



2023 Joint Innovation Projects

Innovations in Processing

Title: *Building a product bridge: Cost-effective primary stabilization for transportation of Alaska kelp to market*

Lead Entity: Atlantic Sea Farms

Project Location: Kodiak

Funding Amount: \$94,598

Project Summary: Alaska has enormous potential to support the US's growing seaweed farming industry thanks to its expansive coastline, support from the state government, and diversity of native, marketable species. However, a massive barrier remains: an economic means of transporting the harvested product to market. There are currently only two primary stabilization methods for processing Alaskan kelp: freezing and drying. Both of these options are very expensive; cold-chain transport of frozen kelp is the most expensive shipping option, and dried product is extremely energy-intensive, requires expensive drying equipment, and constrains options for end-products. Without other preparation methods, Alaska's kelp industry is at an economic disadvantage to other kelp growing regions. This project will explore primary stabilization of kelp using USDA approved ingredients to produce a bulk product which does not require any refrigeration. Success for this project will result in an orders-of-magnitude cheaper primary stabilization method, a reduction in shipping cost of > 40% over frozen product, and an immediate buyer of Alaska-grown kelp in Atlantic Sea Farms (ASF), interested in purchasing over 200,000 pounds annually.

Title: *Evaluating and Sharing Methods to Efficiently Dry Kelp for Rural Communities*

Lead Entity: Barnacle Foods

Project Location: Juneau

Funding Amount: \$97,625

Project Summary: Globally, seaweed and kelp are most commonly sold in the dried form. Supplying dried kelp for this existing demand is the most direct channel for kelp farmers in Alaska to sell their product and expand their farms. Farmers face significant challenges accessing markets; high perishability of kelp, distance to market and high energy and operational costs all contribute. This project seeks to recommend a cost effective method to dry kelp on a small scale in remote coastal communities, communities that are closest to the site of kelp farms. The project will provide publicly available information on methods and equipment to dry kelp efficiently. This information will start to break down the barriers to the growth of the mariculture industry and involvement of rural and Native communities who are faced with high

energy costs, limited labor capacity, and opportunity to cultivate kelp. This information will be useful for kelp farmers who are looking to vertically integrate their operations, to communities looking to invest in primary processing, and kelp processors. The analysis will encompass both an investigation of existing efforts in the field and the trialing of new methods and equipment. Containerized systems, mechanical dryers/dewaterers, and thermal dryers with electric heat pumps will be considered in this project.

Title: *Primary Stabilization of Seaweed Thru Drying Technique*

Lead Entity: Blue Evolution

Project Location: Kodiak

Funding Amount: \$96,350

Project Summary: Blue Evolution, in partnership with Sun'Aq Tribal Enterprises through Wildsource, proposes an innovative project aimed at enhancing the mariculture industry in Kodiak, Alaska. This project focuses on the primary stabilization of seaweed through drying, a significant barrier to industry growth. Leveraging Blue Evolution's extensive experience in seaweed processing and Wildsource's vast expertise in seafood processing, the project aims to develop and optimize drying conditions, establish product specifications, and introduce the product to the marketplace. This initiative is expected to contribute to local economic development, job creation, and the sustainable production of seaweed, a promising ocean crop. Blue Evolution has prior and existing experience in stabilization of seaweed using dehydration techniques from its own operations in Baja California, Mexico where it currently processes more than 200,000 lbs annually of seaweed for drying that is being exported to the United States as powder and flakes. Blue Evolution has high confidence that it can bring its expertise to bear on this project to develop the kelp drying process for a viable stabilization process and market a stable product. Innovating the processing conditions in Alaska by addressing the drying challenges requires a combination of technological advancements, infrastructure improvements, best practices, and collaboration among industry stakeholders. When these challenges are addressed, the seafood and mariculture industry in Kodiak will enhance the quality, safety, and marketability of dried seafood products while maximizing economic opportunities for local communities.

Title: *Evaluate Marketability and Production Protocols for Kelp Based Wine and Spirits*

Lead Entity: Float Camp

Project Location: Ketchikan

Funding Amount: \$86,050

Project Summary: Though there is extensive literature on grape wine production/marketing in addition to producing/marketing grain spirits, there is almost no information on kelp wine/spirit production and no marketing studies. Due to this, the optimum time from harvest to use, best yeasts, additives, sterility methods, fermentation, stabilization, and bottling are all unknown. Even the market for these wines/spirits is unknown, including the best way to market the products. By utilizing enology and marketing consultants with extensive academic and real-world experience, I hope to answer these questions. The kelp industry is in its infancy in Alaska and opening new markets is paramount. Developing environmentally sensitive Alaskan wine/spirit products could present a new market for our kelp growers while helping local

businesses expand. I have found that approximately eight pounds of sugar kelp is needed per case of wine and that case could either be sold as wine or distilled into a smaller quantity of spirits. Even a very small winery is defined as 1,000 to 4,999 cases produced per year. Extrapolating this, each very small winery would need 8,000 to 35,000 pounds of sugar kelp annually and possibly more for a distillery. Though I have made wines on an amateur level for years, this project needs input from experts in the field to move it to a production level, marketable wine. I will be donating my time and equipment for this project but will need to pay the consultants, buy ingredients, and additional testing equipment that they designate. Though eighteen months is considered a short time in the wine making world, this will allow enough time to complete multiple trials to develop best practice protocols for commercial wineries/distilleries. Also allowing time for the marketing consultants to create their report and recommendations.

Title: *Kelp Stabilization for Rural Communities: Designing for Decentralized Processing*

Lead Entity: GreenWave

Project Location: Kodiak

Funding Amount: \$94,848

Project Summary: Fresh seaweed degrades rapidly after harvesting, preventing farmers and processors from bringing it to market in sufficient quantity and quality. To relieve this bottleneck, we will develop an open-source primary processing line capable of stabilizing kelp at ambient temperature as close (physically and temporally) to the farm as possible that could be deployed in rural communities across Alaska. Providing rural kelp farms with affordable stabilization technology is key to extending the shelf life of their product, and ultimately securing realistic access to markets.

Title: *Pilot scale forced-air drying and milling of farmed kelp - gateway to mid to large scale drying, qualitative assessment, and development of dried kelp products*

Lead Entity: Kodiak Archipelago Leadership Institute

Project Location: Kodiak

Funding Amount: \$53,980

Project Summary: This 12-month project proposes to utilize existing technology for forced air drying and milling to run trials to assess the feasibility of utilizing these technologies on a larger scale for the primary stabilization of farmed kelp. The data collected in the trials, held at the Kodiak Seafood and Marine Science Center (KSMSC), will be used to assess the economic feasibility of drying kelp in rural coastal communities based on power costs and labor, the qualitative traits of dried kelp products (nutrient profiles, salt content, heavy metals, water activity, microbial levels), and create nutrient labels and product specifications for dried kelp products. The proposed drying system will be located at the KSMSC pilot plant and will be available during and after the project for kelp farmers to utilize for preserving dried and milled samples of their farmed kelp. This equipment will be used during ASG hosted seaweed handling and processing workshops.

Title: *Testing Four Approaches to Small-Scale Primary Seaweed Stabilization & Matching Methods to Markets*

Lead Entity: Saltwater Inc. & Generation North

Project Location: Homer

Funding Amount: \$99,676

Project Summary: This project will focus on addressing the challenge of primary processing at the community hub and/or small farm collective scale (10-30 acres) and look to matching processing methods to local context and suitability for end products and markets. It will allow us to leverage our S-K funding, build on our 2022-23 season experience and existing partnerships and collaborations with APMI, Alaska Manufacturing Extension Partnership (MEP), the University of Alaska, and Salmon Sisters, and occur at the time when our SK-funded project shifts to a greater emphasis on marketing, distribution, and encouraging value-add product development locally. The Alutiiq Pride Marine Institute (APMI) and the communities of Port Graham and Nanwalek will be engaged throughout the project, testing and learning processing methods that best suit their community needs.

Innovations in Bull Kelp Farming

Title: *Bull Kelp Buoyancy Assessment*

Lead Entity: Native Village of Eyak

Project Location: Cordova

Funding Amount: \$100,000

Project Summary: Kelp farm anchoring systems are the most important and expensive component of a farmer's investment. Balancing costs and efficacy for each unique farm site and species cultivated is critical for the sustainable growth of this industry. Growing bull kelp (*Nereocystis luetkeana*) adds additional hurdles to anchoring designs due to the buoyancy of its characteristic floating pneumatocysts. A lack of information regarding the buoyancy of an entire crop of bull kelp and how this changes during the growing season has made designing appropriate anchoring systems difficult. The objective of this project is to fill this data gap and understand how cultivated bull kelp buoyancy changes during growth at an exposed location in the Prince William Sound (PWS). We propose a straightforward study design to document changes in bull kelp buoyancy over the course of a year. Bull kelp seeded crab pots will be suspended in the water column at 10 m throughout the study. These arrays will be monitored for kelp density and individual morphology (pneumatocyst diameter, stipe length, biomass) and compared to a control array without seed string. Oceanographic conditions including temperature, salinity, and currents will be documented via instrumentation (CTD, temperature loggers, ADCP). Additional measurements of individual bull kelp plants grown on NVE's established MacroAlgal Cultivation Rig (MACR) will be sacrificed monthly to determine buoyancy of each. The results from this study will fill a critical data gap required by engineers to design cost-effective anchoring systems that can maintain this floating kelp throughout its life cycle.

Title: *Evaluating Infrastructure and Seeding Methods for Scalable Bull Kelp Cultivation*

Lead Entity: Sea Quester Farms

Project Location: Juneau

Funding Amount: \$98,958

Project Summary: Sea Quester Farms aims to further develop food-grade, commercially viable bull kelp cultivation techniques through trials conducted at our farm site near Juneau, AK. The proposed experiment aims to compare two factors: the growth of bull kelp on a surface array (tethered to the surface) versus a benthic array (tethered to the seafloor), and the growth of bull kelp on grow lines based on continuous seed spacing versus interval seed spacing. Working collaboratively with farmers at the Native Conservancy, representatives at Spruce Root, and other Sustainable Southeast Partnership communities, the project partners will disseminate the results obtained from this study.

In the wild, bull kelp grows attached to rocks on the seafloor. Bull kelp does not tend to cover the seafloor like it covers a seed line, but rather, it grows in numerous small groups. The use of suspended arrays and dense seed lines have proven to be problematic and costly for commercial farms attempting to scale bull kelp production in Alaska. By spacing the growth on the seed line and using an array tether to the seafloor, we believe we can closely simulate bull kelp's natural growing conditions.

Innovations in Mooring System Technology, Design and/or Deployment

Title: *Helical Anchor Performance Analysis*

Lead Entity: Holdfast Robotics & Premium Aquatics, LLC (D.B.A. Seagrove Kelp)

Project Location: Craig

Funding Amount: \$59,640

Project Summary: The proposed project, entitled Helical Anchor Performance Analysis, is a study of helical anchor installation processes and strength testing under a variety of bottom type and loading conditions. Helical anchors are a high-performance, low-cost, and environmentally-friendly means of anchoring aquaculture installations in challenging environments, and in order to further inform their use for applications within the Alaskan mariculture industry this project will assess the performance of helical anchors in applications relevant to aquaculture installations. It is the goal and intent of this project to increase understanding of helical anchor performance, gain experience and knowledge in helical anchor installation, and explore the efficacy of helical anchors for use within the Alaska Mariculture Alliance.

Boosting Oyster Growth at Nurseries or Farms

Title: *Design and comprehensive planning of an Alaskan optimized intermodal freight container based shellfish setting and pre-nursery seed boosting system*

Lead Entity: OceansAlaska

Project Location: Ketchikan

Funding Amount: \$89,650

Project Summary: Due to cold water conditions in Alaska and a limited growing season, extra-large sized oyster seed from hatcheries perform significantly better than smaller. Having larger seed can reduce the growth time to market size by many months. Smaller sized oyster

seed performs well in the Pacific Northwest and demand for these sizes drives the production goals of hatcheries in WA and HI, which are the seed sources for AK. For decades, Alaskan farmers have attempted to source 3mm and larger seed, but have had very limited access. Another factor for Alaskan farmers is having larger seed available at the perfect time of year to optimize the limited growing season. This proposal focuses on the need to deliver significant quantities of locally conditioned, large sized oyster seed to in-state nurseries at the right time. Development of a solution to this issue is a direct continuation of the oyster hatchery work that has been ongoing at OceansAlaska's facility in Saxman. Container based pre-nurseries can be configured to several sizes and capabilities, but all based on the cultivation of micro-algae for feeding oyster seed (or other shellfish), water filtration and heating of seawater. All components of such a system can be consolidated prior to barge shipping to Alaska. Container based systems can be deployed regionally, as needed, and can be matched to local organizational and labor capabilities. Detailed plans and standard operating procedures can be slightly modified as needed for each different location and organizational needs. OceansAlaska will contract with Pro Aquaculture Solutions of Prince Rupert and Blue Starr Oyster Co. of Tokeen to complete all steps of the proposal. Both companies have a strong history of working with OceansAlaska on hatchery solutions and have intimate knowledge of conditions in Alaska. In person delivery of results of the project will be presented to the Metlakatla High School science program as part of an ongoing outreach program. Site evaluations will be conducted on Prince of Wales Island and Metlakatla.

Title: *Optimizing the tumble culture method to improve Pacific Oyster quality, and reduce labor for shellfish farms in Southeast Alaska*

Lead Entity: Ostrea Engineering

Project Location: Juneau

Funding Amount: \$100,000

Project Summary: Optimizing aquatic farm gear to reduce labor and increase oyster growth and yield is a goal for many Alaskan oyster farms. Tumble cages have become a popular culture method in other oyster growing regions, as they improve oyster shape, size and yield while reducing labor for farmers. The tumble cage method has numerous advantages including: 1) harnessing tidal and wave movement to improve oyster shape, 2) mixing oysters within the cages to prevent uneven growth or crowding without the energy requirement of mechanized tumblers, 3) creating an unfriendly environment for sea stars which reduces predation, and 4) reducing labor by lowering the frequency of removing oysters from the water. Previous trials of tumble culture methods in Alaska have been unsuccessful however, due to the turbulent conditions found at many Alaskan oyster farms. These conditions create an "over tumbling" effect where oysters and gear can be damaged. With a collaborative team of engineers, oyster farmers, and a biologist we will design, fabricate, and test Alaska-specific and farm-specific tumble culture gear. We will utilize industry standard SEAPA cages installed in custom fabricated Alaska-capable support structures. Typically cages are suspended in a structure using clips on a line, allowing for a large and uncontrolled range of motion. In order to account for rough conditions at SE Alaskan oyster farms, we have designed a novel method of mounting the cage to the frames that allows us to both dampen and finely tune the cage motion. Caging systems will be tested at three existing oyster farms spread-out throughout Southeast

Alaska, each with a unique location (tidal and subtidal) and limitations for oyster production. Due to the risk, financial, and staffing burden of testing new gear at individual farms. This collaboration with AFDF funding support is crucial to determine the viability and Alaska-specific best practices for this potentially game-changing oyster growing method.

Title: *Developing improved seed of the Pacific oyster for the Southeast Alaska regions*

Lead Entity: Pacific Hybreed

Project Location: Juneau/Little Port Walter

Funding Amount: \$90,723

Project Summary: Oyster farming in Alaska relies on seed produced in hatcheries on the U.S. West Coast which is optimized for performance in lower-latitude conditions. The result is oysters that grow slowly and are prone to mortality at the juvenile stage. To improve the growth and survival of oysters in Alaska farms, we propose to begin a selective breeding program that targets Alaska conditions using controlled genetic crosses and rigorous field assessments of seed performance. Improving seed performance for specific environmental conditions also facilitates the development of broodstock, a critical component for breeding of aquaculture species. In collaboration with NOAA Fisheries scientists stationed at the Ted Stevens Marine Research Institute (TSMRI) and Little Port Walter Research Station (LPW), this proposal responds to the Eligible Project Category: boosting oyster growth at nurseries or farms. In this project, we propose to conduct a series of diallel crosses using established genetic lines of the Pacific oyster, to produce within-species hybrids at the Pacific Hybreed hatchery facility. Genotyped oysters will be conditioned to reproductive maturation and crossed with different genetic lines. The new hybrid lines will be transferred to TSMRI for initial acclimation and data collection. Following a 2-week acclimation period, the hybrid seed will be deployed at LPW in replicated seed cylinders for assessments of growth and survival. In situ environmental parameters will be recorded, in combination with seed performance and genotype data, for development of physiological growth models. The anticipated results obtained from this experimental site will contribute to improved understanding of seed performance in specific cold-water ocean conditions and could result in selection of genetic lines suitable for the Alaska shellfish industry.

Shellfish Enhancement

Title: *Evaluating subsistence shellfish beaches for future enhancement projects*

Lead Entity: Chugach Regional Resources Commission/Alutiiq Pride Marine Institute

Project Location: Seward

Funding Amount: \$28,350

Project Summary: The project aims to evaluate selected subsistence beaches near seven native communities in south central Alaska. The Chugach regional Resources Commission through funding by the Exxon Valdez Oil Spill Project 97-131 conducted extensive beach surveys identifying shellfish populations and biological and water quality factors for beaches identified by local residents as historical sources of shellfish namely cockles, littleneck and butter clams. Those beaches were then seeded and growth and mortality studies continued for several years. This project aims to re-survey these beaches and document changes, if any, and

provide a baseline to determine if the beaches are still suitable for enhancement. Of the original 7 beaches surveyed only three areas near Port Graham, Tatitlek and Chenega were successful with efforts in the 1990's. Updated technology, including enhanced seeding and predator control efforts warrants another look at these beaches and their suitability for robust enhancement. Researchers will use identical techniques employed in 1990 to ensure equal assessment but will also include newer technologies and strategies employed by PSI which conducts similar work throughout the PNW. Once evaluated, beaches will be selected for future outplant/enhancement work. Understanding and analyzing the characteristics of intertidal areas is requisite for building a successful enhancement project.

Title: *Hatchery cultivation of the Pacific razor clam (Siliqua patula)*

Lead Entity: Chugach Regional Resources Commission/Alutiiq Pride Marine Institute

Project Location: Seward

Funding Amount: \$83,300

Project Summary: The purpose of this project is to master the culture of this important commercial species in the hatchery and nursery. This includes broodstock conditioning, hatchery culture techniques for rearing larvae at commercial densities, and developing nursery grow-out procedures. Razor clams are in APMI's basic management plan² and annual management plan that has been approved by the Alaska Department of Fish and Game to conduct this research. Without a source of hatchery seed, razor clams continue to decline and are unlikely to recover (Bishop & Powers 2003). APMI staff produced razor clam seed for an EVOS Project 97131 and again for an ocean acidification exposure study for UAF researcher Miranda Washburn.