

Mariculture Research and Development Component Narrative

1. Program Description and Scope of Work

a. Executive Summary

The Southeast Conference's Alaska Mariculture Cluster (AMC) Research and Development Project proposes targeted research for use in developing innovative seaweed and shellfish products, including carbon capture benefits, and addressing key issues facing aquatic farmers and mariculture processors. With eight active kelp farm sites and 37 more permit applications in the permitting pipeline (McKinley Research Group, 2021), the Alaska seaweed industry is generating great interest, while shellfish farmers have been growing oysters in Alaska waters for over a century.

Projects funded will support creation of new markets for Alaska seaweed, collect data on mariculture farm site suitability and operational efficiencies, reduce operational costs at seaweed nurseries, increase the translation of research into commerce, and share knowledge and experiences between industry participants.

Project success will be measured by the number of applied research projects completed, number of research positions created, mariculture farm site suitability and carbon capture benefit data collected, and the number of workforce and business operation training participants reached through data distribution trainings and publications.

b. Scope of Work

Seaweed Tissue Analysis: The AMC will contract for tissue analysis of 25 - 30 seaweed species native to Alaska. This analysis will establish chemistry and nutritional profiles of species from three Alaska regions, critical for marketing materials and product manufacturer outreach. Seaweed safety issues will be addressed through heavy metal analysis for seven representative seaweed farms or areas of concern.

Product Research and Development: Alaska oysters are currently sold fresh and there is a need to develop shelf-stable or frozen products to diversify markets available to Alaska's shellfish farmers. AMC will fund shellfish product development trials to be completed at existing facilities at the Alaska Sea Grant's Kodiak Seafood & Marine Science Center. The product development research will be carried out by a postdoctoral fellow and the budget includes funding for a project microbiologist to conduct food safety analyses.

AMC will also fund the State of Alaska's Alaska Plant Materials Center (APMC) to conduct seaweed agricultural product development trials. Large-scale seaweed feed and fertilizer markets have developed in other regions of the world, but research is needed pertaining to the seaweed species native to Alaska. APMC agronomists will develop protocols for seaweed product handling, processing, and stabilization as well as evaluate the performance of these pilot feed and fertilizer products at their test farms.

Joint Innovation Projects: The Alaska Fisheries Development Foundation will create and implement a new program designed to accelerate development of applied technologies addressing barriers to growth in Alaska's mariculture industry. AFDF has previous experience with similar projects related to Alaska's seafood industry. AFDF will use a competitive process to solicit, select, and fund joint projects proposed by mariculture businesses, seafood

processors, technology companies, or other businesses and organizations. Selection criteria will include the feasibility of the proposed joint innovation project, potential impact of the project on removing barriers to mariculture industry growth, and other resources committed by the project proponent, among others. Examples could include working with a seaweed business to test a new aquatic farm technology, novel sensors for collecting ocean data, or innovative automated processing machines to optimize seaweed harvest procedures. Findings from these projects will be compiled into reports and datasets and distributed to the public, ensuring benefits are available to all industry participants.

Annual Conference: An annual conference will be funded to support information exchange between coalition members and offer a venue to share outcomes and findings from AMC funded activities. The event will also include training sessions, seminars, and networking opportunities. Coalition members Alaska Mariculture Alliance and Alaska Sea Grant's Mariculture and Training Research Center are expected to organize and sponsor the conference. The conference will be open to the public or those individuals interested in getting involved or are currently involved in the industry.

Seaweed Genetic Diversity Analysis: Alaska Department of Fish & Game will be funded to document the degree of adaptive genetic variation within commercially grown seaweed species and populations in Alaska waters. Current seaweed seed acquisition policies are based on limited information and correspondingly conservative approaches. Genetic diversity information is expected to improve regulatory efficiency by identifying areas where seed stock could be shared regionally and/or maintained by hatcheries over multiple years. This will reduce operational costs at seaweed nurseries and address a major potential bottleneck to growth of Alaska's seaweed industry.

De-risk Investments in Aquatic Farming: SEC will contract with researchers to produce and make available to the public region-wide modeling of ocean current and waves at a scale relevant to aquatic farms. This data will increase the chances of success for new aquatic farms by providing the information needed to right-size anchors and reduce gear costs. This information is not currently available when selecting locations for farming consequently increasing risk that the ocean conditions of the selected site may require different equipment than what may have already been invested in or installed. The upfront costs associated with aquatic farming equipment (especially if a season of product is lost or poor due to insufficient or wrong equipment) is a significant barrier to existing and new farmers – the availability of this information reduces that barrier.

SEC will also fund data collection at aquatic farms in Alaska by hiring firms selected through a competitive RFP process. These firms would work with aquatic farmers to develop a site characterization and monitoring plan to optimize that aquatic farm's success. The AMC will then provide matching funds for implementation of the site characterization and monitoring plan in exchange for data on the participating farm's operations and site characteristics. Data collected could include water quality data (nutrient concentration, salinity, light penetration, and temperature), ocean current velocities and directions; and multibeam sonar mapping of the seafloor under an aquatic farm – all information that increases an aquatic farm's likelihood of success. This information will be gathered into a report and made available to the public.

The goals of this effort are to rapidly accelerate understanding of the characteristics of successful aquatic farm sites; increase farming success rates; provide farmers with site selection and monitoring that most farms, especially small businesses, would not have the funding to seek otherwise; and improve aquatic farm site data availability for regulators and researchers.

Carbon sequestration feasibility: There is an emerging international consensus that limiting the increase in average global temperatures to 1.5 degrees Celsius will require large-scale carbon dioxide removal (CDR) from the atmosphere. While the potential CDR benefits of macroalgal cultivation are beginning to be recognized globally, the specific research necessary to support the application in Alaska has not been undertaken. This project will fund an assessment and analysis of the CDR potential for the specific strains of macroalgae cultivated in Alaska. The project will work with cultivators to quantify CDR potential, review life-cycle emissions from operations, assess economics and evaluate the potential for participation in developing carbon offset markets.

2. Regional Industry Assets and Needs

a. Regional Description

The AMC cluster is focused on southern coastal Alaska (Southeast (SE), Prince William Sound (PWS), Kenai Peninsula (KP), Southwest (SW)) where there are waters appropriate for mariculture development as well as the existing seafood industry participants and interested workforce, infrastructure, and vessels that already operate and move across communities to access fishery resources. See attached separate FIPS code spreadsheet as directed by EDA staff.

Alaska comprises more than half of the US coastline, continental shelf, and exclusive economic zone (EEZ) and is a world leader in seafood production; over 60% of the seafood harvested in the US comes from Alaska waters. Therefore, Alaska has the coastline and infrastructure to support growth of its mariculture industry. At the same time, Alaska has over 250 rural coastal communities that are largely inaccessible by road and have limited employment opportunities. Many of these communities have high numbers of Alaska Native residents, who make up 22% of the population of the AMC project area. The communities in these coastal regions have the need and desire to build ocean-related businesses, diversifying opportunities for residents to live and work in their communities in an industry that is beneficial to the environment and complementary to commercial and subsistence fishing.

b. Industry, Employer, and CEDS alignment

Alaska's mariculture industry "is currently oriented around small volumes of seaweed processed into specialty food products" (McKinley Research Group, 2018). The Alaska Mariculture Task Force's Five Year Action Plan (2019) and goal of catalyzing a \$100 million/year mariculture industry are the primary strategic drivers for expanding mariculture in Alaska. To support product development as a way of expanding market demand, the Five Year Action Plan specifically identifies "establish a mariculture research center" as a priority recommendation for use in conducting research and development of Alaska mariculture products. Mariculture development is a priority in state and regional development efforts and as well as aligning with the [Alaska Mariculture Development Plan](#), this cluster also aligns with the CEDS for each of the EDDs ([SEC](#) - pgs. 2, 11, 24, 41-43, [PWSEDD](#) – pgs. 8, 32, 41, 44, 58, [KPEDD](#) – pgs. 39-50, [SWAMC](#) – pgs. 1, 4, 5, 7), and the State of Alaska (pgs. 2, 11, 24, 41-43). References to supporting the mariculture industry in AMC coalition members' CEDS include:

- KPEDD CEDS: “Objective 4.4, Support emerging sectors with high growth potential: assist mariculture operations in meeting capital and expansion needs” (2021).
- PWSEDD CEDS: supporting the Sound’s Blue Economy is central to its vision statement, and Priority Objective (C.)(1.)(a.) states “attract investment in PWS mariculture by facilitating relationships with prospective kelp and shellfish farmers, buyers and processors” (2021).
- Southeast Conference’s 2025 CEDS identifies Mariculture Development as its top priority in its Seafood and Maritime sector (2020).
- SWAMC 2019 CEDS: “educate, advocate and assist in the development of the mariculture industry to diversify rural economies”.

3. Proposed Solution

Our outreach to kelp farmers, shellfish growers, seafood processors and mariculture industry partners like the nascent Alaska Mariculture Alliance and the Alaska Sea Grant program has raised awareness about some critical gaps that need to be filled to allow Alaska’s mariculture industry to grow into a major statewide economic sector. Interest in mariculture in Alaska has grown considerably in recent years, and yet, of 89 active permits issued, only 29 have reported sales activity for 2021 (e-mail comm., ADF&G, 3/1/2022). Many with seaweed farm permits, for example, have not deployed their farms due to the initial capital costs and uncertain return without commitments from buyers.

This component of the Alaska Mariculture Cluster supports creation of new markets for Alaska seaweed, collection data on mariculture farm site suitability and operational efficiencies, reduction of operational costs at seaweed nurseries, and sharing of knowledge and experiences between industry participants. Several research assets are in place, including the Kodiak Seafood and Marine Science Center (with a postdoctoral fellow starting work on product development in 2022), Alaska Sea Grant’s Mariculture Research and Training Center, the ADF&G Gene Conservation lab, and the State of Alaska’s Plant Materials Center. EDA funding will support numerous applied research projects focused on mariculture product development at these facilities, while also leveraging resources at other entities through joint innovation projects. Public support, through EDA’s funding of this component, will support tackling the initial low-hanging fruit in the vast R&D needs of Alaska’s nascent mariculture industry.

Growing Alaska’s mariculture industry will help diversify its coastal economies, an important step in balancing recent fisheries declines likely tied to changing global ocean conditions. It will also assist with building a more resilient economy and recovering from the stalled investments that resulted from COVID-related cash crunches and business uncertainty. Further, kelp farming is environmentally sustainable, as it absorbs CO₂ making local waters healthier for shellfish, and as a livestock feed additive it helps reduce methane emissions, the largest source of greenhouse gas warming the planet.

4. Partners and Program Outreach

a. Partnerships

- **Alaska Sea Grant (ASG), Kodiak Seafood & Marine Science Center:** critical partner with research and education resources. Will coordinate with Marine Advisory Program

agents in several remote communities, and with development of Mariculture Research and Training Center.

- **Alaska Mariculture Alliance:** growing association that will help coordinate AMC work.
- **Alaska Fisheries Development Foundation:** statewide leader supporting research and cultivating investment in Alaska fisheries and mariculture, supporting growth of capacity at AMA.
- **Alutiiq Pride Marine Institute** located in Seward, serving Cook Inlet and PWS, is a leading statewide shellfish laboratory and also operates kelp seed nursery to provide seed twine to commercial kelp growers. The institute is part of the **Chugach Regional Resources Commission**, a regional coalition of tribes collectively working on various natural resource and economic development issues.

b. Promoting Diversity, Equity, and Inclusion

Broad community outreach to underserved, rural communities is a specific strategic component of the Alaska Mariculture Cluster, addressed in the Coordination and Outreach section. Historically underserved stakeholders such as remote Native villages and Native populations who have been excluded from access to capital and training will specifically be invited to participate in the AMC's annual forum for sharing research and development findings and mariculture farmer experiences. Key education partners for reaching target audiences, holding mariculture trainings, and providing technical assistance include Alaska Sea Grant, University of Alaska campuses in Anchorage and Fairbanks, the Prince William Sound College, and University of Alaska/Southeast's Fisheries Tech program. Beyond the personal expertise developed by a few kelp and shellfish growers, little is widely known about what makes a successful mariculture farm site. This research and development component will address that gap by devoting funding to examine kelp and shellfish farm site characterization. Research on ocean current and nearshore environment conditions and depth analyses will help prospective mariculture farmers in selecting suitable sites for the species they plan to grow and developing those sites at lower costs due to reduced anchor.

5. Measurable Goals and Impacts

Product Development Data Collected:

- Seaweed tissue analysis: chemical, nutritional and flavor profiles of 25 – 30 species, conducted in 2023, used in subsequent product development research.
- Number of applied research projects on product development of seaweed and shellfish products: agricultural feed, fertilizer, human food products, shellfish by-products.
- Number of new seaweed and shellfish products developed.

Joint Innovation Projects and Product Development Trials: number of projects awarded, number of challenges successfully met, number of product trials held, and the number of new products and/or services relevant to the mariculture sector developed.

Genetic Diversity Data Collected: Any changes to the 50/50 rule for seaweed fertile material collection (50 specimens within 50km of farm site), and resulting reductions in costs to farmers related to fertile material collection and to nurseries related to growing seeded string.

Site Characterization and Monitoring Data Collected: Four years of aquatic farm site data collected, number of partners and researchers using that data to produce publicly available findings, number of aquatic farmers using site selection and characterization program, reductions in aquatic farm capital and operating costs due to use of wave and current data. Funding would be contingent on data collected being made available publicly to aid in cooperative research efforts statewide. Researchers at the University of Alaska have stated that this data is critical to informing ongoing mariculture research priorities.

Annual Conference for Data Sharing: number of mariculture farmers participating, geographic distribution of participants, percentage of participants from underserved communities or populations, distribution in scale of kelp and shellfish farms among participants.

Carbon capture research: progress toward development of a quantifiable figure for the amount of CO₂ sequestered per wet pound of seaweed grown. Number of presentations of project findings and number of follow-on research projects to address the inevitable additional questions related to this potential market for Alaska seaweed.

As a whole, the component projects and complimentary work planned by the Alaska Mariculture Cluster (AMC) coalition is estimated to result in the creation of 318 jobs and \$42 million in private investment leveraged by the final year of the grant period. The AMC programs are collectively estimated to move Alaska's mariculture industry from a status quo growth trajectory (annual economic output of \$4.7 million at year 4 and \$10.8 million in Year 10) to mid-case growth (economic output of \$23 million at year 4 and \$98 million in Year 10).

6. Sustainability Plan

Beyond EDA support, building up industry coordination and capacity for support of mariculture farmers, market development, and on-going marketing at the Alaska Mariculture Alliance (AMA) is critical to the industry's long-term success. Alaska has very successful models of seafood associations in the Alaska Seafood Marketing Institute and regional seafood associations to which we can look for experience and lessons learned. Growing the mariculture industry will help with creating a revenue source to support future AMA work. The listed organizations are funded in part through a self-assessment tax by industry participants, typically between 0.5% and 1%. With EDA investment, Alaska's mariculture industry is projected to achieve revenues of around \$14.1 million by year 4, providing \$140,000 annually at the 1% tax rate for project continuation (growing to \$600,000 by year 10).

The challenges we see ahead include careful coordination in sharing data on product and market research and a need for strong coordination among AMC project components. This AMC Research & Development project will benefit underserved communities by reaching out specifically to Alaska Native villages to talk about assistance with site selection for kelp farms, workforce development, kelp farm operation training, and assistance with collecting seed for seed twine cultivation. Communities expected to benefit include remote coastal communities from SE to SW Alaska, Metlakatla at the southern border to Akutan in the Aleutian Islands.