

**Proposal #:** 22GAR047-077

**Project Title:** A Regional Effort to Increase Monkfish Domestic Demand Through Product Development and Audience Expansion

**Applicant:** Cornell Cooperative Extension, Marine Program (CCE)

**Priority Addressed** Priority #1 – Promotion, Development and Marketing

**Principal Investigator:** Kaitlyn Boyle, Fisheries Technician, kb557@cornell.edu Cornell Cooperative Extension, Marine Program (CCE); Amanda Dauman, Fisheries Specialist, aml357@cornell.edu; Colleen Coyne, Food Export USA – Northeast, Seafood Program Coordinator, ccoyne@foodexport.org

**Amount:** \$182,076

**Abstract:** Cornell Cooperative Extension, in collaboration with Food Export USA - Northeast and monkfish fishing industry partners, proposes to perform a cohesive Monkfish Marketing, Research, and Development Program. This program will address SK Priority #1 by developing a monkfish market analysis and creating a market development plan that will target domestic markets and customers based on that analysis and input from industry partners. The market development plan will engage all monkfish stakeholders to increase revenue to fishers and increase demand in U.S. domestic markets. This project will engage various community stakeholders to provide new opportunities and strategic planning to advance the longterm success of the monkfish fishery.

**Summary of potential commercial benefits to the fishing community of the research results:**

The primary goal of this project is to increase the financial benefits of monkfish fishing in the Northeast US. Achievement of the goal will increase awareness of this local, yet under-utilized resource, increase demand in domestic markets, and, therefore, incentivize the industry to increase supply to meet that demand. By creating more opportunities in the domestic market for monkfish, the industry will benefit from added economic stability.

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**Proposal #:** 22PIR013-027

**Project Title:** Optimizing economic benefits for fishing communities across the Pacific by enhancing artisanal pelagic fishing through Smart-aFAD networks

**Applicant:** Mariana Islands Nature Alliance

**Priority Addressed** Priority #1 – Promotion, Development and Marketing

**Principal Investigator:** Dalia Hernandez-Ortiz (daliakhernandez@gmail.com)

**Amount:** \$161,000

**Abstract:** Coastal fisheries resources that are vital for many island communities across the Pacific are seriously compromised at many locales. Alternatively, many stocks of more resilient highly migratory pelagic fish species remain today on healthy conditions. Unfortunately, access to those resources by artisanal fishers and local demand remains limited. The present proposal would directly address the pitfalls of declining local fisheries production by enhancing pelagic fishing success/profitability around anchored fishing aggregation devices (aFAD) while at the same promoting local demand for pelagic species. Building upon existing echosounder technologies developed for the industrial fishing fleets and preliminary tests, the current project proposes to: i) enhance Guam's aFAD network with echosounder buoys, so live measures of Smart-aFAD fish biomass and species composition become available to managers and fishers, ii) develop a webbased data-sharing platform to disseminate live-feeds fish biomass and location of aFADs to the fishing community, iii) conduct assessments of aggregating stock dynamics and fishing success to provide novel guidance for improved design of aFAD networks and fishing activities around them that maximizes aggregation potential and fisheries productivity/success, and iv) implement a local awareness campaign aimed at increasing both artisanal pelagic fishing participation and demand for pelagic fish.

**Summary of potential commercial benefits to the fishing community of the research results:**

Guam annual coastal fisheries have an estimated value of US 1.5-2 million. Pelagic fisheries account currently for over 95% of that. Yet, the stock remains underfished, and room for further expansion exists. Our project aims to not only increase the net volume/value of the fishery by supporting increased demand and improving aFAD infrastructure, but to also maximize fisher's profitability and retention of overall value by increasing fishing success. Increased productivity will also open the opportunity to target high-end local markets (e.g. tourism). Last, the project will reduce costs of operating the aFAD program by reducing loss of aFADs.

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**Proposal #:** 22SER004-033

**Project Title:** 'Hybridization in Clams to Achieve Efficiency and Larger Markets'

**Applicant:** Southeastern Seaproducts Inc.

**Priority Addressed** Priority #1 – Promotion, Development and Marketing

**Principal Investigator:** Mark Maynard Sr. Southeastern Seaproducts Inc. CEO/President ,  
marksr@frozenliveshellfish.com

**Amount:** \$ \$294,312

**Abstract:** Northern states have laws that prohibit the marketing of hard clams *Mercenaria mercenaria* measuring less than one inch in shell width. Foreign producers have a monopoly on this lucrative small size market, putting domestic producers at huge economic disadvantages. *M. mercenaria*, the choice commercial clam, is not as adapted to the prolonged hot summer

months in the Gulf of Mexico, which results in mortalities of 50%. *M. campechiensis*, the southern quahog, is better suited for warmer water temperatures but has limitations as commercial shellstock. The project will produce hybrids of *M. mercenaria* and *M. campechiensis*, exempt from the size laws and adapted to the region. This work leverages research conducted from the 1960s through the 2000s by universities in Florida that produced viable hybrids with improved growth and survival traits. While the hybrids were never adopted because of short shelf life, new postharvest technologies unavailable then can increase the shelf life of the hybrids, facilitating the adoption of hybrids by industry. To produce a new production system using hybrid clams, we will develop post-harvest processes for the hybrids, conduct market acceptance studies, and determine economic returns from marketing hybrid clams.

**Summary of potential commercial benefits to the fishing community of the research results:**

The project will result in hybrids with reduced mortality rates, shorter growout periods, and lower production risks and costs. The hybrids will be sold less than one inch in size to Northern States, which is currently not possible with pure *M. mercenaria* clams. This will enable the creation of new marketing opportunities previously unavailable to US producers. We anticipate the creation and realization of a new multimillion-dollar industry based on hybrid clams. This will create new jobs and revitalize coastal fishing towns, simultaneously strengthening the economy and assisting in closing the seafood trade deficit.

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**Proposal #:** 22PIR009-016 (7)

**Project Title:** Development, promotion and marketing of locally caught Alfonsin in Hawaii's seafood market and restaurants

**Applicant:** Pacific Islands Fisheries Group

**Priority Addressed** Priority #1 – Promotion, Development and Marketing

**Principal Investigator:** Clay Tam, PIFG Research Coordinator, [pacificfisheries@gmail.com](mailto:pacificfisheries@gmail.com)

**Amount:** \$ \$163,156

**Abstract:** Alfonsin is an underutilized deep slope groundfish species, *Beryx splendens*, that is incidentally caught in Hawaii's handline fishery targeting deep slope snappers. This project provides development opportunities for fishermen, seafood producers, and restaurants while reducing Hawaii's dependence on imported foreign products. The project addresses SK Priority #1 to support the development, promotion and marketing of US fisheries and seafood products. This project will benefit the Hawaii fishing community by broadening opportunities for fishermen to commercially target a new high value species aimed at supporting local seafood markets and consumers. Project principals will work with local fishermen to deliver alfonsin that will be shared with seafood distributors to test market the local species in restaurants currently using imported alfonsin, also known as kinmedai in Japan. Expanded

business opportunities will be provided through the development and test marketing of locally produced value-added alfonso products that already have consumer recognition through foreign imports. Surveys and evaluation forms will be shared with fishermen, seafood distributors and consumers to assess product potential for fishery development and distribution. Development of an alfonso fishery can provide restaurants with a sustainable local product, promote US commercial fisheries while at the same time reducing the reliance on foreign imports.

**Summary of potential commercial benefits to the fishing community of the research results:**

This project benefits Hawaii's commercial small boat fishery, seafood distributors, producers, restaurants and consumers. Secondary benefits support the local economy by reducing reliance on foreign imports and generating new locally produced seafood and value added products. The fishing community will benefit by being able to target and sell a new high value fish species to seafood distributors that can be provided to their established vendors to supplement or replace foreign imported products. Restaurants and fish markets will have access to fresh local high value fish species and seafood products that align with current efforts to eat local and support Hawaii's diversified economy.

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**Proposal #:** 22AKR002-014

**Project Title:** Increasing Consumer Awareness of and Confidence in the Sustainability of Alaska's Crab Fisheries Marketing Program

**Applicant:** Alaska Bering Sea Crabbers (ABSC)

**Priority Addressed** Priority #1 – Promotion, Development and Marketing

**Principal Investigator:** Dana Rudy – Executive Assistant, Alaska Bering Sea Crabbers, danarudy@alaskacrabbers.org; Bri Dwyer – B. Dwyer Images, bridwyer.images@gmail.com;

**Amount:** \$234,401

**Abstract:** ABSC's Increasing Consumer Awareness of and Confidence in the Sustainability of Alaska's Crab Fisheries project will increase overall knowledge about how the Bering Sea crab fisheries are sustainably managed and how crabbers care for the resource and have a rich history in the industry. Its goal is to combat misinformation that negatively impacts public perception of crabbing. ABSC will work with contractors to develop high-quality images and video footage to be used in social media content as well as create a short film. This campaign develops a robust online presence through social media outlets by showcasing the work of local crabbers and the hardworking families fueling this industry. Collaborative work with crabbers throughout the Bering Sea region, local and national brands that support the industry, and regional restaurants that showcase our products is a key element. The resulting social media campaign will provide insight into our fisheries' sustainability and how strategic use of closures protects the longevity of the crabbing industry. At a time when we are experiencing a decrease

in crab stocks and an increase in negative public perception of commercial fishing, this project provides positive messaging for crabbing communities and for the fishing industry as a whole.

**Summary of potential commercial benefits to the fishing community of the research results:**

ABSC's Marketing Program provides small, independent fishermen with a platform to combat misinformation about crabbing's sustainability and ecological impacts (spread in part by the viral 2021 film, *Seaspiracy*, which negatively affected fisheries worldwide). Public education will increase trust in the industry and demand for crab, resulting in an increase of the market value. Higher product values benefit fishermen and suppliers (such as industry-related clothing manufacturers, gear producers, and seafood distributors) on a regional and national scale. Locally, economies of remote fishing villages such as Dutch Harbor and St. Paul will improve with the influx of cash into their population.

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**Proposal #:** 22WCR017-040

**Project Title:** Del Norte Sea to Market

**Applicant:** Family Resource Center of the Redwoods

**Priority Addressed** Priority #1 – Promotion, Development and Marketing

**Principal Investigator:** Amanda Hixson , Family Resource Center of the Redwoods: Del Norte and Tribal Lands Community Food Council— Food Program Director—  
ahixson@frceredwoods.org

**Amount:** \$278,196

**Abstract:** The COVID-19 pandemic has affected all aspects of the small-scale fisheries sector including fishing, processing, and marketing. Closures of restaurants, processing plants, and disrupted export chains have decreased demand and deflated prices while decreasing access to seafood. Local food networks are rapidly adapting to fill the gap by developing local fish landing facilities and online marketing platforms to build alternative seafood supply chains that provide direct access to domestic seafood. In order to keep working waterfronts viable and small-scale commercial fishermen supported, local processing and marketing infrastructure must be developed to respond to and circumnavigate future supply chain and market disruptions. The Del Norte Sea to Market project is an example of such a response. Through providing commercial small-scale fishermen in the Crescent City harbor district infrastructure to process, store, and market their catch direct to consumer, restaurant, and institution as an alternative to traditional seafood supply chains, it will increase the number of small-scale fishermen selling fish at a premium to the local market, as well as increasing the number of consumers, and pounds of local fish bought and consumed in Del Norte County and the surrounding region.

**Summary of potential commercial benefits to the fishing community of the research results:**

Direct-to-market fish sales bring in nearly five-times the amount of money per pound to fishermen as selling whole-sale to concentrated fish buyers. Moreover, for every dollar spent

on locally-produced food, \$1.70 recirculates throughout the community, stimulating the area economy upon which the fishing community depends for its livelihood, and enabling more consumers to pay premium prices for local catch. While the majority of the small-scale fleet in the CC Harbor District is selling to external buyers, there is a large untapped potential to market to local individuals, restaurants, and institutions that currently buy large amounts of fish from commercial distributors.

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**Proposal #:** 22GAR013-082

**Project Title:** Building Awareness and Demand for Gulf of Maine Seafood through Business Partnerships

**Applicant:** Gulf of Maine Research Institute

**Priority Addressed** Priority #1 – Promotion, Development and Marketing

**Principal Investigator:** Kyle Foley Senior Program Manager, Sustainable Seafood Gulf of Maine Research Institute kfoley@gmri.org

**Amount:** \$296,713

**Abstract:** The Gulf of Maine is home to an abundance of responsibly harvested seafood, but it is often difficult for New England consumers to know whether the seafood they are purchasing has come from our region's waters. At the Gulf of Maine Research Institute (GMRI), we engage with ~80 restaurants, institutions (college dining halls, K-12 schools, hospitals), and grocery stores on sourcing more regional Gulf of Maine seafood. Yet, our business partners need more sophisticated communications tools to ensure their consumers are aware that they have prioritized local seafood and to help them tell the story of the local seafood they sell. We plan to develop a suite of digital assets and communications tools to help our partners increase the volume of regional seafood they sell. We also plan to work with businesses involved in our programs to help them achieve sourcing at least 30% of their seafood from the Gulf of Maine region, and we will work individually with several partners who set goals to source more than 50% of their seafood from the Gulf of Maine. We will continue to help partners make progress beyond those goals after laying important groundwork during this project.

**Summary of potential commercial benefits to the fishing community of the research results:**

Even in New England, much of our seafood is imported, particularly when it comes to groundfish and other finfish. Our goals of garnering specific public commitments from our business partners to source at least 30% of their seafood from this region will directly increase demand for Gulf of Maine seafood, which benefits fishing communities here. Providing our partners with better communications tools to make their customers aware of the local seafood available will also increase awareness of the range of regional seafood they could be eating from the Gulf of Maine. This will benefit fishing communities by creating longer-term markets and demand for the full diversity of regional seafood.

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**Proposal #:** 22WCR006-005

**Project Title:** West Coast Groundfish winning at the retail counter

**Applicant:** Positively Groundfish

**Priority Addressed** Priority #1 – Promotion, Development and Marketing

**Principal Investigator:** Jana Hennig, the Executive Director of Positively Groundfish  
(jana@positivelygroundfish.org)

**Amount:** \$299,870

**Abstract:** The West Coast groundfish fishery has experienced a remarkable ecological recovery since its collapse in 2000. However, the fishery is now struggling with low market demand which causes the fishery to be underutilized and undervalued. The pandemic, which pummeled foodservice and shifted demand to retail, further exacerbated this issue and highlighted West Coast groundfish's weakness in the retail channel. To unlock the full economic potential of the fishery, we need to better understand and address its underperformance in the domestic retail channel. Positively Groundfish thus proposes a project to promote key groundfish species in the retail channel, enhancing their presence in store and online, and improving the shopper experience. The project will focus on promoting MSC-certified Rockfish, Dover Sole, Sablefish and Lingcod in retailers in the three West Coast states. The 15-month long project breaks down into four key work tracks: 1) three retail market research projects to identify specific actionable opportunities to increase sales; 2) a retail staff training and engagement program; 3) a shopper marketing outreach campaign using retailer-owned media; 4) the development of an ecommerce sales kit to help the industry improve groundfish presence in online stores.

**Summary of potential commercial benefits to the fishing community of the research results: :**

This project is designed to increase domestic market demand for West Coast groundfish, and particularly the IFQ trawl fishery that chiefly supplies the retail channel, and bring direct economic benefits to West Coast fishing communities. By addressing the current underperformance in retail, the project will increase harvest volumes, utilization rates, and operational efficiencies (greater economies of scale). And by focusing on non-price sales drivers, the project seeks to also increase price-per-pound and make groundfish less vulnerable to price pressures from imports. Finally, we hope to raise the industry's level of engagement with retailers, especially for smaller players with fewer marketing resources.

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**Proposal #:** 22SER029-031

**Project Title:** Economic Evaluation of Four Shellfish Species to determine Aquaculture Commercial Viability, Break-even Values, and Risk Assessment

**Applicant:** Live Advantage Bait LLC

**Priority Addressed** Priority #1 – Promotion, Development and Marketing

**Principal Investigator:** Nicole Kirchhoff, Live Advantage Bait LLC, nkirchhoff@gmail.com Co-I: Brad Gentner, Gentner Consulting Group, brad@gentnergroupp.com Co-I: Tom McCrudden, Great Florida Shellfish, raiclams@bellsouth.net

**Amount:** \$300,000

**Abstract:** Currently, the Southeast regional clam industry has been growth-limited through unclear costs associated with production and its associated animal production performance, ie. expected time to market, survival, and risk mitigation. This project aims to clarify these unknowns through enterprise budgets. Land-based agricultural extension has long used enterprise budgets to assist farmers in making business decisions. These budgets are constructed for different crops and livestock and are specified for the region. They demonstrate the ideal or optimized budget for various operation sizes and are available for use by individual farmers. “One of the most basic and important production decisions is choosing the combination of products or enterprises to produce. An enterprise is defined as a single crop or livestock commodity that actually produces a marketable product. Examples of agricultural enterprise budgets include; cow/calf, feeder cattle, sheep, corn for grain, corn for silage, etc.” They allow farmers to examine profitability to evaluate routine business decisions like changing species, technologies, increasing outputs, managing crop failure risks, changing inputs or starting a new operation within an existing operation or as a stand-alone operation. It allows the business person or investor to evaluate the break-even point and analyze risk in their production process. By helping the business to evaluate profitability and risk, sustainability and resiliency is improved in the industry.

**Summary of potential commercial benefits to the fishing community of the research results:**

The creation of commodity-specific enterprise budgets will have a direct contribution to the development of a sustainable aquaculture industry by providing peer-reviewed and ground-truthed enterprise budgets for individuals wishing to start or scale up their aquaculture operation and for investors interested in evaluating these investments. The primary outcome of this proposal is to provide the business informatics to engender sound business investments into sustainable aquaculture. The secondary outcome is to examine risk within the industry, its economic costs, and use these enterprise budget models to look at different risk mitigation strategies to insure against crop failure.

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**Proposal #:** 22GAR007-012

**Project Title:** Meet the Fleet: Expanding domestic seafood consumption by connecting the public and fishing communities

**Applicant:** Cape Cod Commercial Fishermen’s Alliance, Inc. (CCCFA)

**Priority Addressed** Priority #1 – Promotion, Development and Marketing



**Principal Investigator:** Melissa Sanderson, Chief Operating Officer  
melissa@capcodfishermen.org

**Amount:** \$147,862

**Abstract:** The Cape Cod Commercial Fishermen's Alliance will leverage a decade of hyper-local public seafood event experience to expand the successful Meet the Fleet model across the region and the country. Meet the Fleet builds knowledgeable seafood consumers who are committed to expanding their seasonal seafood choices, buying local seafood, and supporting working waterfronts. The project will create professional videos and online content to expand the reach of Meet the Fleet events and target younger consumers. The proposed project will create meaningful, personal connections between the fishing community and the general public and seafood loving chefs, de-mystify seafood storage and preparation for the home cook, increase domestic consumption of local, underutilized seafood, and provide templates and guides to transfer and customize the Meet the Fleet model to other regions and fishing communities. The project will directly reach more than 5,000 people and support seafood awareness in more than 50,000 people.

**Summary of potential commercial benefits to the fishing community of the research results:**

The project is designed to increase demand for local, underutilized seafood and increase seafood demand from younger, online consumers. This increase in demand should result in economic returns to U.S. fishermen. Massachusetts fishermen, processors, seafood dealers and retailers will benefit from increased demand for and increased prices for underutilized and local species. Meet the Fleet events build critical public support for maintaining working commercial fishing communities and preserving or even improving working waterfronts. This transferable model will be shared with other regions to replicate Meet the Fleet benefits across the country.

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**Proposal #:** 22PIR008-015

**Project Title:** Development of Mariana Islands Squid (Ika) and Monchong Fishery through Domestic and Regional Marketing and Promotion

**Applicant:** Pacific Islands Fisheries Group (PIFG)

**Priority Addressed** Priority #1 – Promotion, Development and Marketing

**Principal Investigator:** Clay Tam, PIFG Research Coordinator, pacificfisheries@gmail.com

**Amount:** \$229,702

**Abstract:** PIFG completed a two year project assessing the viability of establishing a squid fishery and potential market in Guam and CNMI. The project has shown there exists pelagic squid species that can be caught using traditional squid jigging fishing lures and gear. The project also demonstrated clear market interest in locally produced fresh squid that can supply the islands with fresh island seafood that is favorable over foreign imported products. A

secondary outcome has been the identification of the potential to develop a monchong, sickle pomfret, fishery for export to international markets as a high value fresh seafood product. Monchong is highly regarded a valuable seafood product in Japan but is not locally produced. Monchong is commonly available in the Pacific Islands (Hawaii, Guam, CNMI), but is not targeted as a directed fishery in the Mariana Islands.

This project furthers fishery development in the region by: 1) expanding pelagic squid fishing by making sample squid fishing tackle and display of methods available at fishing tackle stores and 2) shipping and test marketing fresh monchong to Asian seafood markets. Informational materials/video will be produced to support these activities. PIFG will work with project participants to evaluate activities and outcomes.

**Summary of potential commercial benefits to the fishing community of the research results:**

This project benefits Guam and CNMI's small boat fishermen, seafood distributors/producers and tackle suppliers. The fishing community will benefit by being provided practical information needed to participate in an unexploited fishery. Tackle shops will be able to carry new fishing tackle to support the developing squid fishery. Secondary benefits support fishermen, seafood dealers and the local economy by developing a new locally produced and high value exportable seafood product. The local and visitor communities will have access to fresh local high value seafood products that align with current efforts to eat local and support Guam and CNMI's diversified economy.

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**Proposal #:** 22SER003-017

**Project Title:** From Problem to Opportunity — Creation of a Robust Nontraditional Market for Lionfish Byproducts and Protecting U.S. Fish Stocks from the Invasive Lionfish

**Applicant:** Quintessence Marine (QM)

**Priority Addressed** Priority #1 – Promotion, Development and Marketing

**Principal Investigator:** Aarav Chavda, Co-Founder/CEO (aarav.chavda@gmail.com); Roland Salatino, Co-Founder/COO (roland.salatino@gmail.com)

**Amount:** \$299,494

**Abstract:** The invasive lionfish poses a grave threat to Atlantic coral reef ecosystems and important U.S. commercial fisheries. Unchecked by Atlantic predators, a single lionfish will extinguish ~79% of juvenile native life in 5 weeks<sup>1</sup>, consume ~5,000 native fish/year<sup>2</sup>, and facilitate coral suffocation. Today, managing the lionfish invasion at-scale is an economic impossibility: lionfish are small, have low fillet yields, and are expensive to hunt. With 2019 prices as low as \$3.75-5.00/lb in some regions and many cities with no lionfish market whatsoever, fishermen can manage lionfish only in select cities and only on nearby reefs with high densities, so most reefs remain unmanaged. In response, Quintessence Marine (QM) has established the supply chain infrastructure around a new lionfish management fishery that

produces lionfish fillets and lionfish leather, a proprietary, protected product QM has developed from lionfish skins. This project's goal is to bring more demand for lionfish products from the management fishery by gaining acceptance of lionfish leather from the global fashion community. Successfully integrated into the fashion world, lionfish leather would increase lionfish dock prices and expand reef area under active management.

**Summary of potential commercial benefits to the fishing community of the research results:**

Acceptance of lionfish leather within global fashion will create a scalable lionfish management fishery that: (a) creates new revenue streams for fishermen; (b) drives larger catch volumes from adjacent commercial species due to reduced lionfish-driven pressure; (c) adds hundreds of seafood supply chain jobs; (d) builds U.S. capabilities in lionfish management and fish tanning. By creating export demand, this project positions the U.S. seafood industry to better compete in global markets, and by solving an international problem, ultimately this American lionfish management solution can be realized across the Caribbean. This project supports federal 2030 Food Loss & Waste Reduction goals.

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**Proposal #:** 22AKR003-007

**Project Title:** Kachemak Bay Kelp Processing & Distribution Hub: Removing a Bottleneck to Growth of the Alaska Seaweed Industry

**Applicant:** Saltwater Inc.,

**Priority Addressed** Priority #1 – Promotion, Development and Marketing

**Principal Investigator:** Kathryn Carovano, Program Manager, Saltwater Inc.  
[kathryn.carovano@saltwaterinc.com](mailto:kathryn.carovano@saltwaterinc.com); : Co-PI, Evie Witten, Principal, Regeneration North LLC,  
evie1witten@gmail.com

**Amount:** \$297,563

**Abstract:** The goal of this project is to address recognized bottlenecks—lack of processing options and absence of markets-- that inhibit the expansion of the commercial seaweed sector in Alaska, and specifically in Kachemak Bay. Stakeholders at all levels--from growers to buyers to state mariculture staff---all agree that there is a need for expanded processing and marketing capacity for the seaweed mariculture sector to reach its full potential in Alaska. The primary objective of this project is to design and test a Proof of Concept (POC) seaweed processing and distribution “hub” in Homer, Alaska that would serve multiple small farms in the Kachemak Bay region. The project will have the active participation of the mariculture community and will address a significant barrier inhibiting the sector's economic growth. The project aims to promote new business practices that will allow for increased seaweed production, (e.g. centralized processing and distribution), developing new local and regional markets for minimally processed seaweed, and supporting local production of new value-added seaweed products. The project also aims to create new jobs and business opportunities using existing

infrastructure in ways that will contribute to the economic resilience of working waterfront communities in Kachemak Bay.

**Summary of potential commercial benefits to the fishing community of the research results:**

By establishing a seaweed processing and distribution hub to meet the needs of small-scale seaweed farmers, this project has the potential to have both immediate and long-term impacts on both seaweed production and sales. It also holds the promise of creating new partnerships that leverage the use of existing coastal infrastructure, identify new markets, catalyze the development of new local value-added seaweed products, and contribute to a greater public understanding of the benefits of seaweed mariculture in Alaska. If successful, it could also serve as a model for other regions of Alaska and potentially other coastal States facing similar challenges.

relations with the greater community, the media, and sustainable seafood market.

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**Proposal #:** 22PIR005-007

**Project Title:** Collective Grassroots Pathways Toward Restorative Aquaculture: Removing Invasives and Bringing Back Native Species

**Applicant:** Kua'āina Ulu 'Auamo

**Priority Addressed** Priority #1 – Promotion, Development and Marketing

**Principal Investigator:** : Kevin Chang, Executive Director, kevin@kuahawaii.org

**Amount:** \$131,232

**Abstract:** Hawai'i is home to some of the first known aquaculture practices in the Pacific with a celebrated history and abundance generated from loko i'a (traditional Hawaiian fishponds) throughout the islands. Though operators have struggled for decades with declining recruitment of juvenile fishpond species such as 'ama'ama (striped mullet) and awa (milkfish), it is an opportune time to enhance the integration of contemporary aquaculture practices in the ongoing, 800+ year adaptation and innovation of traditional practices. This project aims to accelerate the information exchange about innovative nursery tank systems through an existing network of loko i'a in Hawai'i. This project also includes an outreach event focused on the invasive kanda mullet and its potential as a new seafood product to generate income for loko i'a while simultaneously improving their nearshore ecosystems. As an overarching theme that ties together the workshop and outreach event, this project will generate forward-looking discussions and plans for the socioeconomic sustainability of loko i'a for the current and future generations of kia'i loko (fishpond caretakers, operators, and managers).

**Summary of potential commercial benefits to the fishing community of the research results:**

Successful restorative aquaculture has the potential to yield environmentally compatible socioeconomic benefits, support Native Hawaiian cultural revitalization, increase food diversity

and independence and benefit seafood consumers. At the intersection of these various benefits lies the potential for fishers to commercially profit, through an increased population of cherished food fish such as native 'ama'ama (which had historically thriving fisheries in various locations in Hawai'i), support of a more local and Native Hawaiian cultural diet, and the regeneration of our celebrated ecosystem infrastructure that is foundational to diversifying our economy in Hawai'i.

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**Proposal #:** 22SER031-006

**Project Title:** Ensuring new shark regulations in Puerto Rico lead to a sustainable fishery and accurate landings data in a data poor region

**Applicant:** Mote Marine Laboratory, Inc.

**Priority Addressed** Priority #2 – Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting

**Principal Investigator:** Demian D. Chapman, Ph.D, Sharks and Rays Conservation Program, Mote Marine Laboratory & Aquarium, (954) 552-6595; Raimundo Espinoza, Conservación ConCiencia Inc. San Juan, Puerto Rico, (787) 902-7760

**Amount:** \$234,827.00

**Abstract:** Sharks are overexploited throughout the Caribbean, but the U.S. territory of Puerto Rico has the potential to set the standard for regional shark fisheries management. New regulations allow HMS Commercial Caribbean Small Boat (HMS CCSB) permit holders a daily catch limit of 3 sharks, with species restrictions, to supply a local market for meat. A recently completed SK-project revealed the size (at least ~ 10,000 lb per year) and species composition of this fishery prior to regulation. Sixteen species were identified but the most observed species landed (Caribbean Sharpnose, *Rhizoprionodon porosus*) is now prohibited and the second is prohibited and listed under the Endangered Species Act (the Scalloped Hammerhead, *Sphyrna lewini*). Further, Scalloped Hammerheads are being targeted in their nursery areas. We propose to engage the shark fishing community of Puerto Rico to: (1) obtain post-regulation species- and size composition shark catch data that can be used to assess this fishery and determine compliance with new regulations, (2) map coastal shark habitats and determine species-specific overlap with fishers, and (3) conduct workshops to further improve species identification, socialize the new regulations, facilitate fishers getting HMS CCSB permits, and identify practical ways for them to avoid areas frequented by prohibited species, especially Scalloped Hammerheads.

**Summary of potential commercial benefits to the fishing community of the research results:** Shark fishing supplies a limited local market for affordable meat, suggesting that it could be sustainable and contribute to territory food and livelihood security if managed and focused on relatively productive species. Even though two prohibited species are numerically dominant in

the landings, much of the weight is from legal shark species (mainly Tiger [Galeocerdo cuvier]). The value and food security of benefits of this fishery could be retained if fishers move away from prohibited species. Continued monitoring of landings and consultation with the fishing community is required to help them transition and provide information for assessments and management.

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**Proposal #:** 22GAR009-011

**Project Title:** An examination of softshell clam, *Mya arenaria* L., fecundity along the Maine coast: the influence of clam size, tidal height, season, and geographic region

**Applicant:** Downeast Institute

**Priority Addressed** Priority #2 – Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting

**Principal Investigator:** Brian F. Beal, Director of Research & Professor of Marine Ecology; Downeast Institute, Beals, Maine

**Amount:** \$300,000

**Abstract:** The softshell clam, *Mya arenaria*, fishery has been an iconic cornerstone of Maine's coastal economy for >150 years. Since 1975, commercial landings have declined by 75%, and are correlated directly to climate change and warming in the Gulf of Maine. Fisheries independent data demonstrate that observed declines are due primarily to predation, especially on 0-year class recruits. Recent interest has piqued among fishermen and managers around adjusting the 2-inch minimum size law for softshell clams, and instituting an upper size limit and/or creating spawner sanctuaries. Decisions about implementing new laws hinge on information related to reproductive output in *Mya* that is not readily available. We plan to conduct comparative, manipulative field experiments in three coastal regions along the Maine coast (downeast, midcoast, southwest) over two spawning seasons (April-August 2023 & 2024). This research program will determine: 1) whether reproductive senility occurs in larger/older individuals; and, 2) the role that spatial and temporal variability play in: a) the relationship between clam size and number of eggs; b) the timing and duration of the spawning season; and, c) egg viability as a function of clam size. Coastal communities representing clammers, an association of clammers, shellfish businesses, and state managers are collaborators.

**Summary of potential commercial benefits to the fishing community of the research results:**

As a result of the proposed research, stakeholders in the fishing community will benefit from hands-on participation as well as obtaining biological information to allow informed debate and discussion of the merits, or lack thereof, of instituting new rules, regulations, and laws to promote sustainable softshell clam production. Specifically, should results suggest that reproductive senility does not occur in softshell clams, instituting a maximum size limit could enhance reproductive capacity of the softshell clam population with subsequent increases in

recruitment and commercial landings, as has been the case with some populations of European and North American crustaceans.

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**Proposal #:** 22WCR010-034

**Project Title:** Sustaining long-term yield of the Puget Sound Dungeness crab fishery by accounting for complex mixed-stock population structure

**Applicant:** Western Washington University

**Priority Addressed** Priority #2 – Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting

**Principal Investigator:** Dr. James Dimond, Western Washington University (WWU) Research Assistant Professor; Email: dimondj2@wwu.edu; Co-Principal Investigators: Dr. Katelyn Bosley, Washington Department of Fish and Wildlife (WDFW); Email: katelyn.bosley@dfw.wa.gov; Sarah Grossman, Swinomish Indian Tribal Community (SITC); Email: sgrossman@swinomish.nsn.us; Dr. Elizabeth Tobin, Jamestown S’Klallam Tribe (JST); Email: etobin@jamestowntribe.org

**Amount:** \$298,657

**Abstract:** Several lines of evidence suggest that the Puget Sound Dungeness crab fishery may be composed of multiple genetically differentiated populations. Meanwhile, numerous threats to the fishery indicate that a laissez-faire management approach is imprudent. The proposed research will determine if Puget Sound constitutes a genetically differentiated, mixed-stock Dungeness crab fishery. Genomic analyses of adult and larval crabs from throughout the region will test for population structure and evaluate the sources and sinks of gene flow. The project will then use research results to determine if the existing spatial management framework aligns with biological data. Current management schemes will be evaluated in context of new biological understanding, fishery priorities will be identified, and alternative management approaches will be evaluated in collaboration with state and tribal fishery managers and industry stakeholders. The project will be highly collaborative, engaging numerous state, tribal, academic, industry, and citizen partners through established regional monitoring efforts and stakeholder workshops of the Pacific Northwest Crab Research Group. The ultimate goal is to strengthen the existing fishery and benefit the fishing community by using the best available science to ensure a sustainable management framework that maintains or increases long-term fishery yields.

**Summary of potential commercial benefits to the fishing community of the research results:**

The goal of the proposed research is to prevent fisheries closures and further declines in Puget Sound Dungeness crab populations and fisheries by facilitating biologically-based optimal harvest strategies that maximize long-term yield. An appropriately managed fishery that

sustains a balanced and robust 'portfolio' of individual crab stocks will produce greater long-term harvest yields while also being more stable and capable of weathering change.

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**Proposal #:** 22PIR015-025

**Project Title:** Mitigating shark depredation in Guam fisheries

**Applicant:** University of Hawaii, Hawaii Institute of Marine Biology

**Priority Addressed** Priority #2 – Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting

**Principal Investigator:** Dr. Carl Meyer

**Amount:** \$251,799

**Abstract:** Shark depredation causes significant economic losses for the Guam fishing community. Finding effective ways to reduce shark depredation requires a detailed understanding of the phenomenon including the species involved and how sharks behave during depredation events, and how shark abundance varies over time on fishing grounds. We propose using a combination of novel transfer DNA analysis of depredated fishes and underwater cameras to provide insight into species composition and behavior of sharks interacting with Guam fisheries. Fishers will be trained as citizen scientists to use simple DNA swab kits and line cameras to unequivocally identify the shark species depredating their catches and gain clear insight into how depredation events unfold. We will track sharks captured at fishing sites to determine their patterns of visits to these locations. This information will be used to identify potential mitigation strategies to reduce depredation losses.

**Summary of potential commercial benefits to the fishing community of the research results:** Reducing shark depredation losses will increase profit margins for the fishing community.

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**Proposal #:** 22SER030-045

**Project Title:** Maximizing utility of eye lens core isotopic information for fisheries management: ageing validation, natal origins, and ontogenetic habitat shifts of reef fishes across the southeastern U.S. and U.S. Caribbean

**Applicant:** University of South Carolina

**Priority Addressed** Priority #2 – Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting

**Principal Investigator:** Virginia Shervette (shervette@gmail.com) and Jesús Rivera Hernández, University of South Carolina; Scott Van Sant, NMFS Wilmington; Kate Overly, NMFS Panama City; Julie Vecchio, FWCC, St. Petersburg; Allen Andrews, Age and Longevity Research Laboratory



**Amount:** \$299,962

**Abstract:** Over the past 40 years, analysis of archival biological structures of fishes, such as otoliths, has developed into a useful tool in the advancement of fisheries sciences and continues to provide critical information in support of sustainable fisheries management. Through the analysis of chemical components recorded in calcified and non-calcified structures of fisheries species, researchers have obtained valuable insights concerning longevity, movement and migration patterns, natal origins, stock structure, and ontogenetic shifts in diet. Reef-associated fishes have supported fisheries across the southeastern U.S. and the U.S. Caribbean for centuries. Regional Fisheries Management Councils cannot effectively accomplish their goals related to sustainable fisheries management without assessing species. Age is the fundamental parameter to estimate population dynamics, with otolith analysis providing age estimates of bony fishes via reads of alternating translucent and opaque zones in otolith thin sections. There is a premium on validation of age estimation for fishes that support commercial and recreational fisheries. Length-at-age data are essential for conducting rigorous stock assessments; age is the critical and most influential biological parameters because it forms the basis of determining growth and mortality rates. Annual opaque zone formation in otoliths has not been directly validated for many southeastern U.S. (SEUS) populations of important fisheries species. We successfully developed a region-specific bomb  $^{14}\text{C}$  time series for the northern Caribbean and applied it using eye lens cores to directly validate age estimation for U.S. Caribbean populations of over 10 reef fish species. We will utilize a similar method to develop the bomb  $^{14}\text{C}$  chronometer for the SEUS region then validate age estimation for greater amberjack, hogfish, black grouper, and blueline tilefish, several of the important fisheries species with no such information.

Stable isotope analysis (SIA) in eye lens cores of marine fisheries species is currently utilized as a novel approach to determine natal origins and connectivity of populations among habitats and regions. The larval/postlarval period of reef-associated continental-shelf fishes lasts from a few weeks to months and is critical to survival. During this period, fish may travel long distances from spawning to juvenile and adult habitats. We will explore the utility of stable isotope ratio information obtained from eye lens cores in elucidating natal origin, ontogenetic habitat shifts, and population connectivity of fisheries species between/among SEUS waters, south Florida waters, and the U.S. Caribbean. This portion of our study will focus on three species: silk snapper, graysby, and queen triggerfish. The eye lens core SIA results for each species will be analyzed in relationship to geographic origin of the region of collection and trends across regions evaluated in relation to life history patterns. Concurrent studies are underway examining the population genetics of each of these three species between/among the regions and findings will help to inform SIA results and refine future questions. Objectives: 1) Establish a region-specific bomb  $^{14}\text{C}$  chronometer for waters of the SEUS (Florida through North Carolina); 2) Document isoscape patterns of the SEUS and utilize  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  from eye lenses to explore their potential in elucidating natal origins, ontogenetic shifts in habitat, and population connectivity in SEUS, south Florida, and north Caribbean waters; 3) Employ the SEUS region specific bomb  $^{14}\text{C}$  time series to validate age estimation for greater amberjack, hogfish, black grouper, and blueline tilefish from

the region using otoliths and eye lenses; and 4) Evaluate 14C results from lens and otolith cores of the same individuals across a broad range of species with varying differences in spawning strategies, larval period diet sources, and early life history patterns in habitat use.

**Summary of potential commercial benefits to the fishing community of the research results:**

The proposed work addresses Priority # 2 in multiple essential ways. First, it will directly impact commercial and recreational fisheries through the development of science and technology by establishing a region-specific bomb 14C time series for the SEUS that will be utilized to validate ageing for multiple fisheries species and will continue to be used for ageing validation work of additional species in the future. This will benefit the fishing community directly by ensuring the sustainable management of these fisheries. We will work directly with local seafood dealers, charter boat captains, and commercial/recreational fishers to obtain samples and will continue to collaborate with seafood industry personnel to educate people in the regions on the research outcomes. Second, the eye lens cores SIA for silk snapper, queen triggerfish, and graysby will be evaluated in understanding natal origins, ontogenetic habitat shifts, and connectivity for populations between/among regions (SEUS, north Florida, and U.S. Caribbean), especially as relates to differences in life history strategies. Fishers in the U.S. Caribbean and SEUS will directly collaborate with us on the collection of samples for this and assist in outreach for educating the public on our findings.

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**Proposal #:** 22WCR002-006

**Project Title:** Development and Demonstration of Economically Viable Ropeless Fishing Systems for Single-Line Trap Fisheries

**Applicant:** Sub Sea Sonics

**Priority Addressed** Priority #2 – Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting

**Principal Investigator:** Dr. Bart Chadwick, bart.chadwick@subseasonics.com

**Amount:** \$243,009

**Abstract:** Our conservation engineering proposal is focused on providing economical ropeless fishing systems to support the sustainability of single-line trap fisheries. This directly addresses the 2022 SK Competition as outlined in Section I.B Priority #2 which calls for “the development of science and technology-based projects that lead to the strengthening of existing, or the creation of new markets and opportunities in U.S. fishing communities.” Sustainment of these fisheries in the face of restrictions related to marine mammal entanglements requires access to the ropeless technologies that minimize these risks. However, most of these technologies have been developed with a focus on deep water, multi-trap trawls with commensurate high levels of sophistication and cost, leaving them out of reach to the inshore single-line trap fisher. Singleline trap fisheries such as crabs, lobsters, shrimp, crayfish, fish, and whelks represent a

broad swath of both the commercial and recreational fishing economy, and are generally conducted by individual or family operations that do not have the resources to capitalize, operate and maintain expensive and complex ropeless systems. To preserve and strengthen these fisheries for the future, simple, low-cost ropeless fishing technologies are required that do not put an undue burden on the single-line trap fisher.

**Summary of potential commercial benefits to the fishing community of the research results:**

Availability and introduction of low-cost ropeless fishing technologies into these fisheries has the potential to provide significant commercial benefit. These benefits stem primarily from the ability this technology will provide to fish in areas and during times that would otherwise be closed to fishing. In addition, there is a growing awareness and demand for sustainably harvested and whale-safe seafood products, and products with these characteristics can have a significant market advantage compared to products harvested using traditional methods. Simple, low-cost ropeless fishing technology can provide these opportunities, while at the same time significantly reducing the entanglement risk for marine mammals.

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**Proposal #:** 22SER005-035

**Project Title:** Demonstrating effectiveness of a microprocessor-based shark bycatch reduction device (BRD) in longline fisheries using an academic-industry partnership

**Applicant:** North Carolina Sea Grant College Program at NC State University

**Priority Addressed** Priority #2 – Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting

**Principal Investigator:** : Sara Mirabilio, MSc, fisheries extension specialist, NC Sea Grant, semirabi@ncsu.edu

**Amount:** \$263,283.00

**Abstract:** Reducing shark bycatch in the pelagic longline (PLL) fishery is a NOAA Fisheries management priority; several species unintentionally caught are overfished and/or experiencing overfishing. In the U.S. Atlantic PLL fishery these shark species include: scalloped hammerhead (*Sphyrna lewini*), dusky (*Carcharhinus obscurus*), sandbar (*Carcharhinus plumbeus*), and blacknose (*Carcharhinus acronotus*). For industry, shark bycatch has financial implications including reduced target catches, gear damage or loss, and increased gear retrieval times. We have data supporting the hypothesis that weak electric stimuli generated by a microprocessor-based bycatch reduction device (M-B BRD) will reduce shark bycatch in longline fisheries. A National Sea Grant Office award (NA19OAR4170413) funded manufacture of the first field-ready, M-B BRD. Fifteen days of commercial bottom longline cooperative research resulted in the total capture of 141 sharks (across nine species) but with only 34 of those individuals on hooks near a M-B BRD emitting an electric field. This represents greater than a 50 percent reduction in shark catch on hooks near a M-B BRD emitting an electric field. While

these field trials demonstrated the viability of a microprocessor-based device, modifications and industry trials are crucial to move towards a commercial-ready product and broad PLL fishery application.

**Summary of potential commercial benefits to the fishing community of the research results:**

Shark bycatch is a significant problem in longline fisheries worldwide. We contend shark bycatch can be reduced by taking advantage of the unique sensory biology of elasmobranch fishes, specifically their exceptional ability to perceive electric fields of less than five nanovolt per centimeter. Using a M-B BRD, this reduction could be accomplished without imposition of time-area closures, significant gear modifications, or mandated hook types; and, with little or no effect on catches of non-electro sensitive target teleost fishes (e.g., swordfish and tunas). We have survey data documenting that PLL operators are motivated to use effective and affordable shark BRDs.

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**Proposal #:** 22GAR023-086

**Project Title:** Incorporating Markets into Models: Charting the Pathways to Resilience in New England Seafood Supply Chains

**Applicant:** : University of Massachusetts Dartmouth

**Priority Addressed** Priority #2 – Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting

**Principal Investigator:** Gavin Fay, Department of Fisheries Oceanography, School for Marine Science and Technology, University of Massachusetts Dartmouth, [gfay@umassd.edu](mailto:gfay@umassd.edu)

**Amount:** \$286,302

**Abstract:** The purpose of the work is to improve relevance and impact of fisheries management decisions by incorporating New England seafood supply chain considerations into strategic decisionmaking. Global climate change, trade disputes, pandemics, and regulatory change can create abrupt and long-term shocks in supply and demand for New England caught species. Using data synthesis, informant interviews, and participatory modeling with an advisory group of industry and business members, we will develop a supply chain model for New England seafood. We aim to understand how the pathways seafood products take may (or have) change with systemic shocks, and identify opportunities to strengthen supply chains in New England communities, including providing access to seafood to communities and food distribution systems that have previously found seafood difficult to access. We will build upon data from the New England State Food System Planners Partnership's efforts to have thirty percent of New England's food be produced in New England by 2030. We will pair our supply chain model with fishery ecosystem models to develop indicators of supply chain structure and dynamics, to show how changes in availability and abundance of seafood species could be translated to positive outcomes for food security and the regional economy.

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**Summary of potential commercial benefits to the fishing community of the research results:**

Understanding how the structure of seafood supply chains and marketing solutions contribute to the ability to adapt to shocks can help promote stability and productivity of fisheries and aquaculture by identifying strategic solutions to ensure markets can pivot in the face of systemic change. By filling the gaps and illustrating current pathways our locally harvested species follow to get to end-consumers, our project will provide a framework to highlight for food systems planners and seafood purchasers opportunities to increase regional consumption of locally harvested seafood, and boost efforts for stronger seafood markets and more vibrant local New England food systems.

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**Proposal #:** 22WCR001-008

**Project Title:** Investigating seasonal nearshore dynamics of Pacific sardine in California

**Applicant:** CWPA ~ California Wetfish Producers Association

**Priority Addressed** Priority #2 – Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting

**Principal Investigator:** Joel Van Noord, Supervisory Research Biologist, CWPA,  
joel.van.noord@gmail.com

**Amount:** \$298,473.00

**Abstract:** The “Pacific sardine is one of the top ten highest valued commercial fisheries in California.”<sup>1</sup> But declining stock assessments precipitated closure of the directed sardine fishery in 2015. In 2019, “northern” sardines were declared “overfished,” curtailing the allowed incidental catch rate. This also curtailed fishing for species that school with sardines, inflicting serious impacts on industry. Stock assessment scientists hypothesize two sardine stocks on the West Coast: northern (NSP) and southern (SSP), separated by 16.7°C sea temperature (SST). The Pacific Fishery Management Council (PFMC) manages only the ‘cold water’ NSP, but counts all sardines landed in California as NSP regardless of the SST. Stock assessments for NSP based on annual NOAA Acoustic Trawl (AT) surveys now omit sardines estimated to be in water above 16.7° C SST. A report<sup>2</sup> also noted that assessments excluding the nearshore area would be negatively biased. To address this, NOAA and industry have initiated a collaborative nearshore survey using fishing boats to expand acoustic and biological sampling. However, aerial surveys and California fishermen have reported thousands of tons of sardines yearlong inshore of NOAA’s summer surveys, questioning NMFS’s declaration of NSP sardines as overfished and the use of 16.7°C to separate NSP from SSP. The goal of this project is to collect and analyze historical and current biological and landings data yearlong, bi-monthly observations and monthly samples from purse seine fishing and live bait catches, to test the hypothesis that NSP and SSP sardines, particularly sardines inshore of NOAA surveys, can be accurately separated by their association with 16.7°C SST using morphological (e.g. length, weight, age, vertebral count)

and biological metrics. The outcome will enhance understanding of stock structure and may lead to increased fishing opportunities.

**Summary of potential commercial benefits to the fishing community of the research results:**

This project addresses a sardine management conundrum: the fishery was closed due to perceived low biomass estimates, but the quantity of nearshore fish and mixing between the NSP and SSP are unknown. Benefits include chartering fishing boats and organizing fishermen and processors as “citizen scientists” to document observations of sardine yearlong. This will enhance understanding of stock identity. Improved assessments of NSP above the “overfished” level would increase sardine incidental catch rates, allowing fishing for other ‘mixed school’ coastal pelagic species (CPS). Data also provide information to assess the presence of SSP in California, potentially leading to future Council management of a fishery for the SSP.

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**Proposal #:** 22SER014-066

**Project Title:** Whale-Safe Alternatives to Closures of Black Sea Bass Pot Gear in the Southeast US

**Applicant:** Sustainable Seas Technology, INC

**Priority Addressed** Priority #2 – Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting

**Principal Investigator:** Kim Sawicki (PI)-Sustainable Seas Technology, Ocala, FL, kims@sustainableseastechnology.org; Co-PI- Robert Griffin, UMASS-Dartmouth, rgriffin5@umassd.edu

**Amount:** \$299,999

**Abstract:** The critically endangered North Atlantic right whale (NARW) uses SE inshore waters as winter calving grounds and transit areas. Historically, black sea bass (BSB) pot fishing in the southeast US took place inshore during winter, when cooler water temperatures increased the quality of BSB and provided the highest yields. Vertical end lines & buoys, such as those used in this fishery, present entanglement risks to whales and sea turtles. Adopting subsea buoy retrieval systems (SBRS), or "ropeless" systems, could allow fishers to utilize preferred inshore fishing grounds when BSB is most plentiful and of the best quality, and whales are present. Project partners from three states will test approved gear during the winter closure period in specific "experimental fishing areas" to provide a more detailed performance analysis of the devices and an economic effectiveness analysis of various gears and configurations. We will determine best practices for the successful use of SBRS in this fishery during hands-on fishing and trials with our fishing partners. This project will expand a smaller project in Georgia to include other fishers from the SE region with varying fishing styles and will produce valuable information required to adopt these gears regionally.

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**Summary of potential commercial benefits to the fishing community of the research results:**

Spatial and temporal closures of preferred inshore BSB pot fishing grounds were implemented to reduce entanglement risk to NARWs, which has led to a decline in effort & landings of BSB from the fishery in recent years. This project expands our funded Georgia Sea Grant project to examine if this fishery can adopt SBRs to reestablish a safe, productive, and economically profitable BSB pot fishery while maintaining negligible entanglement risk for whales. The project will provide information critical to risk reduction planning and an economic decision-making framework that can be extrapolated to other global fisheries facing similar conflicts.

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**Proposal #:** 22GAR040-097

**Project Title:** Fishing SMELTS' Lift Bag Ropeless/Buoyless Gear in the Gulf of Maine with Commercial Fishermen

**Applicant:** SMELTS Sea Mammal Education Learning Technology Society

**Priority Addressed** Priority #2 – Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting

**Principal Investigator:** : Richard Riels, Founder and Executive Director, info@smelts.org, Sedro Woolley, WA 98284, (360) 303-9338 Co-Principal Investigator: Kevin Rand, SMELTS Director of East Coast Operations smelts.org@gmail.com, Plymouth, MA

**Amount:** \$ \$297,217

**Abstract:** SMELTS invented, patented, developed and produced the SMELTS ropeless lift bag fishing gear specifically to maintain sustainable fisheries operations. This gear enables fishermen to harvest their catch during closures associated with the critically endangered North Atlantic Right Whale (NARW). SMELTS ropeless gear addresses potential gear conflicts by incorporating unique smart buoys, acoustic modems and Directional Acoustic Transponder (DAT) technology in the design. The DAT and acoustic modem allow for easy retrieval and subsea acoustic marking so fishermen and regulators can mark, locate and retrieve the gear. With the S-K Program funds SMELTS will build and provide 10 Lobster Rafts and technical support to partner commercial fishermen at no cost to them, providing direct economic benefits. Data on efficiency, usability and effectiveness will be collected (including set and haul times) and compared with traditional buoy line gear. This data will be used for continuous development of this technology with the advisory of the commercial fishermen. The results of this project will show the economic benefits to the fishermen and coastal communities, the effectiveness of the gear in commercial fisheries and how well the new marking technology works for reducing potential gear conflicts all while removing potential for marine mammal entanglements.

**Summary of potential commercial benefits to the fishing community of the research results:** : SMELTS' ropeless lift bag fishing gear resolves the issue of persistent vertical lines in the water

column; these lines can negatively impact marine mammals like the critically endangered NARW. Conservation management closures cause a financial burden to fishermen and coastal towns, the fishing industry supports the working waterfronts and attracts visitors and residents alike to eat local seafood, shop at nearby stores and stay at local accommodations. SMELTS' technology provides large economic benefits as it will allow bottom set fishing during conservation closures, allowing commercial fishing to continue to thrive throughout the year, while protecting marine mammals

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**Proposal #:** 22SER016-068

**Project Title:** "A novel trap accessory that reduces bycatch and marine debris while improving lost trap recovery"

**Applicant:** The Florida International University Board of Trustees

**Priority Addressed** Priority #2 – Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting

**Principal Investigator:** Dr. Mark Butler, Institute of Environment, Department of Biological Sciences, Florida International University, North Miami, FL 33181; Email: mbutleri@fiu.edu; Dr. Norman Munroe, Department of Mechanical and Materials Engineering, Florida International University, Miami, FL 33174; Email: munroen@fiu.edu

**Amount:** \$291,932

**Abstract:** Perhaps the most damaging consequence of trap fisheries is the production of derelict fishing gear including lost "ghost" traps. In the Florida spiny lobster fishery alone, where the proposed project is focused, ~ 80,000 traps are lost per year (18% of all traps) - even more after hurricanes. The direct cost of trap loss to fishers is \$2–12M per year (depending on hurricanes), not to mention lost fishing opportunities. The ecological consequences of derelict traps are equally shocking. A recent study in the Florida lobster fishery revealed that >30M fish and macroinvertebrates are killed annually in lost traps, as are ~650,000 lobsters. Some fisheries have instituted derelict trap removal programs or mandated trap escape gaps, but those efforts do not help fishers recover their lost traps. We have designed a novel, inexpensive trap accessory that offers a "win-win" solution to the ghost trap problem. At the end of the fishing season the accessory releases a floating trap slat that: (a) creates an opening in the trap to minimize bycatch, and (b) allows the trap to be recovered by fishers. We propose to finish development of the accessory and conduct rigorous tests of its efficacy with fishers under real-world conditions.

**Summary of potential commercial benefits to the fishing community of the research results:**

The impacts of this project on the Florida lobster and stone crab fisheries and their sustainability are potentially enormous. Research indicates that the direct cost of trap loss to lobster fishers is \$4M-\$15M per year; another \$6M/yr is lost due to mortality of lobsters



entrapped in derelict traps. The Florida stone crab fishery is even larger than for lobsters, but the economic and environmental costs of lost crab traps are not known. Ghost traps kill tens of millions of nontargeted species each year - a massive detriment to environmental sustainability and public perception of fishery practices.

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**Proposal #:** 22AKR007-010

**Project Title:** Stock Assessment of Giant Red Sea Cucumber (*Apostichopus californicus*) in Prince William Sound to Determine the Potential for a Commercial Fishery

**Applicant:** Alaska Department of Fish and Game

**Priority Addressed** Priority #2 – Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting

**Principal Investigator:** Janet Rumble

**Amount:** \$257,912

**Abstract:** Prince William Sound (PWS) supported lucrative fisheries for crab and shrimp prior to the Exxon Valdez oil spill in 1989. Subsequent declines in these populations have resulted in lost earning and employment opportunities for Prince William Sound communities. Recent positive abundance trends of shrimp and Tanner crab rekindled interest in developing fisheries on unexploited populations to supplement residents' incomes and stabilize communities economically. We are proposing to explore the potential for a new giant red sea cucumber fishery.

Economic benefits from commercial giant red sea cucumber fisheries in bordering regions have been high. The results of this research have the potential to provide commercial benefits to the fishing communities of the Prince William Sound region. Southeast Alaska has the most lucrative commercial fishery for giant red sea cucumbers; the 2019/2020 season set a record with estimated ex vessel value of \$11.6 million. There has been a steady seasonal increase following the 2016/2017 season of \$5.3 million with multiple processors participating. Kodiak's commercial fishery has a more modest economic value with an average annual ex vessel value of \$508,444 for the last 9 seasons with up to 4 processors participating seasonally.

Development of a sustainable and economically valuable commercial giant red sea cucumber fishery in Southeast Alaska has been accomplished with a partnership between industry and the Alaska Department of Fish and Game (ADF&G). A method of stock assessment using SCUBA diving has been established, scientifically reviewed, and supported. Industry has provided in-kind services to identify areas for ADF&G to explore using standardized stock assessment tools. Alaska State Statute 16.40.240 allows the commercial giant red sea cucumber fishery participants to tax their product and use these taxes to fund ADF&G giant red sea cucumber assessment. ADF&G would like to use this existing framework to assess and potentially develop a commercial giant red sea cucumber fishery in PWS, if a harvestable surplus exists.

**Summary of potential commercial benefits to the fishing community of the research results:**

This fishery could benefit the residents of PWS and surrounding communities by providing jobs commercially harvesting and processing giant red sea cucumbers and provide revenue to businesses supporting these activities. These businesses would include water and electricity utility companies, grocery stores, harbor facilities, companies that sell fuel, fishing supplies, SCUBA diving gear, and other necessary equipment. This kind of positive economic impact could add income to participating fishers which in turn could allow people to remain and prosper in smaller communities in PWS. Diversification of the PWS fishing fleet is necessary to be economically feasible and it is common for fishers to participate in multiple fisheries due to fluctuations in the market and also abundance of other commercially harvested species.

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**Proposal #:** 22PIR012-006

**Project Title:** Collaborative Fishing Community Assessment for Sustainable Management of the Coral Reef Fishery in the Commonwealth of the Northern Mariana Islands

**Applicant:** University of Hawaii at Manoa

**Priority Addressed** Priority #2 – Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting

**Principal Investigator:** Dr. Erik C. Franklin, Ph.D., Associate Research Professor Email: erik.franklin@hawaii.edu

**Amount:** \$269,329

**Abstract:** Coral reef fisheries in the U.S. Pacific Island region represent a critical resource for the livelihoods and food security of island fishing communities. In the Commonwealth of the Northern Mariana Islands (CNMI), the coral reef fishery has commercial and non-commercial sectors that target multiple species using multiple gears, active on all inhabited islands of the archipelago. Unfortunately, many of the species targeted by the fishery lack reliable catch and effort data or sufficient life history information such as age, growth, maturity, and reproduction. This data deficiency is coupled with a lack of local institutional capacity to perform stock assessments which has led to a need for better scientific information to manage these fisheries. To support a sustainable coral reef fishery in the CNMI, we propose to train and work collaboratively with the local fishing community and territorial fishery agency to identify 5 fish species in the catch that represent dominant catch components and/or those vulnerable to overfishing. Using the FishPath tool, we will lead community-based meetings to utilize the “best scientific information available” for decision-making, develop institutional assessment and management capacity among the local fishing community and fishery agency, and generate stock assessments and fishery harvest advice for these data-limited species. For species that lack life history information, we will generate those data to supplement existing information. This project will provide science that promotes sustainable seafood production and harvesting in the CNMI.

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**Summary of potential commercial benefits to the fishing community of the research results:**

The coral reef fishery of the CNMI represent a complex blend of commercial, recreational, cultural, and subsistence catches which currently require updated stock assessments and a fishery management strategy. Given the importance of the coral reef fish fishery in the CNMI, the lack of assessment information for the stocks is a major concern to the fishery sustainability in the region (Western Pacific Regional Fishery Management Council Annual Stock Assessment and Fishery Evaluation Report: Mariana Archipelago Fishery Ecosystem Plan 2018). There is a critical need to develop conservation measures for coral reef fishes in the CNMI that are now classified as Ecosystem Components Species (ECS), meaning that they are highly unlikely to be assessed by NOAA stock assessment programs. Thus, the proposed work also directly addresses Island Fisheries Research Priority #2 “Develop and define objectives for target ECS reference points” of the Western Pacific Regional Fishery Management Council (WPRFMC) Five-year Research Priorities under the MSRA2020- 2024. The project will work with the local fishing community and the CNMI Division of Fish and Wildlife (DFW) to apply the FishPath tool to guide the development of data limited stock assessments and determine a community-focused fishery management strategy for five dominant catch components and/or vulnerable fish species in the coral reef fishery of the CNMI. The project will also engage with the Western Pacific Regional Fishery Management Council’s archipelagic plan team for the CNMI and the NOAA NMFS Pacific Islands Fisheries Science Center (PIFSC). The project and outcomes should generate a community-led effort to identify practical and effective fishery management strategies for the species targeted by the coral reef fishery of the CNMI.

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**Proposal #:** 22WCR014-001

**Project Title:** Development of Chemosensory-based Control Methods to Reduce Losses of Commercial Oyster Stocks by Oyster Drills.

**Applicant:** Nereus Laboratories Inc

**Priority Addressed** Priority #2 – Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting

**Principal Investigator:** Sang-Seon Yun, Ph.D. Chief Scientist, syun@nereuslabs.com,

**Amount:** \$297,500

**Abstract:** Predation by the two oyster drills, the Japanese drills and the Eastern drills, has had very detrimental effects on oyster stocks in the West coast, causing astronomical economic damage to the oyster industry in the West coast and other marine ecosystems in the USA. Various control strategies have been developed and implemented with limited success. There is an urgent need to develop a novel strategy with minimal environmental impacts to overcome challenges associated with oyster drill predation. The proposed work is to advance our knowledge of chemosensory biology in oyster drills, which can be used to develop an environmentally friendly, effective control tool for oyster drills. In this project, four objectives

were identified to achieve the goal, including: 1) Characterize oyster drill chemosensory behaviors mediating feeding and aggregation; 2) Isolate and characterize chemosensory cues/chemical attractants mediating behavioral responses in oyster drills; 3) Develop a chemosensory based control tool to remove oyster drills or disrupt their life cycles; 4) Conduct field tests to evaluate the utility of the tool for oyster drill control. The scientific information about the chemical cues mediating critical life history behavior will greatly promote oyster growers' efforts to protect and maintain their oyster

stocks.**Summary of potential commercial benefits to the fishing community of the research results:** The oyster drill control strategies resulting from the proposed research will offer oyster growers and fisheries managers a practical tool that can be used to minimize economic and ecological losses incurred by oyster drill predation in the West coast. Once successfully developed and implemented, the novel strategy based on chemosensory biology of the pest organisms will remove one of the biggest obstacles in the sustainable growth of oyster industry worldwide. Therefore, commercial oyster growers and tribal/government fisheries managers will greatly benefit from such an innovation in sustainable production of oyster products in the face of environmental changes.

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**Proposal #:** 22GAR035-098

**Project Title:** Biotechnology to enhance oyster seed production in shellfish aquaculture industries

**Applicant:** Virginia Institute of Marine Science

**Project Type:** Aquaculture (Under Priority #2)

**Principal Investigator:** Dr. Bongkeun Song, songb@vims.edu

**Amount:** \$299,857.00

**Abstract:** The eastern oyster (*Crassostrea virginica*) is an important economic resource for the Atlantic and Gulf coasts of the U.S. Increased production of larvae will enhance the economic gain and sustainability of commercial oyster hatcheries. The overarching goal of this project is to develop a method that is easily adaptable and applicable to shellfish hatcheries, one which provides a biopolymer poly- $\beta$ -hydroxybutyrate (PHB) as a prebiotic to improve larvae and seed production in hatchery systems. With the promise of our previous studies, this project will determine the effects of PHB feeding on *C. virginica* larval microbiomes and the prebiotic potential of PHB by conducting five different experiments combined with monitoring larval growth and survival and testing vibriosis resistance. We expect to identify the most effective parameters enhancing *C. virginica* larvae and seed production. Metabarcoding analysis of 16S rRNA genes in larval microbiomes will be conducted to determine the increase of beneficial bacterial taxa in the families of Alteromonadaceae and Rhodobacteraceae, which were recognized as the core microbiomes of healthy oyster larvae in our previous studies. A cost

benefit analysis will be performed to evaluate the economic benefits of the PHB feeding in shellfish hatcheries.

**Potential Commercial Benefits to the Fishing Community of the Research Results:** Oyster aquaculture is a multi-million dollar industry in the Chesapeake Bay and a billion dollar industry worldwide. The mortality of oysters prior to reaching market size is a constant economic problem. The hatchery stage of production represents a particular bottleneck. Commercialization of a methodology to reduce hatchery mortality would be highly beneficial, since high mortality of oyster larvae is a common and widespread problem in the hatchery. Even a small reduction of mortality would have significant economic benefits to the oyster aquaculture industry. A specific method of probiotic application in oyster hatcheries would have high potential to increasing income significantly.

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**Proposal #:** 22WCR020-032

**Project Title:** Developing Domestic Formulated Feeds and Sea Cucumber Polyculture Integration for California Abalone Aquaculture and Abalone Conservation Production

**Applicant:** The Kashia Band of Pomo Indians of the Stewarts Point Rancheria (KBPI)

**Project Type:** Aquaculture (Under Priority #2)

**Principal Investigator:** Dan Swezey PhD; Lead Scientist [dsswezey@ucdavis.edu](mailto:dsswezey@ucdavis.edu)

**Amount:** \$299,984

**Abstract:** Over the course of the last decade, the north coast of California has seen a “perfect storm” of environmental change, resulting in collapses of California kelp forest ecosystems and the closure of the connected recreational red abalone (*Haliotis rufescens*) fishery. The Kashia Band of Pomo Indians of the Stewarts Point Rancheria, a federally recognized tribe of Native Americans, propose science to develop new technologies for domestic abalone aquaculture as the foundation for a new tribal abalone aquaculture and conservation enterprise. These activities will lead to the creation of new markets and opportunities for domestic U.S. aquaculture and will boost efforts to restore declining populations of abalone in California. Specifically, in collaboration with the researchers from the UC Davis Bodega Marine Laboratory (BML), The UC Davis Department of Food Science and Technology and Moss Landing Marine Laboratories (MLML), we will examine the utility of: a) milled and dried grape marc meal, derived from California winery waste, for use as a kelp-alternative feed for commercial abalone production and b) the experimental co-culture of abalone with California sea cucumbers (*Apostichopus californicus*), a lucrative export species which has been experimentally shown to maintain positive growth rates in captive co-association with abalone. These research objectives are directly responsive to the needs of both wild abalone fisheries and the abalone aquaculture community and will enhance the competitiveness of the commercial abalone aquaculture industry in the USA.

**Potential Commercial Benefits to the Fishing Community of the Research Results:** Kelp shortages driven by changing environmental conditions represent a major barrier to the continued success of domestic abalone aquaculture, which has historically depended on wild kelp as a primary source for abalone feed. The continuation of domestic abalone aquaculture, including conservation aquaculture for the purposes of wild abalone restoration, will require the development of alternative feeds, ideally derived from low-cost locally sourced inputs. “Grape marc” (or pomace) composed of grape pulp, seeds and stems from winery waste, is an ideal feedstock for this purpose. Feeds derived from this material have exhibited success in trials with Australian abalone (*Haliotis laevis*) and if this relationship holds true for California species, the development of a grape marc-based diet could reduce reliance on diminishing wild kelp, increase the profitability of domestic abalone aquaculture and support conservation aquaculture to enhance local abalone stocks. Grape marc waste from wineries in California is plentiful and widely available. Our proposed trials with abalone will incorporate sea cucumber co-culture, building on prior work. There is growing interest in the commercial application of sea cucumbers as nutrient recyclers and processors of particulate waste in multi-trophic aquaculture. A well-developed export market exists for the sale of sea cucumbers and co-culture systems for these species have been successfully implemented in land-based abalone aquaculture systems in Asia and Mexico but not in the USA. As such, developing domestic sea cucumber production integrated with abalone aquaculture holds significant commercial potential. Through experiments focused on the commercial and conservation applications of these technologies, our project will provide direct benefits to the west coast aquaculture community, supporting new jobs, products, production techniques, and linkages to terrestrial agriculture. Further, these techniques will benefit efforts to restore abalone stocks through captive culture, benefiting the recreational fishing community in the future once stocks rebuild.

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**Proposal #:** 22GAR036-103

**Project Title:** A transcriptomic study of the differential stress response between diploid and triploid eastern oyster *Crassostrea virginica*, and its potential involvement in triploid mortality

**Applicant:** Virginia Institute of Marine Science (VIMS)

**Project Type:** Aquaculture (Under Priority #2)

**Principal Investigator:** : Dr. Hamish J. Small, Department of Aquatic Health Sciences, Virginia Institute of Marine Science, hamish@vims.edu,

**Amount:** \$299,995

**Abstract:** The eastern oyster, *Crassostrea virginica*, is the basis of a growing shellfish aquaculture industry from New England to the Gulf of Mexico. The present-day industry is primarily based on the use of hatchery-derived, selectively-bred oysters, which are often triploid in ploidy. Triploid oysters are favored by growers because they have higher growth rates than diploids and maintain higher meat quality during the spawning season.

Aquaculturists from the Mid-Atlantic to the Gulf of Mexico face significant unexplained mortalities of near market-sized oysters in late spring and early summer months. Reported mortality has averaged ~30%, but has approached 50-85% in some cases, resulting in significant economic impacts to growers. It is likely that selectively-bred triploids respond differently to stressors as compared to their diploid counterparts, due in part to the fact that energy reserves normally used for reproduction are diverted to somatic growth. We propose a series of side-by-side field experiments and concurrent laboratory-based exposure studies utilizing diploid and triploid *C. virginica* to better understand the differential gene expression responses of diploid and triploid oysters to stressors (ex. elevated water temperature and food limitation), and explore the potential role of stress in observed triploid mortalities.

**Potential Commercial Benefits to the Fishing Community of the Research Results:** Triploid oyster mortality represents a direct threat to the viability and long-term profitability of oyster aquaculture along the East and Gulf coasts. The proposed studies will help better define this nebulous condition, and the pathways involved in responses to stress. If a relationship between mortality, gene expression and ploidy is uncovered, these data could be incorporated into the well-established eastern oyster breeding program at the Virginia Institute of Marine Science Aquaculture Technology and Breeding Center (VIMS ABC) and thereby used to produce lines of oysters for industry that have a better resistance to this phenomenon.

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**Proposal #:** 22PIR001-013

**Project Title:** Development of an Integrated Multitrophic Aquaculture System to Restore Hawaii's Vulnerable Limu (Seaweed) Populations.

**Applicant:** Oceanic Institute of Hawaii Pacific University

**Project Type:** Aquaculture (Under Priority #2)

**Principal Investigator:** Shaun Moss, Ph.D., Executive Director, Oceanic Institute of Hawaii Pacific University (smoss@hpu.edu)

**Amount:** \$187,669

**Abstract:** The degradation of Hawaii's nearshore environment, coupled with overharvesting, has resulted in the depletion of endemic and indigenous seaweeds known locally in Hawaii as "limu". Limu enhance the biodiversity and structural complexity of Hawaii's nearshore habitats and many species are culturally important to native Hawaiians as food, medicine, and ceremonial adornments. This project will focus on the development of an Integrated Multitrophic Aquaculture (IMTA) system for limu culture using nutrients supplied by "fed" aquaculture systems, as well as a traditional Hawaiian fishpond. This approach will provide Hawaii's aquafarmers with a tool to mitigate negative impacts of nutrient-rich effluent while creating a consistent source of limu for Hawaii's local communities involved in limu restoration.

Oceanic Institute of Hawaii Pacific University (OI) will collaborate with Paepae o He'eia, which operates an ancient Hawaiian fishpond, to develop limu culture systems for deployment in their pond. OI also will collaborate with Waimanalo Limu Hui, a Hawaii community organization, to outplant limu into nearby coastal areas to help restore native habitat and enhance local recreational fisheries. This project will fulfill NOAA priorities to support local aquafarmers and recreational fishing communities, including local limu "pickers".

**Potential Commercial Benefits to the Fishing Community of the Research Results:** This project will benefit three broad stakeholder groups; Hawaii's aquafarmers, Hawaii's local community organizations involved in limu restoration, and local recreational fishing communities. Many of Hawaii's fish and shrimp farmers rely on "fed" systems which produce nutrient-rich effluent. The development of an Integrated Multitrophic Aquaculture (IMTA) system for limu culture, using nutrients supplied by these systems, will provide Hawaii's aquafarmers with a tool to mitigate negative impacts of nutrient-rich effluent from their ponds. In addition, these IMTA systems will create a consistent source of limu for Hawaii's local communities involved in limu restoration which will support local fishing communities.

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**Proposal #:** 22GAR034-099

**Project Title:** Virginia coast bay scallops, *Argopecten irradians*: aquaculture and wild restoration

**Applicant:** Virginia Institute of Marine Science (VIMS)

**Project Type:** Aquaculture (Under Priority #2)

**Principal Investigator:** Richard Snyder, Professor and Director Virginia Institute of Marine Science Eastern Shore Laboratory, [rsnyder@vims.edu](mailto:rsnyder@vims.edu)

**Amount:** \$299,238

**Abstract:** This project would continue restoration of bay scallops in the Virginia coastal bays to harvestable levels for ecological and recreational fishery benefits, and engage growers to demonstrate and raise awareness of bay scallop culture as a viable commercial enterprise. Our restoration work involves growing and releasing bay scallops and maintaining spawning cages to support a wild population. We conduct an annual population survey and preliminary genetic work has started to track genetic diversity within the restoration population gene pool. Bay scallops show promise as a commercial product from work at VIMS ESL since the 1960s, and market price points are now reaching levels where this species may be successfully grown commercially. We are proposing this project with two commercial aquaculture business partners to test two different grow out methods, to supply plans for a small-scale hatchery for scallop seed production and stimulate market demand. We would also pursue genetic analysis of 4 bay scallop brood stock lines currently maintained at ESL (FL, NC, ESL, NY), and use the genetic information in both our restoration and aquaculture efforts. Getting commercial



growers working with bay scallops and stimulating market avenues will increase the visibility of bay scallops as a viable aquaculture enterprise.

**Potential Commercial Benefits to the Fishing Community of the Research Results:**

Demonstrating the feasibility of bay scallop culture or bay scallop and clam co-culture as viable commercial enterprise would create alternative opportunities for watermen and the local economy on the Eastern Shore of Virginia (ESVA). The region is economically depressed, dominated by agriculture, fisheries and aquaculture, with aquaculture rising as a significant economic driver. Hard clams and oysters dominate aquaculture activity, and there is a need to diversify the industry. Previous efforts have demonstrated a demand for product, but local production and market pathways have not yet developed.

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**Proposal #:** 22SER002-042

**Project Title:** Preadapting oysters to multiple stressors through predator exposure in nurseries

**Applicant:** Marine Environmental Sciences Consortium

**Project Type:** Aquaculture (Under Priority #2)

**Principal Investigator:** Dr. Lee Smee, Dauphin Island Sea Lab, [lsmee@disl.org](mailto:lsmee@disl.org); Co-PI: Dr. Ben Belgrad, Dauphin Island Sea Lab, [bbegrad@disl.org](mailto:bbegrad@disl.org); Dr. PJ Waters, Auburn University Marine Extension, [waterph@auburn.edu](mailto:waterph@auburn.edu)

**Amount:** \$296,607

**Abstract:** Oyster (*Crassostrea virginica*) harvesting is a key feature of the economy and culture of Gulf Coast states. Unfortunately oyster populations have declined precipitously. Harvesting has been severely curtailed and in some years completely closed due to low natural abundance. To restore oyster populations and boost production levels, state fisheries resource agencies in Mississippi and Alabama initiated a fisheries enhancement effort to rebuild oyster populations and increase on-bottom aquaculture by remote setting where hatchery reared oyster larvae are settled onto hard substrate (e.g., shell) and then placed in an estuary to form a new reef or enhance an existing reef base. We will investigate a new hatchery technique to increase oyster resilience, aquaculture yields, and improve remote setting restoration by stimulating oysters to grow stronger shells, thereby reducing their predation risk and susceptibility to stressful abiotic conditions like low pH. Our previous research revealed early exposure to predator cues caused oysters to produce thicker, stronger shells, which increased their survival. We hypothesize that exposure to predator cues within the hatchery will speed oyster growth, cause them to grow stronger shells that have higher survival during transport and maturation in the field, and be more resistant to predation and stressful abiotic conditions.

**Potential Commercial Benefits to the Fishing Community of the Research Results:** Traditional off-bottom aquaculture cannot satisfy the demand for oysters. We propose to develop a new inexpensive technique to improve the return on investments states are making towards on-

bottom aquaculture. By stimulating oysters to grow stronger shells, we will reduce their predation risk and susceptibility to adverse conditions in the field. Increasing the number of oysters which survive to maturity will help revitalize this decimated fishery, speed reef recovery efforts, and provide essential habitat to other commonly fished species. Indirectly, oyster reefs slow coastal erosion and facilitate salt marshes than in turn provide habitat and resources for numerous fishery species.

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**Proposal #:** 22GAR050-055

**Project Title:** Influence of selective breeding on human pathogenic *Vibrio* spp. in eastern oysters

**Applicant:** Virginia Institute of Marine Science (VIMS)

**Project Type:** Aquaculture (Under Priority #2)

**Principal Investigator:** Corinne Audemard, Associate Research Scientist audemard@vims.edu

**Amount:** \$299,718

**Abstract:** The production of oysters safe for human consumption is one key factor for promoting a sustainable oyster aquaculture industry. The threat of human pathogenic *Vibrio* bacteria naturally associated with oysters is managed through broad measures that fail to account for the wide range of *Vibrio* spp. concentrations observed among individual oysters within a population. Building upon results from our previous studies, we propose to evaluate the effects of oyster lines and associated oyster health on variations in levels of these pathogens among individual oysters. We will deploy eastern oysters from three genetically-distinct lines at a polyhaline and at a mesohaline salinity site and we will determine 1) concentrations of total *V. vulnificus* and total and pathogenic *V. parahaemolyticus* and 2) general oyster health through expression profiling of seven genes involved in stress response as well as histopathological analyses. Potential influence of oyster line and health status will be analyzed through generalized linear mixed-effects models. This project will determine whether inclusion of *Vibrio* spp. levels should be an additional trait controlled through oyster selective breeding programs, and whether using lines that are selected for specific grow-out environments may bring potential benefits with regard to *Vibrio* spp. abundance and thus control.

**Potential Commercial Benefits to the Fishing Community of the Research Results:** The commercial benefits of this project lie in the economic strengthening of oyster aquaculture production through the production of oysters safer for human consumption. Indeed, *Vibrio* illnesses associated with oyster consumption can have a detrimental economic impact on the oyster industry. Illnesses traced to oyster consumption can lead to product recall and harvest closure, but also adverse publicity. Negative consequences can expand beyond the local area impacted by closures or recalls to the region and nation by eroding consumer confidence in

product safety, especially with regard to the lucrative sector of boutique, raw oysters sold on the half shell.

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**Proposal #:** 22WCR016-039

**Project Title:** Examining the capacity of seaweed and shellfish co-culture to improve the physiology, biomechanics, and outplanting of farmed juvenile abalone and oysters

**Applicant:** San José State University

**Project Type:** Aquaculture (Under Priority #2)

**Principal Investigator:** Maya deVries, Assistant Professor, San José State University, maya.devries@sjsu.edu

**Amount:** \$299,663

**Abstract:** Farmed oysters and abalone are rapidly growing sectors of the global food market. However, there is widespread concern that ocean acidification (OA) threatens these industries, because OA profoundly impacts growth, shell construction, and physiological stress in these shellfish as juveniles. Co-culturing shellfish with seaweeds via integrated multi-trophic aquaculture (IMTA) is a proposed mechanism for ameliorating OA effects on shellfish. Seaweeds uptake carbon dioxide, which increases seawater pH and creates more favorable conditions for growth and shell calcification. The proposed project will partner with industry (MAC, HIOC, and MBS) to develop land-based co-cultures of seaweeds and juvenile abalone and oysters to help curb OA effects on calcification and physiology. Our goals are to determine whether seaweed and shellfish co-cultures (1) increase growth and decrease stress response in juveniles through measures of growth, in situ respirometry, and oxidative stress, (2) increase shell calcification and muscle force production as measures of animal condition, and (3) yield improved growth, stress physiology, shell calcification, and nutritional quality in adults once juveniles are outplanted and grow in open water facilities. (4) Finally, we will create a best practices manual and virtual workshop on co-culturing seaweeds and shellfish, while working with growers to implement coculture farming practices.

**Potential Commercial Benefits to the Fishing Community of the Research Results:** This project has the potential to create jobs through increased production and distribution of sustainable shellfish to seafood markets and restaurants. It will likely yield improved growth rates, nutritional quality, and shell and muscle strength of abalone and oysters, which would reduce the time to market and increase marketability and resiliency during handling and transportation. Thus, this research will translate broadly to shellfish farms across the U.S. Given that the research conducted at Moss Landing Marine Laboratories (MLML) is non-proprietary, all project data will be made freely available to entrepreneurs who are interested in farming

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**Proposal #:** 22PIR006-026

**Project Title:** Most likely to succeed: demonstrating commercial viability of Hawaiian snapper

**Applicant:** Ocean Era, Inc.

**Project Type:** Aquaculture (Under Priority #2)

**Principal Investigator:** Dr Dale Sarver,

**Amount:** \$299,890

**Abstract:** The goal of this project is to develop spawning, larval rearing, juvenile and growout methodology for the high value marine snapper (uku, *Aprion virescens*). This will entail catching adult broodstock from offshore waters off the Kona coast, and holding them in tanks at the Natural Energy Laboratory of Hawaii Authority. Natural spawning season is from May through October. Building on the spawning season, some tanks of fish will be treated with a spawning hormone, and other control tanks will be left untreated. Spawning activity will be monitored daily. Gonad status will be monitored through catheterization occasionally throughout the spawning cycle. Egg quality will be evaluated for each spawn. Larvae from good quality spawns will be transferred to self-cleaning larval tanks. Standard operating procedures developed successfully for other marine fish will be applied. We will compare different feed sizes and contrast mediums during larval rearing to learn if they impact survival and deformity rate. Successfully weaned juveniles will be moved to larger outdoor tanks. Feeding trials will be conducted with a variety of diets and evaluated for fish growth rate, feed conversion, and general health. Once fish have grown to harvest size flesh samples will be chemically evaluated and taste tested to compare various feeds.

**Potential Commercial Benefits to the Fishing Community of the Research Results:** Success in these endeavors should result in an economically and environmentally preferable species as a candidate for open ocean culture in U.S. waters, or in land-based culture systems. The techniques developed by this work will be made available to the aquaculture community via conference presentations and publications in trade magazines. This work addresses the Magnusen-Stevens Act priority of preventing overfishing, and realizing the full potential of US fisheries resources.

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**Proposal #:** 22GAR044-100

**Project Title:** Characterizing the role of toxic phytoplankton byproducts in shellfish hatchery failures

**Applicant:** Virginia Institute of Marine Science (VIMS)

**Project Type:** Aquaculture (Under Priority #2)

**Principal Investigator:** Meredith White, PhD, Director of Research and Development, Mook Sea Farm, meredith@mookseafarm.com; Bethanie Edwards, PhD, Assistant Professor, UC Berkeley,

bethanie\_edwards@berkeley.edu; Juliette L. Smith, PhD, Associate Professor, Virginia Institute of Marine Science, jlsmith@vims.edu

**Amount:** \$299,934

**Abstract:** We propose a project that will promote the sustainability of oyster seed production through mitigation of an emerging disease syndrome on the US East Coast. A troublesome new syndrome presented in young oyster larvae at several regional hatcheries in 2020, resulting in production failures decreasing seed output by over 40%. Moribund, dwarfed, and delayed in development, affected larvae clearly displayed pale digestive glands suggesting failure of digestion despite a stomach full of microalgal food. The signs reappeared in 2021, demonstrating the disease's persistence. Similar signs presented across a wide geography, with reports of seed not digesting their food, and therefore not growing, at hatcheries in Maine, New York, and Virginia. Preliminary work conducted by one of these hatcheries, Mook Sea Farm (Maine), demonstrated a link between the signs and toxic phytoplankton byproducts in the hatchery water. This timely project now builds on this information, expanding the study to include three East Coast hatcheries and experts in disease and lipidomics. Through partnerships between industry and academia, this project strives to understand this new but persistent disease, increase awareness along the East Coast, and identify mitigation technology to avoid or minimize symptoms with the overall goal of improving product yield.

**Potential Commercial Benefits to the Fishing Community of the Research Results:** Successful hatchery production, as the start to the supply chain, is essential for the entire shellfish aquaculture industry and is becoming more important as wild production declines due to changing environmental conditions. Understanding the root cause of hatchery failures is critical to ensure that shellfish aquaculture is sustainable. This project is expected to directly improve production yield, defined as seed raised to 1–2 mm for sale, by testing two mitigation approaches that can be adopted by all regional hatcheries by the end of the project. Identifying seasonality will indicate when the mitigations can be planned to be most effective.

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**Proposal #:** 22SER008-037

**Project Title:** A Production-Scale Queen Conch Hatchery at the Naguabo Fishing Association for Region Wide Growout of Sustainable Seafood in Puerto Rico

**Applicant:** Florida Atlantic University

**Project Type:** Aquaculture (Under Priority #2)

**Principal Investigator:** Megan Davis, Ph.D., Research Professor, Aquaculture and Stock Enhancement, Florida Atlantic University, Harbor Branch Oceanographic Institute, mdavi105@fau.edu; Co-PI, Raimundo Espinoza, Executive Director, Conservación ConCiencia, San Juan, Puerto Rico, rai@conservacionconciencia.org

**Amount:** \$299,140

**Abstract:** The queen conch *Aliger gigas* is an important fishery in the Caribbean and is overfished. The Queen Conch Resources Fishery Management Plan is used to help rebuild conch populations in the U.S. Caribbean. There is a closed season in Puerto Rico's jurisdictional water (Aug 1 to Oct 31) and harvest has been prohibited since 1997 in the U.S. EEZ off of Puerto Rico. Most conch (known as 'carrucho') fished in Puerto Rico are consumed locally with very little export. With the decline in conch populations in state and federal waters, closed seasons, and disruption of conch habitats from hurricanes such as Maria, conch is a prime candidate for aquaculture in Puerto Rico for restoration and sustainable seafood. The project goal will expand the existing S-K NOAA supported Puerto Rico Queen Conch Hatchery, which is located at the Naguabo Fishing Association, to produce higher numbers of conch juveniles for restoration and sustainable seafood. Local fishers, technicians and interns will operate the aquaculture operation. Two Mobile Conch Farms will be located at other Fishing Associations for growing juvenile conch and for community outreach. This project will serve as a model that can be transferred to more fishing communities in Puerto Rico.

**Potential Commercial Benefits to the Fishing Community of the Research Results:** The benefits to the fishing communities include diversified incomes for the fishers that work on the conch aquaculture operations. In addition, the three Fishing Associations involved in this project will benefit from conch aquaculture being part of their working waterfront, because it will provide community outreach and ecotourism opportunities. Overall, the participation of the Puerto Rico fishing community in developing aquaculture projects will strengthen Puerto Rico's queen conch fishery and enhance the supply chain value of conch products in the marketplace.

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**Proposal #:** 22GAR018-018

**Project Title:** Community Science to Support Sustainable and Local Seafood Production in Maine

**Applicant:** University of Maine

**Project Type:** Aquaculture (Under Priority #2)

**Principal Investigator:** Dr. Heather Leslie, Director & Professor, University of Maine (heather.leslie@maine.edu)

**Amount:** \$281,653.00

**Abstract:** The overall goal of this project is to investigate the co-occurrence of a wild oyster fishery and oyster aquaculture in Maine's Damariscotta River Estuary. This study will provide a framework for research and knowledge-to-action activities in other contexts where wild-caught fisheries and aquaculture co-occur, particularly for bivalve species. As climate change impacts these sectors and other living marine resource-dependent industries, it is important to understand how individuals and communities adapt to these changes and how local knowledge can contribute to effective management and adaptation. The Damariscotta River Estuary is one

of Maine's aquaculture and coastal fisheries centers and is also the location of an interesting phenomenon, beginning to be observed elsewhere in Maine: the expansion of 'wild' Eastern oyster (*Crassostrea virginica*) populations. Wild oysters provide shared economic benefits for shellfish harvesters and farmers. Not only do they contribute to seafood production, but they also enhance both water quality and marine habitats. Improved understanding of aquaculture's benefits and costs will help informed decision making about both seafood sectors and the broader ecosystem in which they are embedded.

**Potential Commercial Benefits to the Fishing Community of the Research Results:** This project will have three main benefits, or impacts, for fisheries and fishing-dependent communities. It will: 1. Support co-management and sustainability of wild shellfisheries; 2. Facilitate development of a market for wild oysters, thereby generating value and cobenefits for both the wild shellfish fishery and the aquaculture sector; and 3. Contribute to effective ecosystem-based management of dynamic coupled fishery aquaculture systems in Maine and beyond. The project impacts will be created through integrated research, education and outreach and engagement activities involving fishermen, oyster farmers, managers, scientists, students, and other key stakeholders of seafood production in the Damariscotta River Estuary.

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**Proposal #:** 22WCR011-015

**Project Title:** Developing the native California Mussel (*Mytilus californianus*) as a new aquaculture product

**Applicant:** Holdfast Aquaculture LLC

**Project Type:** Aquaculture (Under Priority #2)

**Principal Investigator:** Dr. Nathan Churches (PI), holdfastAQ@gmail.com; University of Southern California (USC); Dr. Sergey Nuzhdin (Co-PI), snuzhdin@usc.edu; Santa Barbara Mariculture Co. (SBM); Bernard Friedman (Co-PI), bernard@sbmariculture.com

**Amount:** \$300,000.00

**Abstract:** Mussel aquaculture provides nutritionally dense food without the need for freshwater, land, or feed, making it an effective means of addressing both food insecurity and environmental issues. Appetites for mussels and shellfish are also expanding, yet U.S. mussel production has not increased since 2010, and represents only ~0.02% of global mussel production. In Southern California, there is a unique market opportunity to significantly expand domestic aquaculture production of mussels using locally adapted, regionally produced, and native mussel varieties. We propose to develop the native California Mussel (CM, *M. californianus*) as a new aquaculture species, and to develop a scientifically managed breeding program for the new species. Our preliminary studies demonstrate desirable traits including greater shell and byssal strength, beautiful plate appearance, capacity for synchronized mass spawn, in-hatchery settlement, amenability to modern long-line techniques, and genomics data

informative to breeding approaches. We propose three distinct objectives here: 1) produce annual commercial runs of the CM and traditionally farmed Mediterranean Mussel to demonstrate feasibility, 2) begin a selective breeding program using a Mass-Selection and Genomic-Selection strategy, initially targeting Ocean Acidification tolerance, and 3) develop a product strategy including product testing for the CM.

**Potential Commercial Benefits to the Fishing Community of the Research Results:** There is huge potential for Southern California aquaculture expansion into recently dedicated Aquaculture Opportunity Areas. However, growing non-native, Pacific Northwest derived mussels presents a major disadvantage – costs are higher, transplanted animals underperform, and disease and predation liabilities increase. Extant and nascent mussel farming operations in this sector would benefit from having a local hatchery which can produce robust, locally adapted, and commercially competitive products. The CM can fill this niche - in a lucrative manner if appropriately marketed. Beginnings of a breeding program for Ocean Acidification tolerance will also be crucial (and pan-species informative) in the face of climate change.

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**Proposal #:** 22GAR039-024

**Project Title:** Probiotics to improve sea scallop (*Placopecten magellanicus*) hatchery success

**Applicant:** University of Maine

**Project Type:** Aquaculture (Under Priority #2)

**Principal Investigator:** Dr. Timothy Bowden, Associate Professor of Aquaculture, University of Maine, Orono, Maine. Email: [timothy.bowden@maine.edu](mailto:timothy.bowden@maine.edu).

**Amount:** \$299,992.00

**Abstract:** There is a clear interest in sea scallop aquaculture in Maine and the Northeast U.S. Currently, all seed is sourced from the wild creating a range of vulnerabilities for this aquaculture sector. Hatchery-reared scallops would establish a more reliable seed source, raising the potential for year-round supply, and for breeding programs. Successful larval production has become routine for several bivalve species including oysters, clams, and more recently blue mussels. *P. magellanicus* has been reared in research hatcheries, and the procedures are documented. But, spawning success is variable as is larval survival. Therefore, there is a need to optimize hatchery methodologies to ensure it is economically viable and dependable for the growing culture industry. To enable year-round hatchery production of larvae, this proposal will focus on improving larval survival and reproducibility. As such, this science and technology based project directly impacts commercial aquaculture through the development of opportunities for U.S. working waterfront communities, and expansion of commercial sea scallop hatchery operations.

**Potential Commercial Benefits to the Fishing Community of the Research Results:** The main economic benefit of the project will be to support the development of scallop aquaculture. The



U.S. scallop market has an annual landed value of approximately \$380 million. Sea scallop landings in Maine have an annual landed value of up to \$9 million. Hatchery technology provides essential infrastructure for the sector, and could result in up to a three-fold increase in harvest. This offers the potential for significant economic impact in rural, working waterfront communities where seasonal scallop fishing is as much a cultural and economic working waterfront tradition as lobster fishing.

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**Proposal #:** 22SER028-052

**Project Title:** Empowering growers while growing capacity: Research, testing, and training to address microbiological impediments on shellfish aquaculture.

**Applicant:** Auburn University, School of Fisheries, Aquaculture, and Aquatic Sciences

**Project Type:** Aquaculture (Under Priority #2)

**Principal Investigator:** Melissa L. Partyka, PhD. m.partyka@auburn.edu, 251-348-5436, Auburn University Marine Extension and Research Center,

**Amount:** \$299,907

**Abstract:** Off-bottom shellfish aquaculture in Mississippi (MS) and Alabama (AL) is a new and growing industry that requires a significant investment by would-be growers. Growers that have successfully applied for permits and sited their operations often face environmentally driven regulatory closures, potentially leading to significant financial hardship. Though the quality of water within oyster growing areas is of critical importance for both seafood safety and harvest quality, current regulatory monitoring by Alabama state officials is severely limited in space and time, adhering to the minimum sampling required under the National Shellfish Sanitation Program. The lack of data reduces the ability of growers to understand variability in water quality conditions that impact both profitability and seafood safety. While existing state-funded labs can analyze water and shellfish meats from growing areas, they cannot perform the analyses that allow growers to “test to open” following sewage overflows or excessive rainfall events. Nor can these labs test wet storage tanks for certification, a tool that can help limit the impacts of extended regulatory closures. Finally, there are currently no training programs that inform prospective, new, or established growers about regulatory hurdles related to microbiological water quality and give them the knowledge to navigate those hurdles with confidence and understanding.

**Summary of potential commercial benefits to the fishing community of the research results:** .

In 2019, the direct sale value of operations in Alabama alone exceeded \$1.4 million which helped provide at least 42 full-time jobs and 30 part-time jobs at 21 operations. However, the expansion of the industry is limited by a lack of regulatory monitoring to classify new and potentially profitable growing areas. Further, a lack of microbiological testing capacity has led to loss of profits, and in some instances, farms themselves, following extended closures. This project will work toward classification of new growing areas and help growers “test to open” following emergency closures, reducing the burden while maintaining seafood safety.

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