cameras to existing buoys at farms.

Table 3. Positive identifications of marine mammals using three cameras deployed at Peterson Bay. Cameras were programmed to sample 4 times per hour 24 hours per day, using infrared spotlights in darkness. Image resolution is 4k and cameras observe the farm from a 12 m height at 50 m horizontal distance.

Camera ID	Dates Sampled	N images collected	N images flagged	Positive identifications: Count (proportion of all images)
CAM01-NC	11-18 Oct 2025	3,500	172	8 (4.5%)
CAM02-NC	11-14 Oct 2025	1,245	128	19 (15%)
CAM01-C	11 Oct - 3 Nov 2025	12,901	623	55 (9%)

A NOAA Fisheries *Letter of Conformation* permit is in review to permit installation of these cameras at harbor seal haul-outs in the Kodiak Island and Kachemak Bay study regions to track haul-out occupancy season-over-season. Upon permit issuance, camera installation will be made during FY26. Unlike camera data collected at farms, the cameras will be used for raw counts of a single species using established ADF&G protocols, using single hourly images.

Figure 16. In-use image of Reconyx, Inc. 4k UHD camera (left photo, facing left) and combination solar cell - 105 mAh gel cell battery (top of buoy) installed on an existing buoy at a farm. Cameras are programmed by SD card and sighted on the farm in the field (center photo). Cameras in Jakolof Bay (right) require a larger 50 Ah deep cycle battery due to lack of sunlight.

Figure 17. Time-lapse still photo-identification of Steller sea lions (left) and northern sea otters (center) using manual review to fine-tune camera programming. Video flagged by a simple, experimental audio-spike detection algorithm (right) revealed sea otters.

Farmer-Collected Wildlife Observations: The Marine Mammal component launched a *Marine Wildlife Observations* app to better structure and encourage the previously anecdotal and post-hoc reporting of marine wildlife interactions with mariculture farms. This is intended to be a practical way to integrate science into daily farm operations while advancing shared stewardship of Alaska's coastal waters. Using a set of known wildlife interaction types and wildlife species previously identified by farmers in their mandated annual permit reporting and a statewide online survey of wildlife interactions by ADF&G, we produced an app to record wildlife interactions and the aftermath of wildlife interactions in the moment and on location as they are observed. By structuring this data collection using a location- and time-aware app, with standardized responses, we hope to better solve the problem of incidental sightings by providing some measure of observer effort and a central, QAQC'd database of responses. Since rollout at the

2026 Mar ReCon PI meeting, three farmers have recorded test data using the system. We anticipate more usage as the 2026 production season begins.

The database is hosted on the ADF&G ArcGIS Online server and maintained by the Marine Mammal component staff. Accommodations to the difficulty of fitting in wildlife observations to farm or other scientific operations include a time- and location-linked "voice memo" feature for when there is no opportunity to fill out the app form, and the ability for the app to work completely off grid and automatically upload its results at a later time.

This app will be demonstrated at the 2026 Alaska Mariculture Conference (presentation *"The Other Harvest: Mariculture Farmers as Marine Wildlife Monitors"*) to encourage wider evaluation, feedback, and use for this tool. We produced training materials for the wildlife observations work, available to farmers and researchers online: the presentation *Reporting Wildlife at Mariculture Operations* and a *Kachemak Bay Marine Mammal Identification Guide*. The app is available for testing by downloading *Survey 123* from an app store and then scanning this QR code.

Component 3A: Drivers of Regional Variation in Production

We established regional liaisons (as described in Component 1) to streamline communications between farmers and researchers, allowing kelp and oyster collection to take place smoothly. Members of the team led by PI Eckert helped farmers sample kelp and oysters when in town for fieldwork, facilitated shipping of tissue samples, and aided in maintaining the production array, kelp grow lines, and oyster cages. Environmental data collection is described above in Component 1.

The kelp production team led by co-PI Umanzor worked directly with farmers to deploy kelp seed for the 2025–2026 growing season and to collect water samples for analyses of nitrogen, phosphorus, and silicate. Water sampling was conducted at least monthly from January through December 31, 2025. More than 500 samples were processed in 2025, with an additional 100 samples currently in the analytical queue. All data will be uploaded to the project repository upon completion of sample processing. In preparation for the upcoming pre-harvest and harvest season, expected to begin in March 2026, the team assembled all tissue and water sampling kits. In addition, independent kelp performance reports were prepared and shared with each participating farmer.

The oyster production team led by co-PI Hollarsmith sampled 120 oysters at each of the nine production arrays in March, June, and September 2025 (T2-T4). We collected data on oyster morphometrics including length, width, depth, whole weight, and meat weight. Oysters were further subsampled and prepped for fatty acid, energy density, and isotope analysis. Oysters were analyzed for fatty acid, energy density, and isotopes up to the March 2025 (T2) time point. June 2025 (T3) oysters are in the process of being analyzed. The larger "subadult" oysters were sampled down and used in gonad conditioning experiments, described below. The smaller "seed" oysters were thinned by splitting them from 3 bags to 6 bags to reduce risk of overcrowding as they grew.

Initial data analysis efforts were made to understand variation in growth across farms and relate that to available environmental data. All farms saw a large increase in meat weight from June to September 2025, signifying a productive second growing season across all regions (Figure 18). Mortality remained low. Differences in shell shape and size were observed at more exposed sites and thus are potentially driven more by exposure than water column temperature, salinity, or chlorophyll. Data analysis structures were determined that include chlorophyll-a, and temperature and salinity using a degree-day approach and will be implemented once data collection is complete in 2026.

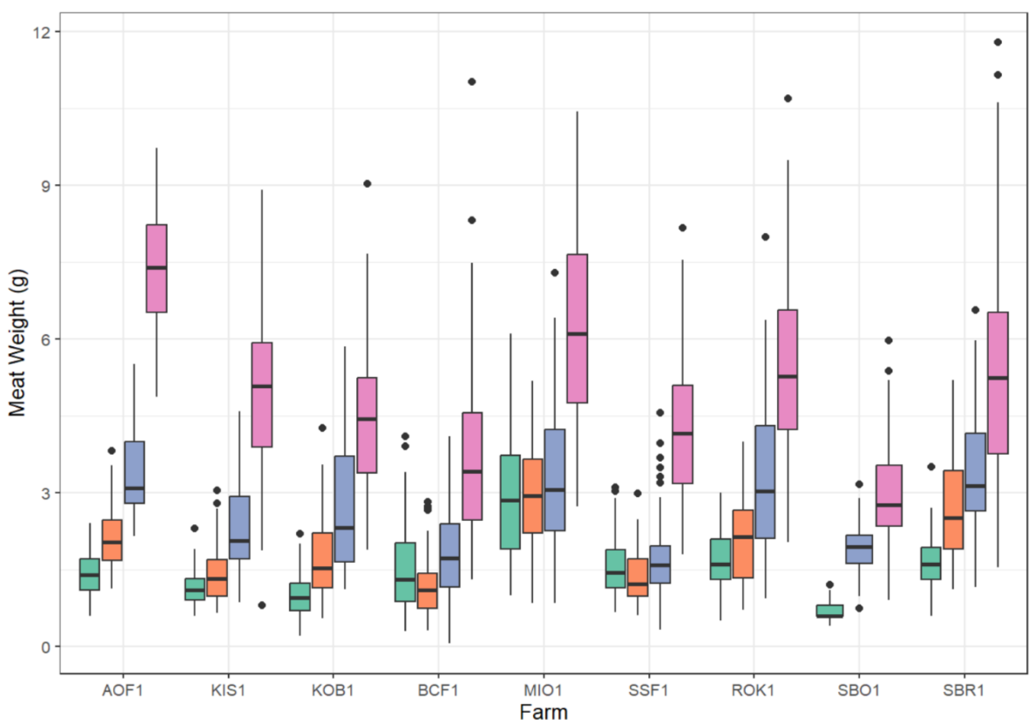

Figure 18. Meat weight (g) at the Mar ReCon experimental arrays across sampling events (Fall 2024 in green, Spring 2025 in orange, Summer 2025 in blue, and Fall 2025 in pink). The horizontal line indicates the median, the upper and lower bounds of the box the 25th and 75th percentiles, the vertical lines the minimum and maximum values, excluding outliers, and the points as potential outliers.

As glacial silt is a potentially important environmental factor that varies across the tested region, we conducted experiments assessing oyster response to concentrations of glacial silt observed in coastal waters in the spill zone. We found that the levels tested (0.1 g L^{-1} and 0.2 g L^{-1}) had no significant impact on oyster growth, survival, condition index, or feeding efficiency. This suggests that the turbidity from glacial runoff is likely not responsible for variation in oyster performance and that these regions are suitable for oyster production.

We conducted a survey of shell boring worms (Annelida: Spionidae) in all sampled oysters in September 2025. Shell-boring worms are shellfish parasites that burrow into bivalve shells, creating "mud blisters" that can reduce oyster marketability on the half-shell market. We visually screened the oysters for worms, measuring worm prevalence (proportion of oysters with detectable worms) and intensity (number of worms per infected oyster). While worm prevalence varied widely across regions and farms (Figure 19A), intensity was modest at all farm sites: only one farm exceeded an average of 2 worms per infected oyster, and no farms exceeded an average of 3.5 worms per infected oyster (Figure 19B). To assess whether worm infestation could have negative effects on oyster growth, we compared our infection results with morphometric data, finding no significant correlation between prevalence and meat weight (Wald $\chi2 = 0.732$, df = 1, p = 0.392; Figure 20A). However, we found a small but significant negative correlation between the number of worms per oyster and meat weight ($\beta = -0.032$, SE = 0.014; Wald $\chi2 = 4.88$, df = 1, p = 0.027; Figure 20B). These results suggest that while shell-boring worms could harm oyster growth when infection loads are high, high infection loads are rare in southcentral Alaskan oyster farms, so shell-boring worms are currently unlikely to be a major industry concern in this region.

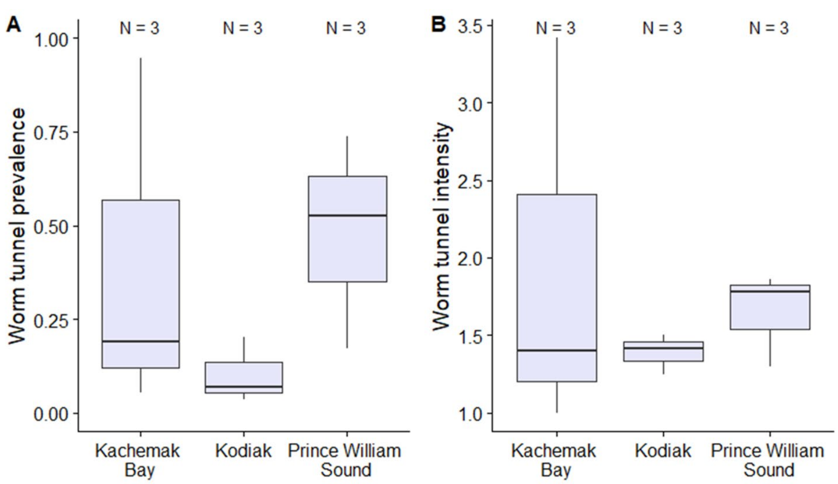

Figure 19. Worm A) prevalence (proportion of oysters with detectable worms) and B) intensity (average number of worms per infected oyster) across farms sampled in Kachemak Bay, Kodiak Island, and Prince William Sound in September 2025. N=3 farms per region; N=60 oysters per farm.

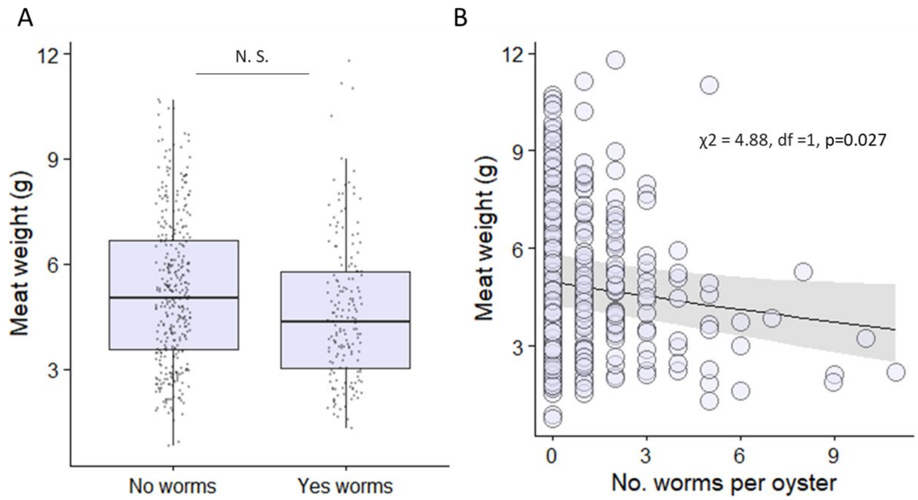

Figure 20. A) There was no significant relationship between worm prevalence and meat weight. B) There was a small but significant negative relationship between worm intensity (number of worms per oyster) and meat weight. Trendline represents GLMM model predictions and the shaded area represents the 95% confidence interval. Each point represents one oyster; N=60 oysters per farm.

Seaweed contaminants: Heavy metal testing was conducted on wild samples collected in Kodiak in 2024, including analysis for arsenic and lead. In 2025, both farmed and regional wild samples were collected and analyzed for arsenic, cadmium, lead, and mercury. Laboratory results are currently pending and will be uploaded upon receipt. Continued contaminant monitoring at both farm and control sites is planned for 2026.

Component 3B: Oyster Selective Breeding

During this reporting period, the oyster team hired a hatchery manager (Spencer Lunda, UAF). In 2025 we completed the build of the Mariculture Research Hatchery (MRH) at the NOAA Ted Stevens Marine Research Institute in Juneau, AK and obtained the necessary research and commercial permits to conduct oyster reproduction and hatchery experiments. Updates to the MRH include scaled up microalgae production (8 x 250L Pure Biomass photobioreactors), installation of a seawater heat pump capable of producing high volume heated seawater at 20°C for broodstock conditioning or 25°C for larval culturing, and upwellers for cultivating spat (Figure 21).

Figure 21. From left: Pure Biomass photobioreactors, bottle upweller system for spat cultivation, larval rearing tanks.

In collaboration with UAF and Texas A&M - Corpus Christi, we assessed the gonadal development of oysters grown in the spill area. At the beginning of the experiment, the gonads in the sampled oysters were predominately male or undifferentiated and had no ripe gametes. After four weeks of immersion in 20°C water with ample food, 52% were female and 79% of females had ripe eggs (Figure 22). All males sampled at four weeks ($n = 21$) had sperm with high motility. These results suggest that oysters from the spill zone can be used as broodstock in hatchery efforts. Based on these pilot studies and the infrastructure completed in 2025, we are now able to conduct multiple spawns of oysters sampled from the Mar ReCon farms in 2026, towards our selective breeding goals.

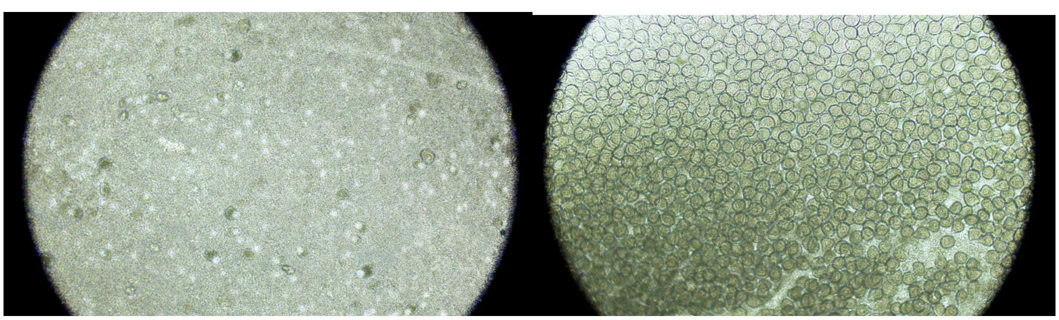

Figure 22. Gonad quality at time of sampling from a Prince William Sound farm, indicating poor egg development and low egg abundance (left); gonad quality after four weeks of conditioning, showing abundant ripe eggs (right).

In collaboration with Pacific Hybreed, a selective breeding company based in Manchester, WA, we continued data collection (survival and family yield) on two cohorts of oysters outplanted in spring 2024 and 2025 that were selectively bred using a hybridization approach. Major differences in oyster family performance were detected suggesting a strong genetic component to oyster growth in Alaska. Data are still being collected, and an additional cohort will be outplanted in 2026.

To further assess the performance of selectively bred oysters in Alaska, we partnered with the USDA to outplant Pacific oysters from the Miyagi Prefecture produced in the USDA hatchery to assess variation in growth. After collecting initial morphometric data in June 2025, oysters were deployed to six of the nine farms in the spill area. In September 2025, 60 oysters were subsampled from each of the participating farms for length, width, depth, whole weight, and meat weight. Data collection will continue in 2026.

Component 3C: Kelp Farming Method Development

During this reporting period, the kelp team conducted a comprehensive assessment of the relationship between kelp seeding density on spools and biomass yield at harvest. This assessment evaluated sporophyte density and length at the time of deployment in relation to harvest performance metrics, including density per meter, blade morphometrics, and yield per meter. The objective was to quantify the influence of seeding practices on farm-scale performance. Analyses were completed for the 2024–2025 growing season, and initial measurements were collected for the 2025–2026 season. In addition, the team completed and published all analyses examining the effects of line spacing on kelp phenotype and yield (Umanzor et al. 2025). Finally, a physiological assessment of juvenile sporophytes from all three study regions was completed under hatchery, deployment, and harvest conditions, with the goal of identifying region-specific physiological differences in sugar kelp.

Component 4: Economic Feasibility Analysis

Industry and Technical Committees were formed in 2025 to guide the economic feasibility analysis. The Industry Advisory Committee identified four oyster seed supply scenarios for cost–benefit comparison: the status quo (purchasing seed from outside Alaska), a purpose-built permanent stand-alone hatchery, a barge-based hatchery operated by the university, and a modular containerized hatchery. Operational and cost data were collected, and a preliminary bioeconomic model was developed for the containerized hatchery system. During this process, the co-PIs and Technical Committee recognized that while hatchery models can be constructed in a theoretical framework, there is insufficient real-world operational experience within the group to generate results and recommendations for the mariculture community, policymakers, and potential investors with a high degree of confidence. As of this writing, Fong and Provan Crump, former hatchery manager for Hawaiian Shellfish and a consultant specializing in hatchery construction and start-up, are in communication to provide technical consultation and support the development of practical, stakeholder-relevant outcomes.

Component 5: Product Development

Our extensive efforts to hire a UAF Faculty Product Development Specialist were not successful, because of the limited number of specialists in this field. We are working on a scope and budget revision to redirect the funds for this position to work with Marine Biologics on a contractual basis. We continue to support product development through direct business consultation and support for the mariculture industry.

Direct business consultation and technical support for the mariculture industry remained a primary focus of the product development component. Chris Sannito provided one-on-one consultations to 12 Alaskan mariculture businesses regarding products under development for commercial sale. Technical services at the Kodiak Seafood and Marine Science Center included shelf-stability testing for a new commercial food product, the evaluation of two shelf-stable kelp-based products, and the launch of a six-month shelf-life study for dry salted kelp for a Homer-based firm. Furthermore, we provided critical safety guidance to PWSSC Cordova regarding optimal temperature schedules for drying kelp. Over the past year, our team advanced workforce expertise through the delivery of five specialized training workshops. We conducted three Hazard Analysis Critical Control Point (HACCP) Segment 2 classes and one Better Processing Control class, resulting in full certification for all 20 participants. Additionally, we hosted an Ammonia Refrigeration Assistant Operator workshop to support technical safety in processing facilities.

On a strategic level, the team continues to conduct comprehensive literature reviews and engage with professionals across the food and seafood value-adding chains to better understand the profitability of farmed seaweed and shellfish. These efforts have led to a productive partnership with Marine Biologics, which is currently conducting a statewide seaweed tissue analysis project. We are actively working with them on a proposal to develop novel mariculture products. Our expertise was also recognized on a national scale, as Alaska Sea Grant served as a primary reviewer for the "Seaweed Food Safety Guidance" publication and provided expert guidance on an oyster model HACCP plan for an upcoming Pacific oyster guidebook.

Component 6: Outreach

During this reporting period, Alaska Sea Grant engaged in a suite of outreach and technical assistance efforts. Project updates and research findings were systematically disseminated through the Alaska Mariculture Research and Training Center (AMRTC) website, newsletters, and social media platforms. A primary focus this year was bridging the gap between scientific research and industry application by integrating Mar ReCon data into educational tools, workshops, and stakeholder engagements.

Throughout the year, Alaska Sea Grant represented Alaskan mariculture interests at local, national, and international forums:

- Mariculture Conference of Alaska 2025: Shared project overviews and research components (February 18–20).
- Aquaculture America 2025: Good, Crimp, and partner farmer Nick Mangini presented on the collaborative nature of Mar ReCon at the world's largest aquaculture conference in New Orleans (March 11).
- ComFish 2025: Hosted an informational booth and presented on mariculture workforce development (April 15–17).

- Updates were shared via: Bristol Bay Lunch and Learn, the Alaska Food Festival and Conference, the CORaL Network annual meeting, and the PWS Regional Citizens' Advisory Council Science Night.
- International Seaweed Knowledge Exchange: Good hosted a Scottish delegation in Kodiak for five days of site visits and networking to foster global collaboration on seaweed cultivation and processing.
- Mar ReCon Annual Meeting (Homer): Hosted researchers, farmers, and partners from January 6-8 to share results across project components, coordinate upcoming activities and refine strategies to support industry needs.

Industry training and technical assistance efforts focused on equipping farmers with practical skills and ensuring the safety of Alaskan seafood:

- Kelp Farm Operations (Training of the Trainers): An immersive workshop in April provided participants with "kelp farm in a box" kits and the pedagogical skills to train others in their home regions.
- Business Planning for Kelp Farms: Developed economic tools and hosted a virtual workshop to assist farmers in strategic financial planning.
- Food Safety & Monitoring: Staff provided intensive technical training in Ketchikan and Kodiak for monitoring *Alexandrium catanella* (PSP).
- Contributed to national safety standards by reviewing the "Seaweed Food Safety Guidance" and developing a model HACCP plan for Pacific oysters.
- Interstate Farmer Exchange: In August, Alaska Sea Grant and Washington Sea Grant led an exchange across Puget Sound and Hood Canal, allowing farmers to visit hatcheries and processing facilities while discussing the Mar ReCon collaborative model.

To increase industry visibility and stakeholder knowledge, several media projects were launched:

- "Know Your Farmer" & "AMRTC Salty Interview Sessions": Launched new video series on Instagram, Facebook, and LinkedIn. Featured farmers include Seawan Gehlbach (Simpson Bay Oyster Co.), Sean Crosby (Moss Island), and Lindsay Olsen (Spinnaker Sea Farms).
- Mar ReCon Video Series: Production has officially begun on a dedicated series showcasing all project components, with a launch expected in the next reporting cycle.
- Alaska Oyster Grower's Manual: A Mariculture Fellow is currently leading a year-long update to this foundational manual, incorporating new data and farmer interviews to reflect modern best practices.

Community Engagement

- Kodiak Kelp Festival: A six-day community celebration in June featuring educational sessions on seaweed harvesting and cultivation, local food showcases, and arts, highlighting the cultural and economic importance of the kelp industry.
- Homer Outreach Event: Mar ReCon researchers and farmers hosted community members on a public radio show during the day and at the Islands and Oceans Visitors session at night to share information about mariculture, marine ecosystems and the Mar ReCon project.

In Q3 2025, the management team opened the planned application period to existing partner farms. Consistent with the original project design, all currently contracted farms were given the opportunity to reaffirm their interest and availability to continue participation for an additional two years. All nine contracted farm partners across the EVOS-affected regions confirmed their commitment to continue. Because the project requires substantial training and coordination between farmers and scientists to ensure consistent sampling protocols, data quality, and successful data uploading procedures, maintaining continuity with the same farm cohort strengthens the integrity of the long-term dataset. Continued monitoring at the same sites increases the value of the work by allowing trends to be interpreted over a longer time period using comparable methods and conditions. Given that all participating farms re-committed during the reapplication period, and because the project was already at capacity based on available funding, the team did not open a new public application cycle for additional farmers this year. We are developing an opportunity to broaden participation to new farmers through a farmer-lite model, in which environmental data will be collected at more sites to better understand environmental variability in the study regions.

Component 7: Administration

During this reporting period, Component team members processed invoices from subawardees. Staff planned and attended the annual Mar ReCon meeting in Homer, January 7-8, 2026. There were 55 attendees who participated in-person and virtually (Figure 23). Component team members submitted the annual EVOSTC report in March 2025 and semi-annual reports to NOAA in July 2025 and January 2026. PWSSC conducted an annual audit, the fieldwork for which was performed in December 2025. This grant is part of the audited financials. Hoffman regularly engaged with other members of the leadership and administration team (Eckert, McKinstry, Huller, Good, Schaefer) in communications and planning about the administrative aspects of the project.

Figure 23. In-person attendees of the annual Mar ReCon meeting in Homer, January 7-8, 2026.

2. Products:

Peer-reviewed publications:

Umanzor, S., A. Meyer, Z. Stamplis, and A. Pryor. 2025. Effect of Line Spacing on Blade Phenotype and Yields of Farmed *Alaria marginata* from Alaska. Phycology, 5(4), 89. https://doi.org/10.3390/phycology5040089.

Haag, J., C. A. Miller, J. Jossart, and A. L. Kelley. 2025. Quantifying farmed kelp atmospheric CO_2 uptake through localized air-sea flux in the Northern Gulf of Alaska. EGUsphere, 2025, 1-29. https://doi.org/10.5194/egusphere-2025-2914.

Haag, J., A. D. Bliese, S. L. Mincks, and A. L. Kelley. 2026. Spatial variability in zooplankton consumption by the Pacific oyster (*Crassostrea gigas*) relative to native bivalves in the Gulf of Alaska. Marine Environmental Research, 107828. https://doi.org/10.1016/j.marenvres.2025.107828.

Reports:

Eckert, G., K. Hoffman, C. McKinstry, and A. Huller. 2025. Sustainable mariculture development for restoration and economic benefit in the EVOS spill area. FY24 Annual Report to the *Exxon Valdez* Oil Spill Trustee Council (project number 24220302).

Hoffman, K. 2025. Sustainable mariculture development for restoration and economic benefit in the EVOS spill area. Semiannual Report to NOAA, July 2025 (project number 25220302).

Hoffman, K. 2025. Sustainable mariculture development for restoration and economic benefit in the EVOS spill area. Semiannual Report to NOAA, January 2026 (project number 25220302).

Popular articles:

Baxter, S., and S. Greene. May 2025. Monitoring Mariculture in the Gulf of Alaska. Environmental Monitor. https://www.fondriest.com/news/monitoring-mariculture-in-the-gulf-of-alaska.htm.

Cypher, A. 2025. There's fish in the sea, folks. Prince William Sound Science Center – Delta Sound Connections.

French, R. 2025. Meet Simpson Bay Oyster Company. Prince William Sound Science Center – Delta Sound Connections.

Good, M. 2025. Mariculture Research and Restoration Consortium annual meeting in Kodiak. Prince William Sound Science Center – Delta Sound Connections.

McKinstry, C. 2025. The mystery of the stunted bull kelp. Prince William Sound Science Center – Delta Sound Connections.

Renta, K., R. Cates, and J. Hollarsmith. 2025. Food sovereignty and mariculture: Current advances in hatcheries. Prince William Sound Science Center – Delta Sound Connections.

Shepard, J. 2026. Mariculture Science Night highlights research in Southcentral Alaska. Homer Independent Press, January 15, 2026. https://homerindependentpress.com/2026/01/15/mariculture-science-night-highlights-research-in-southcentral-alaska/

Whitney, J. 2025. What's on an oyster's menu? Prince William Sound Science Center – Delta Sound Connections.

Conferences and workshops:

Anthony, K., M. and Rehberg. 2026. Using trail cameras to investigate marine mammal occurrence. Alaska Marine Science Symposium, Anchorage, AK, January.

Gomez-Rangel K., J. Hollarsmith,, and K. Bahr. 2025. North Currents: Improving Sustainable Aquaculture in Alaska. Coastal Solutions Symposium, Corpus Christi, TX.

Good, M., and N. Mangini. 2025. Collaborative farmer-scientist efforts in evaluating the impacts of mariculture in Alaska. Aquaculture 2025, New Orleans, LA, March.

Greene, S., J. Crimp, A. Jones, and G. Eckert. 2025. Oceanographic Variability Across Gulf of Alaska Mariculture Sites. Alaska Marine Science Symposium, Anchorage, AK, January.

Greene, S., J. Crimp, A. Jones, and G. Eckert. 2025. Oceanographic Variability Across Gulf of Alaska Mariculture Sites. Alaska Mariculture Conference, Sitka, AK, February.

Greene, S., J. Crimp, A. Jones, and G. Eckert, G. 2025. Oceanographic Variability Across Gulf of Alaska Mariculture Sites. Western Society of Naturalists, San Diego, CA, November.

Haag, J., C. A. Miller, J. Jossart, and A. L. Kelley, A. L. 2025. Quantifying farmed kelp atmospheric CO_2 uptake through localized air-sea flux in the Northern Gulf of Alaska. Alaska Marine Science Symposium, Anchorage, AK, January.

Haag, J., A. D. Bliese, S. L. Mincks, and A. L. Kelley, A. L. 2025. Spatial variability in zooplankton consumption by the Pacific oyster (*Crassostrea gigas*) relative to native bivalves in the Gulf of Alaska. Alaska Mariculture Conference, Sitka, AK, February.

Hollarsmith, J., S. Greene, J. Crimp, and A. Jones. 2025. Environmental influences over summer growth of oyster seed across the GoA. Mariculture Conference of Alaska, Sitka, AK, March.

O'Neil, R., B. Konar, and C. Long 2025. Do Mariculture Activities Influence Sea Otter Prey. Alaska Marine Science Symposium, Anchorage, AK, January.

O'Neil, R., B. Konar, and C. Long. 2025. Do Mariculture Activities Influence Sea Otter Prey. Alaska Mariculture Conference, Sitka, AK, February.

Nicholson, E., and B. Konar. 2025. Oyster Biofouling Communities. Alaska Marine Science Symposium, Anchorage, AK, January.

Nicholson, E., and B. Konar. 2025. Spatial, temporal, and environmental characteristics associated with Alaskan oyster farm biofouling communities. Kachemak Bay Working Group meeting, Remote, November.

Tolman, C., K. Renta, and J. Hollarsmith. 2025. Silt happens: impact of glacial silt on Pacific oyster, Crassostrea gigas, clearance rates and filtration efficiency. Ernest F. Hollings Scholarship Symposium, Silver Spring, MD, July.

Valdes, L. 2025. Regional variation in shell-boring parasites in Alaskan oyster mariculture. Alaska Sea Grant Fellowship Retreat, Fairbanks, AK.

Workshops developed and delivered by Mar ReCon PIs

- Kelp Farm Operations (Training of the Trainers): Kodiak, AK; 6 participants.
- Business Planning for Kelp Farms: Virtual; 19 participants.
- Food Safety & Monitoring – Harmful Algal Bloom Training for Shellfish Farmers: 2 classes offered (Ketchikan and Kodiak); 14 participants.
- Hazard Analysis Critical Control Point (HACCP) Segment 2: 3 classes offered (virtual); 13 participants.
- Better Processing Control: Anchorage, AK; 7 participants.
- Ammonia Refrigeration Assistant Operator workshop: Kodiak, AK; 24 participants.

Public presentations:

Greene, S. January 2026. Oceanographic Variability Across Gulf of Alaska Mariculture Sites. UAF Master's Thesis Defense, Juneau, AK.

Nicholson, E. 2025. Assisted with a field trip organized by the Center for Alaskan Coastal Studies in Seldovia, AK.

O'Neil, R., B. Konar, and C. Long. May 2025. Do Mariculture Activities Influence Sea Otter Prey. UAF Arctic Research Open House. Fairbanks, AK.

Steritz, S., and A. Cypher. 2025. Diving into Kelp. Tuesday Night Talks, PWSSC Community Lecture Series, Cordova, AK.

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

Nothing to report.

Data sets and associated metadata:

Eckert, G., S. Greene, J. Crimp, and A. Jones. 2026. Quality controlled environmental data from mariculture farms in 2023 from Onset HOBO conductivity loggers. Dataset. https://doi.org/10.24431/rw1kai4.

Eckert, G., S. Greene, J. Crimp, and A. Jones. 2026. Quality controlled environmental data from mariculture farms in 2023 from PME miniPAR loggers sondes including PAR, temperature, and tilt. Dataset. https://doi.org/10.24431/rw1kai5.

Eckert, G., S. Greene, J. Crimp, and A. Jones. 2026. Quality controlled environmental data from mariculture farms in 2023 from Lowell Instruments TCM-1 Tilt Current Meters including tilt and temperature. Dataset. https://doi.org/10.24431/rw1kai7.

Eckert, G. 2026. Environmental data from mariculture farms in 2023 from YSI EXO 2 sondes monitoring including temperature, salinity, dissolved oxygen, turbidity, chlorophyll, and photosynthetically active radiation. Dataset. https://doi.org/10.24431/rw1kai6.

Schaefer, A. 2025. Mar ReCon: Interactions with Biological Communities, Marine Birds. Dataset. 10.24431/rw1k9gk.

Additional Products not listed above:

Video series: "Know Your Farmer" and "AMRTC Salty Interview Sessions"

3. Coordination and Collaboration:

The Alaska SeaLife Center or Prince William Sound Science Center

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

PWSSC assisted the Benthic Component with their field sampling in September 2025. The Benthic Component used the Center for its home base where they prepped field gear and processed samples. PWSSC likewise assisted the Regional Variation component in oyster sampling efforts. The Marine Mammal component uses PWSSC housing and office space while servicing time-lapse cameras near Cordova and consults with PWSSC staff on transect survey protocols and imagery analysis.

PWSSC also has several platforms for sharing the Mar ReCon project with the general public. PIs participated in GEMS (Girls Exploring Marine Science) camp. Additionally, Project PIs shared multiple articles in the PWSSC *Breakwater* newsletter, in the annual science and natural history periodical, *Delta Sound Connections*, at the weekly Tuesday Night Talks Community Lecture Series, and in social media posts.

Mar ReCon PIs are collaborating with the CORaL Network, which is led by the Alaska SeaLife Center. Multiple PIs participated in outreach activities with the CORaL Network, such as the Community Science Night in Homer, AK during the annual meeting (January 7, 2026). PIs also hosted interactive booths at the Ocean Sciences Festival (held in Cordova, November 2025) and engaged with the Community Coastal Experience interns. Additionally, PI Good (Outreach Component) attended the CORaL Network annual meeting.

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), 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 January 2026. Similarly, PIs from Gulf Watch Alaska attended the annual Mar ReCon PI meeting virtually and in-person in January 2026 to provide an overview of Gulf Watch Alaska and continue communication between the projects.

LTRM Environmental Drivers Component: Campbell is PI of the Gulf Watch Alaska project 25120114-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) complement the PWS Marine Bird Summer Surveys conducted every two years by U.S. Fish and Wildlife Service (PI Kaler, 25120114-M), the Seward Line surveys (PI Hopcroft, 25120114-L), and the Humpback Whale project (PI Moran, 25120114-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. This component continues to collaborate and share field logistics and field crew with the Kachemak Bay Nearshore Component. Sampling between the components overlapped in May in 2025.

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 refer to 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. Mar ReCon 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.

EVOSTC Mariculture Projects

Members of the Mar ReCon Outreach Component continue to meet regularly with EVOSTC mariculture project leads. Coming up this spring, Alaska Sea Grant will co-host a mini-summit to strengthen cross-project learning and collaboration by clarifying how EVOSTC-funded kelp mariculture projects are engaging different audiences, identifying shared challenges and best practices, and selecting at least one near-term opportunity for cross-team collaboration.

Representatives from the other EVOSTC-funded mariculture projects (Project 25220301 and Project 25220200) attended the Mar ReCon annual meeting (virtually and in-person) in January 2026 where they provided updates about their projects and participated in a panel discussion about mariculture research in the region.

EVOSTC Education and Outreach Projects

The Mar ReCon project is an active partner with the 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, with PI Good as the lead, is fulfilling the role of liaison between Mar ReCon and the CORaL Network. Good's primary contribution in the CORaL project has been intentional coordination and information sharing across EVOS mariculture projects, helping reduce duplication, surface shared challenges, and align engagement approaches. Additionally, representatives from the CORaL Network attended the Mar ReCon annual meeting in January 2026 to discuss ways we can work together, as well as to help coordinate a Community Science

Night in which several project PIs participated. PI Good also attended the CORaL Network annual meeting.

Looking forward, the EVOS mariculture mini-summit represents a move from informal coordination to structured cross-project learning. The focus is on identifying best practices, shared resources, and at least one near-term collaborative action. Overall, the shift is toward viewing mariculture within CORaL as an approach for connecting EVOS project outcomes in ways that support shared learning and ensure results continue to inform communities beyond individual projects.

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 as well as collaborating on the marine bird component. These components use vessels and staff of the ADF&G Homer and Kodiak regional offices for transect surveys and time-lapse camera work. Expenses include covering actual staff time, vessel fuel, and a small contribution toward parts and maintenance, at considerable savings over charters used during EVOSTC FY24. Additionally, the Marine Mammal component used the expertise of Alaska Sea Grant staff to create the initial Wildlife Observations survey app and has consulted with these staff as we subsequently refined and expanded the app.

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), Cordova's federally recognized Alaska Native Tribe, is a core participant in this project and serves as the Community Lead. Caitlin McKinstry, of NVE's Department of the Environment and Natural Resources, serves on the Mar ReCon leadership team. Additionally, NVE's kelp farm is one of the study areas for the farmer-led research component. Project funds supporting NVE's role as Community Lead are disbursed via PWSSC, and project funds provided to NVE in its capacity as a farmer partner are disbursed by the Alaska Fisheries Development Foundation.

As a place-based community benefit organization, PWSSC is deeply embedded in the Cordova community and maintains a mutually beneficial relationship with NVE. 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 opportunities arise. 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.

The Marine Mammal and Marine Birds components engage two tribal biologists from Sun'aq Tribe of Kodiak as observers on mammal and bird transect surveys. ADF&G contracted with the tribe for this assistance and as-needed support for time-lapse camera maintenance. During surveys, one biologist has trained on the SeaLog survey software and protocol used in Mar ReCon, Gulf Watch Alaska, and other EVOS programs, with a longer-term plan for similar tribally-directed transect surveys to meet local information needs.

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 is collaborating with the CORaL Network, whose core team members help direct information exchanges between Alaska Native communities and EVOSTC-funded programs as necessary and appropriate. Coordinating 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.

We are also exchanging information with other EVOSTC-funded mariculture projects, which have an Alaska Native community focus. Information exchange including having Mar ReCon project representatives attend their meetings, inviting them to present and participate at Mar ReCon annual meetings (January 2026), and co-hosting a mini-summit in spring 2026 to further promote cross-project communication and information sharing.

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. Budget:

Budget Category:	AMENDED FY 22	AMENDED FY 23	AMENDED FY 24	Proposed FY 25	Proposed FY 26	5-YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$686,255	$957,602	$1,269,245	$1,209,194	$1,237,922	$5,360,217	$2,050,269
Travel	$80,138	$146,805	$185,453	$138,395	$112,654	$663,445	$226,432
Contractual	$471,081	$586,542	$634,453	$657,655	$673,796	$3,023,527	$1,556,357
Commodities	$427,906	$186,834	$283,006	$123,078	$150,487	$1,171,311	$647,396
Equipment	$325,359	$117,855	$304,763	$112,718	$68,253	$928,948	$522,447
Indirect Costs	$173,232	$147,287	$243,940	$188,785	$198,458	$951,703	$362,864
(rate will vary by project)							
SUBTOTAL	$2,163,971	$2,142,925	$2,920,861	$2,429,824	$2,441,570	$12,099,151	$5,365,764
General Administration (9% of subtotal)	$194,757	$192,863	$262,877	$218,684	$219,741	$1,088,924	NA
PROGRAM TOTAL	**$2,358,729**	**$2,335,788**	**$3,183,738**	**$2,648,508**	**$2,661,311**	**$13,188,074**	**$5,365,764**
Other Resources (In-Kind Funds)	**$60,239**	**$62,333**	**$53,622**	**$67,787**	**$111,360**	**$355,341**	**$0**

Due to the delay in funding initiation, many components within the project are underspent on personnel salaries, travel, and field activities. We anticipate catching up on spending in 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	$399,950
Travel		$1,610	$7,370	$8,430	$8,460	$9,620	$35,490	$24,029
Contractual		$21,780	$78,680	$81,980	$81,280	$84,580	$348,300	$108,596
Commodities		$17,000	$5,750	$7,750	$5,750	$5,750	$42,000	$19,497
Equipment		$160,000	$20,000	$0	$0	$0	$180,000	$145,816
Indirect Costs Rate =	0%	$0	$0	$0	$0	$0	$0	$0
Indirect waived								
SUBTOTAL		$310,183	$323,180	$315,850	$319,748	$330,890	$1,599,851	$697,888
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	$697,888
Other Resources (In-Kind Funds)								

Farm Sampling & Outreach (Huller): 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	$135,197
Travel		$4,200	$29,305	$29,413	$4,523	$4,636	$72,077	$17,677
Contractual		$309,000	$373,920	$361,376	$378,279	$352,053	$1,774,628	$867,252
Commodities		$186,056	$134,084	$109,909	$55,650	$79,579	$565,278	$303,736
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	$96,118
Indirect waived								
SUBTOTAL		$583,982	$598,754	$559,312	$491,689	$490,150	$2,723,887	$1,419,981
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	$1,419,981
Other Resources (In-Kind Funds)								

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

Budget Category:		Amended 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	$229,554
Travel		$33,514	$49,103	$46,995	$48,044	$51,493	$229,150	$55,722
Contractual		$9,400	$14,900	$10,850	$36,400	$61,400	$132,950	$33,872
Commodities		$143,300	$12,500	$12,500	$12,500	$12,500	$193,300	$144,633
Equipment & F&A Exempt		$129,949	$28,350	$15,000	$13,000	$0	$186,299	$156,185
Indirect Costs Rate =	25%	$90,128	$82,617	$92,484	$99,881	$115,722	$480,832	$115,352
(non-equipment)								
SUBTOTAL		$573,942	$441,435	$477,419	$512,405	$578,609	$2,583,810	$735,318
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	$735,318
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	$8,550
Contractual	$0	$0	$69,002	$72,262	$74,636	$215,900	$103,643
Commodities	$18,000	$0	$9,665	$9,928	$18,408	$56,001	$0
Equipment	$0	$15,000	$0	$0	$0	$15,000	$11,142
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0	
Indirect waived							
SUBTOTAL	$18,000	$23,807	$84,287	$90,685	$95,931	$312,709	$123,335
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	$123,335
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	Amended FY 22-24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel			$231,374	$106,366	$109,342	$447,082	$230,796
Travel			$55,451	$26,424	$0	$81,875	$42,463
Contractual			$25,000	$2,500	$0	$27,500	$30,002
Commodities			$92,000	$7,000	$6,000	$105,000	$74,773
Equipment & F&A Exempt			$232,919	$40,418	$41,168	$314,505	$164,626
Indirect Costs Rate = 25%			$93,143	$35,572	$28,835	$157,551	$94,040
(non-equipment)							
SUBTOTAL	$0	$0	$729,887	$218,280	$185,345	$1,133,512	$636,701
General Administration (9% of subtotal)	$0	$0	$0	$0	$0	$0	$0
PROJECT TOTAL	$0	$0	$729,887	$218,280	$185,345	$1,133,512	$636,701
Other Resources (In-Kind Funds)						$0	

Oyster Breeding (Hollarsmith): Component 3

Budget Category:	Proposed FY 22	Amended FY 23	Amended FY 24	Amended FY 25	Amended FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$60,960	$121,920	$144,190	$190,497	$178,994	$696,561	$294,498
Travel	$2,488	$4,976	$4,976	$4,976	$4,976	$22,392	$4,447
Contractual	$49,000	$34,038	$0	$0	$0	$83,038	$169,366
Commodities	$25,250	$4,000	$21,182	$2,000	$6,250	$58,682	$50,432
Equipment	$0	$0	$0	$0	$0	$0	
Indirect Costs Rate = 0%	$0	$0	$0	$0	$0	$0	
SUBTOTAL	$137,698	$164,934	$170,348	$197,473	$190,220	$860,673	$518,744
General Administration (9% of subtotal)	$12,393	$14,844	$15,331	$17,773	$17,120	$77,461	N/A
PROJECT TOTAL	$150,091	$179,778	$185,679	$215,246	$207,340	$938,134	$518,744
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:	Amended FY 22	Proposed FY 23	Proposed FY 24	Proposed FY 25	Proposed FY 26	5- YR TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$85,941	$69,948	$71,835	$73,779	$75,782	$377,285	$80,981
Travel	$15,730	$23,207	$10,369	$10,543	$10,447	$70,296	$21,475
Contractual	$3,300	$4,350	$3,300	$3,300	$8,500	$22,750	$14,198
Commodities	$13,500	$11,500	$11,500	$11,500	$5,500	$53,500	$6,256
Equipment & F&A Exempt	$7,710	$31,107	$32,277	$33,505	$27,085	$131,684	$4,026
Indirect Costs Rate = 25% (non-equipment)	$29,618	$27,251	$24,251	$24,781	$25,057	$130,958	$30,039
SUBTOTAL	$155,799	$167,363	$153,532	$157,408	$152,371	$786,473	$156,975
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	$156,975
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	$12,131
Travel	$4,916	$1,666	$1,666	$1,666	$3,078	$12,992	$7,213
Contractual	$0	$0	$0	$0	$0	$0	$4,347
Commodities	$4,000	$4,000	$4,000	$4,000	$0	$16,000	$11,599
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	$35,290
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	$35,290
Other Resources (In-Kind Funds)	$18,645	$19,018	$19,398	$19,786	$12,064	$88,911	

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	$252,146
Travel		$15,480	$16,100	$16,100	$16,100	$16,100	$79,880	$33,800
Contractual		$9,401	$5,698	$6,664	$3,188	$6,568	$31,519	$24,951
Commodities		$10,000	$10,000	$10,000	$10,000	$10,000	$50,000	$17,084
Equipment		$0	$0	$0	$0	$0	$0	
Indirect Costs	Rate = 0%	$0	$0	$0	$0	$0	$0	$4,339
Indirect waived								
SUBTOTAL		$137,614	$137,615	$137,615	$137,614	$137,615	$688,073	$332,318
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	$332,318
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	$73,357
Travel		$0	$4,966	$5,098	$7,799	$8,012	$25,875	$1,126
Contractual		$0	$2,000	$2,000	$2,000	$5,000	$11,000	$2,238
Commodities		$8,800	$2,000	$1,500	$1,500	$1,500	$15,300	$15,181
Equipment & F&A Exempt		$27,700	$23,398	$24,567	$25,795	$0	$101,460	$40,652
Indirect Costs	Rate = 25%	$5,760	$13,714	$13,943	$14,579	$15,012	$63,008	$22,976
(non-equipment)								
SUBTOTAL		$56,500	$91,966	$94,284	$98,690	$75,059	$416,500	$155,530
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	$155,530
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	$341,659
Travel		$2,200	$1,305	$1,335	$1,365	$1,405	$7,610	$9,931
Contractual		$69,200	$72,956	$74,281	$78,446	$81,059	$375,942	$197,891
Commodities		$2,000	$3,000	$3,000	$3,250	$5,000	$16,250	$4,204
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	$553,685
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	$553,685
Other Resources (In-Kind Funds)								