

Proposal #: 21AKR006-004

Project Title: Improving the Genetic Baseline of Western Alaska Chinook Salmon for Mixed Stock Analysis (MSA) in the Bering Sea

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: Elizabeth Lee – Fisheries Geneticist I, Gene Conservation Lab
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Amount: \$115,881

Abstract: Chinook salmon (*Oncorhynchus tshawytscha*) returns have decreased in many Western Alaska rivers within the last decade, creating economic hardships and food security issues for fishing communities throughout the region. In addition to socioeconomic challenges this poses to fishing communities, this presents sustainable management and harvesting challenges to fisheries managers, biologists, and other stakeholders. With low returns, it is vital to reduce and minimize the uncertainty around stock-specific harvest, escapement, return, and forecast estimates used in management decisions. One estimate maintaining high uncertainty is the stock-specific Western Alaska Chinook salmon incidental harvest (bycatch) in the Bering Sea and Aleutian Islands (BSAI) groundfish fisheries, one of the most economically valuable commercial fisheries in the United States. Genetic mixed stock analysis (MSA) is used to identify stock proportions within BSAI bycatch to determine impacts to Chinook salmon fisheries. However, the genetic baseline currently available for this analysis cannot delineate fine-scale Western Alaska stocks of interest to managers. We propose a project to develop a high-resolution genetic baseline for Western Alaska Chinook salmon using state-of-the-art sequencing technologies. This baseline would provide finer-scale MSA resolution than currently available to support sustainable harvesting in Western Alaska and BSAI fisheries, as well as the greater Pacific Rim.

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

This project will benefit commercial and subsistence fishing communities in Western Alaska and the BSAI groundfish fisheries industry through the development of a science- and technology-based tool that leads to the strengthening of existing opportunities in these U.S. fisheries and fishing communities. This project will use innovative genetic technology to develop a fisheries management tool (genetic baseline) that can be used to improve sustainable harvesting within some of the most economically and socially important federal and state fisheries in the country. When applied, this tool will provide stakeholders with highly accurate and precise stock-specific estimates necessary for achieving management and escapement goals.

Proposal #: 21AKR001-006

Project Title: Development of a Management Strategy Evaluation Framework for Subsistence Salmon Fisheries of the Kuskokwim River Watershed

Applicant: University of Alaska Fairbanks

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

Principal Investigator: Dr. Curry J. Cunningham, Assistant Professor of Quantitative Fisheries, College of Fisheries and Ocean Sciences, University of Alaska Fairbanks, cjcunningham@alaska.edu; Dr. Daniel E. Schindler, Professor, University of Washington, School of Aquatic and Fishery Sciences, deschind@uw.edu

Amount: \$266,186

Abstract: Our objective is to develop a Management Strategy Evaluation (MSE) simulation framework for evaluating trade-offs among alternative salmon fishery management strategies for Kuskokwim River salmon across the range of future conditions that fish populations may encounter (i.e. variation in salmon population productivity due to climate or ecosystem change) and changes in the attributes of the fish themselves (i.e. changes in salmon size and age at maturity). This simulation framework would represent a critical foundation for a broader MSE process, allowing resource users and management agencies to collaborate on model development, and base comparison and exploration of management alternatives on a common and impartial set of quantitative tools

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

This MSE for Kuskokwim River salmon has several direct commercial benefits. Rebuilding stocks to abundances that would support commercial fisheries again is one of many values held by stakeholders. Second, commercial fisheries for sockeye and chum salmon incidentally harvest Chinook salmon and, therefore, have implications for subsistence fisheries. Third, the conservation status of Kuskokwim Chinook salmon has direct impacts on Bering Sea pollock fisheries through the '3-River Index' which regulates the Prohibited Species Catch limit for Chinook salmon. Fourth, subsistence harvest of Chinook salmon forms the basis for a complex economy that permeates the social and economic fabric of this vast watershed.

Proposal #: 21AKR013-010

Project Title: Increasing Market Access and Consumer Confidence with Trusted Nutrient and Contaminant Data and Outreach for Alaska Seafood

Applicant: Alaska Seafood Marketing Institute

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: : Michael Kohan, Seafood Technical Director, ASMI, mkohan@alaskaseafood.org; Co-PI: Dr. Bob Gerlach, Alaska State Veterinarian, Alaska Department of Environmental Conservation (ADEC), bob.gerlach@alaska.gov

Amount: \$284,600

Abstract: We will develop a comprehensive, current, and defensible nutrient and contaminant dataset for Alaska seafood and disseminate the results through an extensive outreach strategy. The project will be evaluated by a representative technical advisory committee guiding the project and we will also employ consumer marketing surveys in various markets for Alaska seafood. S-K Grant Program objectives will be fulfilled by increasing consumer and trade confidence in Alaska seafood resulting in increased market demand. Completion of this project will improve global public relations, satisfy trade requests for information, and encourage collaboration between the state of Alaska and federal agencies to share data on Alaska seafood safety and nutrition information. Additionally, the project will generate marketing and outreach opportunities that can position the Alaska seafood industry to better compete in global markets and both positively differentiate and improve confidence in Alaska seafood products. The nutrient and contaminant data will be valuable to the Alaska seafood industry, researchers, public health initiatives, state and federal government agencies, and consumer marketing programs.

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

Individual businesses and communities dependent on fisheries in Alaska do not have access to the resources to analyze seafood samples and provide comprehensive, 3rd party data to consumers and global markets. An inability to provide contaminant and nutrient information for specific seafood species not only damages consumer trust, but also determines market access and scalability of individual fishing businesses. Small seafood companies in Alaska depend on public resources in order to adhere to state, federal, and international regulations regarding seafood trade and nutrient composition. Smaller companies are often the economic backbone of coastal communities in Alaska, providing local jobs and economic stimulus to support businesses that enhance sustainable communities

Proposal #: 21GAR044-003

Project Title: Implications of Resolving a Mismatch in the Scale of Atlantic Cod Fishery Management

Applicant: Gulf of Maine Research Institute

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

Principal Investigator: Dr. Lisa A. Kerr, Gulf of Maine Research Institute, lkerr@gmri.org; Co-PIs, Dr. Steven X. Cadrin University of Massachusetts Dartmouth-SMAST, scadrin@umassd.edu; Dr. Yong Chen University of Maine/GMRI, ychen@maine.edu

Amount: \$247,161

Abstract: A recent interdisciplinary review of stock identity information on Atlantic cod in U.S. waters revealed inconsistencies between the spatial structure of biological populations and the

definition of management units for cod. Meeting the goal of sustainable fisheries management can be difficult when management units do not match the scale of fish biology and resolving these issues can aid in achieving both fishery and conservation objectives. The goal of our proposed research is to evaluate the performance of alternative management procedures that aim to resolve the identified mismatch in the scale of biological population and management units of Atlantic cod. To address this goal, we will apply management strategy evaluation to quantify and compare the performance of alternative approaches for improving fisheries assessment and management of Atlantic cod. We will engage with fishery stakeholders, including fishermen, state/federal scientists, fishery managers, and environmental scientists, associated with the groundfish fishery through planned meetings to seek feedback on our work and to provide stakeholders an opportunity to propose alternative solutions to address this mismatch in the scale of Atlantic cod fishery management. This research addresses SK program priority #2, Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting.

Summary of potential commercial benefits to the fishing community of the research results: Atlantic cod is considered a 'choke' species because its low catch allocation constrains the ability of fishermen to harvest other co-occurring groundfish stocks for which they have ample allocation. The 'choke' species issue is a critical problem that directly impacts the commercial and recreational fishing communities in New England. Thus, improved management of Atlantic cod will not only impact the health of the resource, but will have broad implications for the groundfish fishery. The results of this study have the potential to transform the science and management process for Atlantic cod through alignment with the best available science on Atlantic cod stock structure.

Proposal #: 21GAR046-066

Project Title: "Assessment of an Alternate Frequency Pinger to Mitigate Gray Seal Interaction in the Northeast Sink Gillnet"

Applicant: Cornell University Cooperative Extension Marine Program

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

Principal Investigator: Scott Curatolo-Wagemann, Senior Resource Educator, Principal Investigator, sw224@cornell.edu

Amount: \$206,279

Abstract: This collaborative project, between CCE, NOAA scientists, commercial gillnet fishermen and fishing gear designers will assess the efficacy of a new acoustic device to reduce seal bycatch in the Northeast sink gillnet fishery. The acoustic device or pinger tested during this study will focus on reducing gray seal bycatch while maintaining reduced porpoise

interactions with gillnets. The “Seal Safe” pinger will be tested against currently regulated pingers required in the Northeast sink gillnet fishery. Paired sea trials will occur aboard commercial fishing vessels from Montauk, NY during the spring and fall monkfish season. To monitor and maintain porpoise bycatch reduction a second research component will be performed using Passive Acoustic Monitoring (PAM). The PAM component will validate the “Seal Safe” pingers effectiveness to sustain reduced porpoise interaction with sink gillnets and test any potential impacts of habituation and ensonification. Successful bycatch reduction determination of the “Seal Safe” pinger will create an effective tool for gillnet fisheries to improve fishing practices, reduce interaction with protected species, and maintain sustainable fisheries.

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

This project proposes to directly inform management and offer this gear modification as a tool for reducing bycatch of both seals and porpoise in sink gillnet fisheries and promoting sustainable gillnet fisheries. Data will provide insight to managers and industry. It will produce a tool that is industry tested, peer-reviewed, and easily adoptable into fishery regulation and commercial fishing industry use. This project will directly benefit the fishing community in strengthening sustainable harvesting methods.

Proposal #: 21GAR045-083

Project Title: “Conservation Gear Technology- Quantifying Bycatch Reduction Benefits of an Excluder in the Small Mesh Fisheries of the Northeast with Focus on Red Hake”

Applicant: Cornell Cooperative Extension

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

Principal Investigator: Scott Curatolo-Wagemann, Senior Resource Educator, sw224@cornell.edu

Amount: \$249,286.00

Abstract: his project will investigate a modification in fishing practices designed to minimize bycatch of fish in small mesh trawls for longfin squid and whiting. The Excluder device for this project will focus on bycatch reduction of southern red hake in the whiting fishery. Additionally, it is hoped the Excluder will be reducing demersal species including flounders and skates and pelagic species of striped bass, scup, and black sea bass. Utilizing a trouser trawl during at-sea research, CCE will evaluate the effectiveness of the modification through catch comparison. One leg of the trawl will be outfitted with the modification and the other leg will be the standard for the fishery. CCE will utilize underwater video to observe fish behaviors and escapement. A total of 60 research tows will be performed (30 for longfin squid and 30 for whiting). Comparative catch analyses will be performed between the control and treatment. A

Project Advisory Committee (PAC) will provide input and direction for research activities. Members of the PAC will include fishermen, net designers, fishery management council members and fishery scientists. Successful bycatch reduction determination of the Excluder will create an effective tool for multiple fisheries to improve fishing practices to maintain sustainable fisheries.

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

The project will specifically reduce impacts to southern red hake, and multiple other species such as scup, black sea bass, striped bass, butterfish, skates, dogfish, haddock and various flounders that are included in the Northeast groundfish catch share fisheries, while seeking to maintain 2 appropriate levels of the target catch species. This project will bring fishermen's information, experience, and expertise into the scientific framework needed for fisheries management. By testing the efficacy of the Excluder to reduce bycatch, we will be providing management and the commercial fishing industry another adaptive tool to maintain sustainable fisheries and promote improved fishing practices.

Proposal #: 21GAR016-058

Project Title: Commercial Enhancement of Bivalve Hatchery Sustainability Through Applied Technology Application

Applicant: Virginia Polytechnic Institute and State University

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

Principal Investigator: PI: Dr. Reza Ovissipour, Assistant Professor, Seafood AREC/Department of Food Science and Technology, Virginia Tech. ovissi@vt.edu; CO-PIs: Dr. Michael Schwarz, Director of the Virginia Seafood AREC, Virginia Tech, mschwarz@vt.edu; Dr. Jonathan van Senten, Assistant Professor, Seafood AREC, Virginia Tech, jonat86@vt.edu; Dr. Richard Snyder, Professor and Director of Virginia Institute of Marine Science-Easter Shore, rsnyder@vims.edu; Michael Congrove, President of Oyster Seed Holdings, Inc, msc@oysterseedholdings.com

Amount: \$169,828

Abstract: In response to national industry concerns about ambient water quality, associated impairments to oyster larvae production, and seasonal constraints on oyster hatchery operations during periods of poor ambient water quality, we have begun design and testing of a prototype bioreactor system to clean and polish production water for direct reuse during oyster larval production. The pilot system integrated directly into standard hatchery operations using a typical drain/fill of larval tanks on a two-day cycle, resuspending the larvae each time in new clean water pumped from coastal waters, or in a continuous supply culture system. With this new technology, the clean water is sourced from a recirculating bioreactor, reducing reliance on water pumped from coastal waters. Conversion of nitrogenous wastes and organic material

resulting from microalgae and larvae is accomplished by the bioreactor. The system removes fast growing bacteria responding to larval culture, including potentially pathogenic bacteria (*Vibrio* spp. and others) by promoting populations of bacterivorous protists within the bioreactor. Primarily, this applied technology supports bivalve hatchery operations “off line” when ambient water quality in coastal areas is impaired. Additionally, this technology supports remote hatchery operations without direct access to surface water, as well as out-of-season, or head-start production.

Potential Commercial Benefits to the Fishing Community of the Research Results: Hatcheries are at the mercy of ambient water quality, the costs to set up and acquire ambient water for use is also inhibitory to many startups as working waterfronts diminish. The implementation of recirculating aquaculture system (RAS) technology would stabilize and maximize existing production facilities affected by the vagaries of ambient water quality conditions by providing control over their production water quality. We anticipate the system will enhance seed production consistency temporally, reduce reliance on coastal waters during poor ambient water quality, and provide improved options for out-of-season or early season seed production.

Proposal #: 21GAR024-105

Project Title: Novel bottom culture of sugar kelp (*Saccharina latissima*) for diversifying marine farms

Applicant: Woods Hole Oceanographic Institution

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

Principal Investigator: David Bailey, Research Associate, Woods Hole Oceanographic Institution, dbailey@whoi.edu

Amount: \$151,806

Abstract: This project will determine if sugar kelp can be effectively grown in the Gulf of Maine (GOM) and particularly in Cape Cod Bay (CCB) near the ocean floor using ropeless/stiff line systems compatible with protected species management, fisheries and navigation . We intend to pursue the following research objectives: 1. Evaluate, test, and document the gear required for farming kelp near the ocean floor 2. Determine the yield and quality of kelp grown at varying depths and associated environmental factors, and compare with traditional kelp aquaculture farms. 3. Identify optimal method for on-bottom farming kelp from evaluated growth and quality Kelp farms, like natural kelp beds, provide habitat for a variety of marine life that are part of important food webs supporting fisheries. Kelp farms have been documented to increase the benthic infaunal species diversity and abundance, and increase the number of mobile faunal species, resulting in improved Benthic Quality Index (BQI) at farm sites. Data collected throughout this research will include: crop yield, fouling and predation, farm and gear

cost and maintenance, planting and harvest efficiency, water quality (temperature, clarity, Lindell Project Summary Page 1 of 2 nutrients), and current speed and direction. Project results will be presented at stakeholder workshops in the Northeastern US.

Potential Commercial Benefits to the Fishing Community of the Research Results: Kelp farming provides a market diversification opportunity for shellfish farmers and fishermen in the Northeastern US. Because kelp aquaculture is a winter/spring crop it is complementary to shellfish farming and many commercial fisheries which demand more attention in the other seasons. We illustrate possibly suitable one-square mile sites that could each support at least a million pounds of sugar kelp production per winter season worth \$500,000 annually at current market prices. Through our workshop and outreach, we expect that at least ten new sub-tidal farms on over 500 acres will adopt the methods we develop within 5 years of the project's conclusion.

Proposal #: 21GAR004-025

Project Title: Knowledge is power: Resolving the geographic distribution and host range of OsHV-1 on the East and Gulf coasts to mitigate impediments on shellfish aquaculture commerce

Applicant: University of Maryland Baltimore County

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

Principal Investigator: Colleen A. Burge, Assistant Professor Institute of Marine & Environmental Technology, colleenb@umbc.edu

Amount: \$299,376

Abstract: Disease outbreaks and associated mass mortality events have plagued many of our shellfish fishery and aquaculture industries over recent decades. Cultured shellfish are worth billions of dollars to global economies, and disease outbreaks have crippled or effectively destroyed some of these industries. Oyster aquaculture contributes nearly a third to shellfish production and is growing rapidly in the US, led by production of the eastern oyster. Critical to managing disease outbreaks are strong biosecurity practices and key knowledge of existing pathogen distributions and susceptibility (i.e. ability to become infected). An emerging pathogen of concern for bivalve aquaculture is the viral pathogen Ostreid herpesvirus 1 (OsHV-1), variants of which have caused major shellfish mortalities around the world. Of particular concern are the OsHV-1 μ vars which have spread globally in Pacific oyster aquaculture since 2008. OsHV-1 is not routinely monitored in potentially susceptible Atlantic and Gulf of Mexico species, with the last survey conducted well prior to emergence of the OsHV-1 μ vars. We seek to increase scientific and practical knowledge on OsHV-1 distributions and the susceptibility of

economically important US East and Gulf Coast species: eastern oysters (*Crassostrea virginica*), hard clams (*Mercenaria mercenaria*), and bay scallops (*Argopecten irradians*).

Potential Commercial Benefits to the Fishing Community of the Research Results: This project seeks to address Priority #2 of the SK Grant Program by providing a science-based project to strengthen the US aquaculture industry. We will actively collaborate with the shellfish aquaculture industry to increase biosecurity focused on emerging disease and reducing regulatory hurdles by resolving the level of threat posed to key Atlantic and Gulf shellfish species by OsHV-1 and providing perspective on what shellfish transfers are safe with regard to OsHV-1. The project will inform management decisions for interstate transfers affecting hatchery, nursery, and farm grow-out and in the context of both domestic and international commerce.

Proposal #: 21GAR022-081

Project Title: Economic and environmental feasibility of soft-shell clam aquaculture in Virginia

Applicant: Virginia Institute of Marine Science

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

Principal Investigator: Rochelle D. Seitz, Research Professor of Marine Science; email: seitz@vims.edu;

Amount: \$300,000

Abstract: *Mya arenaria*, the soft-shell clam, is a suspension-feeding, infaunal clam that ranges from Canada to Georgia. *Mya* has been cultured in Maine (ME) for many years, and there is a niche for its aquaculture in Virginia (VA) to accompany that of hard clams and oysters. In field experiments in VA, transplanted *Mya* survived well and grew from less than 1 inch to market size (2 inches) in 6 months. More studies are needed to assess feasibility of clam reproduction and grow out at varying temperatures, salinities, and predator-exclusion mesh to determine optimal conditions for rearing, lab growth, and field grow-out in VA. We will examine economic and environmental feasibility for soft-shell clam aquaculture in VA by: 1) conducting focusgroup interviews with dealers and processors regarding soft-shell clam aquaculture; 2) testing optimal hatchery and field conditions (temperature, salinity, predator-exclusion caging) for rearing and grow-out of soft-shell clams; and 3) estimating costs for start-up and maintenance of soft-shell clam aquaculture operations. We hypothesize soft-shell clams spawn optimally at 23o C (ME is 15-25o C) and grow optimally at moderate salinity and moderate temperature. Our results will be conveyed through workshops and manuals to end users to promote a new industry in VA.

Potential Commercial Benefits to the Fishing Community of the Research Results: Shellfish, specifically oysters and clams, have traditionally supported commercial fisheries and aquaculture operations along the Atlantic. Currently, aquaculture in VA includes hard clams and

oysters, whereas soft-shell clams (Mya) are only fished in MD. With the threat of job and revenue losses in fisheries due to environmental change, development of a new aquaculture industry would allow fishing communities to diversify their portfolios and expand aquaculture operations. Mya aquaculture has succeeded in other states, and markets exist. Thus, soft-shell clam aquaculture in VA could prove to be an investment and job opportunity for the seafood industry and coastal communities in Virginia.

Proposal #: 21GAR047-031

Project Title: Realizing the Full Potential of Rhode Island Seafood in Rhode Island

Applicant: Rhode Island Department of Environmental Management, Office of the Director, on behalf of the Rhode Island Seafood Marketing Collaborative.

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: Robert Ballou, Assistant to the Director, RIDEM; Robert.Ballou@dem.ri.gov

Amount: \$300,000

Abstract: Informed by ten years of experience and a focused strategic plan, and equipped with the building blocks for success, the Rhode Island Seafood Marketing Collaborative, a vibrant public-private partnership, proposes a robust, statewide seafood marketing and promotion campaign to bolster the market for Rhode Island seafood in Rhode Island. The central project component is a multifaceted consumer awareness initiative hinged upon a refined RI seafood brand and the digital home services provided by the SeafoodRI.com website. The project addresses the core issue of connecting RI seafood consumers with RI seafood products, with particular emphasis on the value and appeal of the diverse array of abundant RI seafood resources and products available on a naturally fluctuating basis throughout the year. The goal is to realize the full potential of RI seafood in RI by optimizing the benefits derived from short, sustainable local supply chains, complemented by traditional out-of-state and export markets. A diverse cohort of in-state seafood sales venues and a singular bellwether species – summer flounder – will be used to track the effectiveness of the campaign over the course of calendar year 2022.

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

The project promises to bolster local demand for RI seafood products, thereby increasing product value and giving rise to long-term stability and growth opportunities for the RI commercial fishing and aquaculture industry. The breakdown of traditional seafood supply chains during 2020 sharpened recognition by the RI fishing and aquaculture community regarding the vital importance of establishing stronger, more secure local markets for the wide range and large quantity of products harvested, grown and landed in RI year-round by the multi-sector commercial community. The project directly addresses this priority need and interest, lending support to all sectors.

Proposal #: 21GAR041-080

Project Title: Increasing Local Seafood Consumption Through Demo, Dialogue and Donations

Applicant: Cornell University Cooperative Extension Marine Program

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: Scott Curatolo-Wagemann, Senior Resource Educator, sw224@cornell.edu

Amount: \$63,668

Abstract: In response to the COVID-19 pandemic, CCE and EWTE have recognized that this as an opportune time to create 15 live, online “Demo and Dialogue” local seafood cooking demonstration/education events. These events are interactive experiences led by expert chefs and Fisheries Specialists designed to teach home cooks how to prepare local seafood in their own kitchen while also providing fishing industry knowledge and education. Increasing interest and demand for local seafood will help to support the local fishing community left reeling from the effects of the pandemic. The proceeds generated through these events will go towards the purchase of local seafood to feed community members in need in both NY and RI. Distribution of seafood donations will be coordinated by CCE, EWTE, East End Food Institute, and the Commercial Fisheries Center of RI in cooperation with local fishermen. The pandemic has left consumers forced to adapt how they shop, cook and eat. This project fills a need for increased at-home cooking instruction specifically for seafood and allows project partners to leverage the bounty of the Northeast region to provide healthy food for our neighbors in need while also providing support for local fishermen by increasing demand for local seafood.

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

This project will establish an upward demand curve for local seafood, particularly underutilized/lesser-known species, which will continue indefinitely once consumer attitudes are changed regarding purchasing local vs. imported seafood. Increased demand for local seafood results in greater economic value and income generation for local fishermen, seafood retailers and coastal communities. This project will help keep NY and RI’s fishing industry competitive and sustainable while stimulating activity for this important segment of the economy during the pandemic. This industry is critical to the heritage and future of the Northeast. This project will help ensure this industry remains viable and thriving.

Proposal #: 21GAR055-069

Project Title: Improving the quality, marketability, and economics for Atlantic bluefin tuna (*Thunnus thynnus*) captured in US fisheries

Applicant: University of Maine

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: Walter Golet, Ph.D. (Lead PI) Professor Gulf of Maine Research Institute School of Marine Sciences, walter.golet@maine.edu; Co/PI Kyle Foley, Sustainable Seafood Program Manager, Gulf of Maine Research Institute, kfoley@gmri.org

Amount: \$296,879

Abstract: US Atlantic bluefin tuna (ABFT) is a well-managed fishery that provides a livelihood for thousands of US commercial fishermen. Unfortunately, US ABFT fishermen and tuna dealers struggle to

break through in the domestic seafood marketplace, in part due to negative perceptions from restaurants, retailers, and consumers about bluefin tuna in general. The ABFT industry has also suffered in recent years from declining export markets for US bluefin, and low prices and lack of markets have become commonplace. One of the challenges is a recent trend of increasing new entrants to the commercial fishery and poorer quality handling. We propose to address these two critical issues hampering the success of the ABFT industry: improving quality handling and doing buyer outreach and communications. We plan to research best handling practices for vessels to implement, and to work with the industry to train fishermen on how to improve the quality of their product. We will also execute an outreach and communications strategy to engage restaurants, retailers, and other key buyers in building demand for US ABFT, which will include hands-on events and an earned media strategy. Combined, these strategies will increase market demand and improve value for the US ABFT industry.

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

This project will benefit the US commercial ABFT industry in several ways. Quality handling on the vessel will be improved, which will result in vessels receiving better value for their landed fish in the domestic and international market space. We have proof of concept of this model for groundfish species in the Gulf of Maine where specific handling techniques have increased prices for fishermen. This project will also increase demand for ABFT in domestic markets, which will benefit US commercial ABFT fishermen by expanding the market for their product and producing more demand for a species with a quota-limited harvest.

Proposal #: 21GAR010-086

Project Title: Evaluating production constraints and consumer demand in an emerging blue catfish (*Ictalurus furcatus*) fishery

Applicant: Virginia Institute of Marine Science

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: Andrew M. Scheld, Assistant Professor, Department of Fisheries Science; scheld@vims.edu

Amount: \$256,103

Abstract: The proposed research seeks to evaluate factors influencing development of an emerging commercial fishery for blue catfish (*Ictalurus furcatus*) in Virginia and produce economic information that promotes sustainable industry growth. Blue catfish is an invasive species of growing management concern found in fresh and estuarine waters of the Chesapeake Bay. Over the last fifteen years, a small commercial fishery has begun to develop, however landings remain low and participation in the fishery is limited. Industry growth is thought to depend on consumer demand for blue catfish products, investment and participation by commercial fishers and processors, as well as perceptions by the public and recreational sector. A fisher survey will be used collect economic information on commercial participation, while focus groups with individuals in the post-harvest sector will identify barriers and bottlenecks in processing and distribution. Additionally, a survey of local seafood consumers will assess preferences and willingness-to-pay for blue catfish products. We will work closely with project collaborators to develop research materials and distribute outreach products to a variety of audiences.

By involving fishers, seafood businesses, consumers, and the recreational sector, this project will produce comprehensive and holistic informational products needed to further develop the underexploited blue catfish resource.

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

This research aims to guide successful development of an emerging blue catfish fishery, yielding economic benefits to Virginia seafood producers and consumers while also reducing a non-native population associated with harmful ecological impacts. Growth in the fishery will create job opportunities and additional revenue streams for small-scale coastal Virginia fishers, fish processors, dealers, and distributors, improving economic viability and stability of local seafood businesses. Increased exploitation of blue catfish will also reduce existing invasive populations, which is anticipated to reduce predation and competition with native fish species and produce commercial benefits for fishing communities who depend on these resources.

Proposal #: 21GAR051-091

Project Title: Promoting the Resurgence of the New Jersey Oyster Through Shell Recycling

Applicant: American Littoral Society

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: Nicole Haines, Director of Education, Nicole.Haines@littoralsociety.org;

Amount: \$300,000

Abstract: “Promoting the Resurgence of the New Jersey Oyster Through Shell Recycling” will strengthen the viability of the New Jersey aquaculture industry by creating a cause related partnership between local oyster farmers and conservation nonprofits. This partnership will promote conservation focused business practices of participating businesses and utilization of cause-related marketing strategies, increasing production and market demand for local oysters through education and outreach, and a direct connection to conservation efforts to restore wild oyster populations, improve water quality, and create habitat for other marine life. The project will enhance and promote the value and importance of the oyster’s impact on the local environment, and educate consumers on the importance of the oyster and oyster growers to the health and conservation of local waters. This partnership will establish roles and responsibilities for each party while working toward the mutual goal of healthy coastal waterways in New Jersey. To support these project goals, the “Shuck It, Don’t Chuck It” shell recycling program will collect used shell from restaurants, removing it from the waste stream and providing substrate for new reefs and building material for living shorelines, while also educating the public about oysters and restoration.

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

“Promoting the Resurgence of the New Jersey Oyster Through Shell Recycling” will benefit the New Jersey fishing community by increasing the demand for local oysters by supplementing present marketing capacity, establishing a public understanding and educating consumers on the value of oyster growing businesses in restoring water quality and ecological quality in coastal waters and relieving pressure on local wild capture fisheries.

Proposal #: 21PIR027-009

Project Title: Community Management of a Data and Capacity Limited Coral Reef Fishery in American Samoa

Applicant: Poseidon Fisheries Research LLC

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

Principal Investigator: Cassandra Pardee Managing Partner and Fisheries Biologist, cassie.pardee@pfr.fish; Co-PI, John Wiley Managing Partner and Fisheries Biologist, john.wiley@pfr.fish

Amount: \$198,806

Abstract: The coral reef fishery in American Samoa is a multi-species and multi-gear fishery, providing food and livelihood for many people. However, this fishery is data limited with inadequate catch, effort, size, reproduction, age, and growth data. The data-limitation is combined with limited institutional capacity to perform quantitative stock assessments and implement and enforce robust management actions. Therefore, community engagement in the data collection, assessment, and management process are critical to produce a sustainable cultural fishery. The purpose of this project is to leverage a bottom-up approach within the local communities, partnering with stakeholders, fishermen, and village chiefs to identify appropriate management tools for the data and capacity limited coral reef fishery of American Samoa. We will work with local fishermen to collect life history information from five species deemed most vulnerable by the community. The life history information will then be used in data-limited assessments which can be easily translated into management goals and stock indicators. By including stakeholders in the entire process of species identification, data collection, stock assessment, and management, the community will be more likely to self-regulate and manage their own resources, in order to produce a more sustainable community managed fishery.

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

Understanding the biology and stock status of commonly targeted fish is an important aspect towards sustainable coral reef fishery management in American Samoa. A community-based management approach will allow local managers to work with the fishing community to develop context-specific and adaptive options for the management of targeted coral reef species. This will result in more effective implementation of management strategies and increased support and buy-in for policies and regulations from stakeholders. Developing a practical management plan with the local community will benefit the fishing community by ensuring the sustainability of an economically and culturally important coral reef fishery.

Proposal #: 21PIR030-006

Project Title: Moving toward Science-driven Management of Bottomfish Stocks in Guam and the CNMI

Applicant: University of Central Florida Board of Trustees

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

Principal Investigator: Dr. Michelle R. Gaither, Assistant Professor UCF Biology Department & Genomics and Bioinformatics Cluster, michelle.gaither@ucf.edu; Dr. Frank Camacho, Associate Professor University of Guam, Biology Department UOG Station, fcamacho@triton.uog.edu

Amount: \$300,000

Abstract: Bottomfish resources in Guam and the CNMI, are managed by NOAA through the Western Pacific Regional Fishery Management Council. Due to a critical lack of scientific data, the thirteen bottomfish management unit species in this region are managed as a species-complex and defined as two stocks based on jurisdictional boundaries and not biological reality. Management of these vital resources without the scientific information needed to define stocks (management units) leaves this resource vulnerable to over- or under-exploitation and opens the door for wasteful research and management practices. Here we propose to fill this perilous data gap by capitalizing on existing tissue collections at PIFSC and employing a seascape genomics approach to define stocks for five managed fish species across Guam and the CNMI. Our study will identify biologically relevant stocks, provide estimates of larval dispersal and direction of gene flow, and pinpoint sources of new recruits into subsistence and commercial fishing grounds. This research is an important component of the biological foundation upon which effective fisheries management is built and will further our understanding of drivers of stock structure and how they impact fish production, and do so while engaging local fishermen and training the next generation of fisheries scientists.

Summary of potential commercial benefits to the fishing community of the research results: Bottomfish fisheries in the remote U.S. Pacific Territories are a vital source of food and revenue to local communities. Currently, stocks are defined not based on biology but on jurisdictional boundaries and the resulting stock assessments are hindered by uncertainty. Our project will provide meaningful stocks definitions, prevent waste of management resources, and provide the data required to develop proper stock assessments upon which catch limits are based. Given the overfished status of Guam bottomfish and the high uncertainty in stock status of CNMI bottomfish, it is important now, more than ever, that this information be provided to managers.

Proposal #: 21PIR043-011

Project Title: Establishing a Supply and Training Program for Aquaculture Production of Hawaiian Sea Cucumber

Applicant: Pacific American Foundation

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

Principal Investigator: David Anderson, Production Manager, Kauai Sea Farm, dave@kauaiseafarm.com

Amount: \$299,154

Abstract: The proposed project aims to develop a sea cucumber aquaculture industry for Hawai'i. This project directly addresses Priority 2 (Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting) of the FY21 Saltonstall-Kennedy Competition Notice of Funding Opportunity by creating a new industry to benefit coastal communities throughout the state, with production of a high value low trophic species that feeds on waste. This will be accomplished through replication and refinement of hatchery techniques, applied research into innovative production methods, and an outreach and training program for the aquaculture and coastal fishing communities. Direct stakeholder involvement in the project will come from the commercial aquaculture sector, the Hawaiian fishpond community, and groups interested in restoring nearshore ecosystems.

The proposed project will develop hatchery methods and facilities at the Nōmilo Fishpond, operated by Kauai Sea Farm in Kalaheo, Hawai'i. The facility includes a small-scale hatchery for bivalve production, with much of the basic infrastructure already in place to accommodate sea cucumber production. Principal Investigator (PI) David Anderson is the Production Manager for Kauai Sea Farm, and has over 10 years of experience in the Hawaiian aquaculture industry. Mr. Anderson's experiences have included hatchery and grow-out production of shrimp, fish and bivalves in both research and commercial applications. Additional hatchery rearing trials will be conducted at the University of Hawai'i Hilo Pacific Aquaculture and Coastal Resources Center (PACRC). Hatchery rearing at the PACRC facility will be overseen by Co-Principle Investigator (Co-PI) Dr. Maria Haws. Dr. Haws is a Professor of Aquaculture who has 25 years of invertebrate hatchery experience, as well as experience with microalgae, macroalgae, and fish culture. Replication of well-documented methods for sea cucumber hatchery rearing will be used to determine which native species of sea cucumber has the highest potential for benefit to fishing and aquaculture communities in Hawai'i.

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

Beneficiaries of this project will be Hawaiian fishpond practitioners and commercial aquaculture operators who wish to expand revenue streams utilizing Integrated Multi-Trophic Aquaculture (IMTA). A modern movement is well underway across Hawai'i to restore ancient Hawaiian fishponds that once fed coastal communities, which are primarily funded through grants and private donations. This project will promote aquaculture of high-value native sea cucumbers, which requires no feed input, and may offer a sustainable source of income for

fishpond operators. The diverse nature of the Hawai'i aquaculture industry presents many opportunities to integrate production with other commercially-grown species as well.

Proposal #: 21PIR033-012

Project Title: Engaging Hawaii's Fishing Community to Establish Marine Aquaculture Techniques for Kumu, an Endemic Hawaiian Goatfish (*Parupeneus porphyreus*)

Applicant: Oceanic Institute of Hawaii Pacific University

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

Principal Investigator: Chatham K. Callan, PhD, Finfish Program Director, OI. ccallan@hpu.edu

Amount: \$295,409

Abstract: The proposed project will establish aquaculture technology for Kumu, the Hawaiian white saddle goatfish (*Parupeneus porphyreus*), an overfished species highly regarded among local recreational and commercial anglers for its cultural and economic value. Oceanic Institute, an aquaculture research institution recognized for its expertise in culturing marine fish species, will collaborate with Pacific Islands Fisheries Group (PIFG), the State of Hawaii's Division of Aquatic Resources (DAR), Paepae o He'eia (POH), and Conservation International - Hawaii (CI) to accomplish project objectives. A monetary incentive will be advertised to engage PIFG's and DAR's local network of recreational and commercial fishermen to participate in Kumu broodstock collection. Oceanic Institute has developed effective technology for broodstock conditioning, live feeds production, and larval rearing of marine fish. These methods are currently being used to culture yellow tang and red coral grouper at commercial scale. This project will apply these techniques with Kumu, demonstrating its application to a similar, previously difficult-to-rear, marine reef fish species. If successful, DAR will assist in evaluation of cultured Kumu juveniles for release into Hawaiian fishponds and local reefs through their existing fish tagging program. Dissemination of project results and outreach/education efforts will be assisted by PIFG and CI.

Potential Commercial Benefits to the Fishing Community of the Research Results: Kumu is considered one of the most valuable reef fish in Hawaii, with whole fish fetching a market price of up to \$40/kg. The development of successful culture protocols for this species will help inform future commercial-scale feasibility. Further, Hawaiian fishponds that receive Kumu fingerlings under this project will benefit commercially by selling adults grown in their ponds to the local restaurant industry. This technology could also facilitate future stock enhancement efforts, which in turn will benefit the commercial and recreational fisheries for this species.

Proposal #: 21PIR023-010

Project Title: Development of Hawaii Squid Fishery and Marketable Products

Applicant: Pacific Islands Fisheries Group

Priority Addressed Priority #1 – Promotion, Development and Marketing

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

Amount: \$119,283.00

Abstract: This project addresses SK Priority #1 to support fishery promotion, development and marketing of the underutilized squid (ika) fishery in the Hawaiian islands. This project will inform fishermen about opportunities for catching, consuming and selling local ika. Demand for squid remains high in Hawaii fisheries as bait and is also extensively used in Hawaii's culinary industry. Decadal fluctuations have impacted normal supplies of squid to global markets. This has resulted in the price of imported frozen squid increasing significantly (>\$5/lb) making it more difficult to source. Annual landings of Hawaii fresh pelagic squid over the past 20 years has been about 2200 pounds, with a total average value of \$6,116. Ex-vessel price per pound has increased by 40% to \$3.58 over the past few years. This project will source and purchase locally caught squid to be provided to participating restaurants free of charge to be used and evaluated against frozen imported products. The project will share the Japanese processing technique, ikejime, with fishermen to produce high quality fresh squid. Finally, fresh local squid and freeze dried squid will be shared with fishermen to evaluate its effectiveness as bait against imported frozen squid in existing shore and boat-based fisheries.

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

This project will promote the development of Hawaii's fresh squid fishery. Locally caught ika will be promoted to fishermen as a fresh alternative source of bait instead of imported frozen bait and to restaurants as fresh high quality locally available seafood. Fishermen will be informed about potential opportunities for catching, consuming and selling local ika. Increased understanding of the species, gear, method, timing, cost and uses will allow fishermen to determine entry costs to the fishery. Information on product handling will ensure delivery of the freshest and highest quality product to Hawaii's fresh "sashimi-grade" fish market. This project will also allow restaurant/seafood companies to test market locally caught squid without cost.

Proposal #: 21PIR028-007

Project Title: Operationalizing offshore pelagic fisheries in the Palau National Marine Sanctuary (PNMS) through a public-private partnership to benefit local fishing communities

Applicant: Ministry of Natural Resources, Environment, and Tourism (MNRET), Republic of Palau

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: Persis Omelau, Fisheries Specialist, Division of Oceanic Fisheries, omelaupersis@gmail.com

Amount: \$300,000

Abstract: In 2015, Palau created the Palau National Marine Sanctuary (PNMS), one of the world's largest Marine Protected Areas. It closed 80% of the EEZ. 20% became a Domestic Fishing Zone (DFZ) to

transition the foreign-dominated exported pelagic fishery to a domestic one with food security and economic benefits for Palauans. Through a private-public partnership, this project will strengthen the fledgling domestic industry (longline, purse seine, pole-and-line, and Artisanal) by stabilizing supply and demand, improving capacity (skills and facilities) to process and create added-value products, and increase the number of participants in pelagic fisheries. The Ministry of Natural Resources, Environment, and Tourism (MNRET) contracted its rights to buy 10% of pelagic longline catches to Belau Offshore Fishers Inc. (BOFI), a Member-based marketplace, buyer, and seller. In return for the rights, BOFI must increase local participation in pelagic fisheries (commercial and Artisanal). This project will improve BOFI's operational and business practices so that it can consistently supply Grade A fish locally (food security) and increase profitability (for Palauans); and it will establish a training program in processing and added-value operations so as to maintain high quality, access top global prices, engage women and vulnerable peoples, and collect data on supply and demand.

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

This project will enable Palau to sustainably manage the PNMS and DFZ for food security and economic benefits. Palau will have a central market place, stabilize supply and demand, and be able to obtain top dollar globally. The Palauan fishing community will have reduced economic risk through a stable and secure buyer; will increase skills to retain quality and obtain top dollar (increasing profitability and removing economic barriers); and have access to diversified employment opportunities and added-value options. The project will document the conversion of a reef fishery to a pelagic fishery and a foreign-dominated fishery to a domestic fishery.

Proposal #: 21PIR011-018

Project Title: Hawaii Seafood Marketing in the Age of COVID

Applicant: Hawaii Seafood Council

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: John Kaneko MS, DVM, HSC Program Manager, Honolulu, Hawaii, info@hawaii-seafood.org

Amount: \$300,000

Abstract: Hawaii's primary Fishing Community is located at Pier 38 in Honolulu Harbor. It includes people working in fishing, the fish auction, seafood wholesale, retail and restaurant companies and support services. In March 2020, the COVID pandemic caused Hawaii to shut down its tourist arrivals, issue stay at home orders, and temporarily close businesses. The cascade of impacts on hotels, restaurants and catering devastated the demand for Hawaii Seafood in Hawaii and across the nation. This project focuses on the branding and promotion of Hawaii Seafood in response to the COVID pandemic impacts and what lays ahead in the fall of 2021 in terms of surviving Hawaii fishing and seafood operations and the Hawaii and US seafood market demand. Branding and promoting Hawaii Seafood will respond to changes in the fishery, seafood market and the consumer and how seafood is purchased and consumed in the COVID era. The project will 1) assess fishing operations and seafood market conditions, 2) strengthen the Hawaii Seafood brand, 3) develop a Promotion Strategy and Plan, 4) upgrade the

Hawaii Seafood website to accommodate branding, promotion and social media, 5) develop social media profile and online branding and promotion content and 6) launch the promotion campaign.

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

Benefits to the Fishing Community include, 1) Hawaii Seafood branding and promotion efforts to build fishing community relations and resilience, 2) a promotion effort that can help support the marketing of Hawaii Seafood, 3) rebuild the market demand for Hawaii Seafood in the COVID era, 4) improved fishing industry relations with the greater community, the media, government agencies, and the sustainable seafood market, and 5) improved long-term resilience and sustainability of the Pier 38 Fishing Community.

Proposal #: 21PIR036-002

Project Title: "Hawaii Seafood Culinary Best Practice Digital Promotion"

Applicant: Kapiolani Community College, University of Hawaii

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: Ronald Takahashi, Professor, rtakahas@hawaii.edu

Amount: 299,985

Abstract: This proposed project targets S-K Program priority #1: to promote Hawaii seafood by developing user-friendly hand-on cooking instruction digital content at two levels of details and complexity: (1) "Video Recipe Cards" for home cooks with recipes, and (2) Professional level cooking instructions for culinary students and novice food service industry cooks without formal training. The content will be marketed and disseminated via social media (Facebook, YouTube, Instagram etc.) and can be viewed using portable mobile platforms such as mobile phone, notepads, laptops available for free

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

This strategy is designed to overcome the uncertain trajectory of reopening of the State and barriers to revival of the food service industry after a massive market shrinkage. Home cooking and online instructions takes the marketing directly to homes and workplaces, eliminating the costly and physically prohibitive method of seafood festivals/events.

Proposal #: 21PIR032-016

Project Title: Expanding Domestic Marketing and Commercial Export Opportunities for Micronesian Value-added Nearshore Pelagic Fish Products

Applicant: MarAlliance, San Francisco, USA

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: KL Rhodes, PhD: klrhodes_grouper@yahoo.com

Amount: \$299,035

Abstract: Micronesia's inshore fisheries are overfished, with some states exceeding sustainable biocapacity by 3.5 times. This situation is driven by an under-valuation of marine resources and unsustainable gear use. There is now widespread interest in decreasing inshore fishing by shifting effort to the artisanal nearshore pelagic realm. Currently high fishing-related commodity and depressed wholesale fish prices have diminished the economic incentive to elicit such a shift. In Pohnpei, Micronesia, the local fisher's association, Menin Katengensed, has established a not-for-profit sustainable fish market focused on fair-market pricing and value-adding to pelagic fish. Products include vacuum-sealed tuna loins, tuna jerky, ground tuna, and pelagic fish fillets. The market is the sole producer of these products in Micronesia and while popular locally, sales opportunities are limited. Thus, there is both an opportunity, a desire, and a need to expand to export markets and expand economic opportunities to local fishers and markets through cooperative purchasing agreements. The project will improve and expand current market operations and develop, market, and promote new and existing products, with the aim of exporting these products to the US, Asia, and Guam and serving as a blueprint to expand economic opportunity and decrease inshore fishing pressure within the region.

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

The current project directly expands economic opportunities by increasing prices for raw products and developing export markets for raw and value-added products. The market is fisher-owned and operates as a not-for-profit, with sales proceeds going directly to the fisher association to expand operations and maintain its existence. Value-added products have increased fisher profits by 30%, while new product development and an expanded market will create additional opportunities for fishers and partnered fish markets to use existing and under-utilized species. The ultimate goals are to improve incomes to fishing families and simultaneously reduce pressure on overfished inshore stocks.

Proposal #: 21SER027-035

Project Title: Methylation-Based Aging: An Efficient Approach to Mass-ageing Fisheries Species

Applicant: Texas A&M University – Corpus Christi

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

Principal Investigator: David S. Portnoy, Associate Professor, Texas A&M University, david.portnoy@tamucc.edu; CoPI(s): Christopher Hollenbeck, Assistant Professor, Texas A&M University, christopher.hollenbeck@tamucc.edu; Dr William Patterson III, Professor, University of Florida will.patterson@ufl.edu

Amount: \$297,986

Abstract: Understanding population dynamics of fishes is critical to assessment of stocks and development of fisheries management plans, and age-structured, integrated stock assessment models rely on accurate estimates of age composition. Otolith analysis, the traditional ageing technique, is labor-intensive and can only be performed on dead fish, thus limiting the amount of age data that can be collected and the types of samples that can be included. Levels of DNA methylation in specific parts of the genome are strongly correlated with age and can be used to develop age prediction models (epigenetic clock assays). Because levels of methylation can be measured using small tissue samples and

genetic techniques, it offers a relatively noninvasive, nonlethal alternative to otolith-based aging. Furthermore, by using well-established techniques, methylation-based ageing would allow data to be collected for tens of thousands of fish in a timely and economically efficient manner, drastically improving the ability to generate precise, accurate age composition estimates necessary for robust stock assessment. To this end, we propose using next-generation DNA sequencing technology to develop epigenetic clock assays for two fisheries species, red snapper (*Lutjanus campechanus*) and red grouper (*Epinephelus morio*), and then test the utility of these clocks for other fisheries species.

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

The proposed research will develop a cutting-edge genetic technique for ageing red snapper and red grouper, both important species in U.S. recreational and commercial fisheries. The technique developed will make ageing large numbers of fish time- and cost-efficient. This will translate into lower uncertainty in stock assessments and benefit fishers by decreasing the buffer between the overfishing limit and acceptable biological catch, resulting in higher annual catch limits (i.e., quotas). The impacts of this project will be far reaching because the technique could in theory be applied to other species, providing transformative benefits across multiple fisheries.

Proposal #: 21SER023-025

Project Title: Strengthening the Georgia hard clam industry through expansion into southern quahog, *Mercenaria campechiensis*, mariculture

Applicant: University of Georgia Marine Extension and Georgia Sea Grant

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

Principal Investigator: Justin Manley (PI)- University of Georgia, Marine Extension and Georgia Sea Grant, manley@uga.edu; Co-PIs: Thomas Bliss, University of Georgia, Marine Extension and Georgia Sea Grant, tbliss@uga.edu; Curt Hemmel, Bay Shellfish Co., curt@bayshellfish.com; Charlie Phillips, Sapelo Sea Farms, ga_capt@yahoo.com

Amount: \$229,704

Abstract: *M. campechiensis* is distributed from the Chesapeake Bay to Florida and west to the Yucatán Peninsula and co-occurs with the northern quahog throughout the southern range of *M. mercenaria* where hybridization between species occurs. In Georgia there is commercial interest in the culture of southern quahogs within the state to reduce heat losses observed (>50% at some sites July-September) with northern quahog culture. Southern quahogs have higher growth and survival rates than northern quahogs at warmer water temperatures. Use of southern quahogs by Georgia clam farmers may offset summer losses observed with northern quahogs in the south resulting in measurable gains in clam production within the state. The proposed research evaluates survival, growth, meat condition, estimated biomass, and harvest between clam species planted at each of three commercial sites in Georgia. Clams will be deployed and cultured in soft mesh nylon clam bags and farmed using methodology consistent with commercial clam farms in the southeast. Data will be collected and analyzed quarterly.

over a two-year period (September 2021-August 2023). The proposed study builds on funded SK research (proposal# 18SER039-044) evaluating southern quahog grow-out in Florida by using clam seed from genetically verified southern quahog broodstock for research in Georgia.

Potential Commercial Benefits to the Fishing Community of the Research Results: Southern quahogs have higher growth and survival rates than the northern quahog at warmer water temperatures and have a similar food quality profile allowing farmers that use southern quahogs access to the same clam markets. Use of southern quahogs in industries characterized by warmer climates can reduce heat losses of clam stocks resulting in increased clam harvest, overall landings value, and increased profits with no change in equipment or commercial production strategies. Increased efficiency and reductions in interruptions to farmed clam production will support greater workforce stability in fishing communities with economies built around the clam industry in Georgia.

Proposal #: 21SER001-056

Project Title: Alabama Off Bottom Oyster Wet Storage and Depuration Facility Pilot Project Using Vacuum Air Lift™ (VAL) Technology

Applicant: Ankers Subsea LLC

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

Principal Investigator: Doug Ankersen, President Ankers Subsea LLC, dougankersen@bellsouth.net

Amount: \$300,000

Abstract: Ankers SubSea LLC requests \$300,000 from the FY21 Saltonstall-Kennedy Competition to develop an innovative wet storage and depuration facility for off bottom oysters using Vacuum Air Lift™ (VAL) technology. The facility will be constructed on Dauphin Island, Alabama to revolutionize coastal Alabama's emerging aquaculture industry. The Alabama State Board of Health closes coastal Alabama waters to oyster harvesting periodically throughout the year due to many factors. Since 2012, the waters have been closed an average of 26% annually. These closures wreak havoc on the off bottom oyster industry as the supply chain is disrupted and suppliers and restaurants are forced to seek alternative markets. Further, the wet storage and depuration technology available to Alabama Oyster farms (traditional microbubble or sand filter/UV Filtration) has higher capital and maintenance cost and is less energy efficient. The Vacuum Air Lift™ (VAL) wet storage and depuration facility will utilize innovative technology to provide a continuous supply of oysters during state mandated closures. This project will result in the removal of a bottleneck in the oyster supply chain, making the industry economically viable as revenue can be generated throughout the year. Further, it will continue to reduce the industry's challenges and create more opportunities.

Potential Commercial Benefits to the Fishing Community of the Research Results: This project will install innovative, efficient technology for wet storage and depuration of the farmed oysters during closures. This technology is called Vacuum Air Lift™ (VAL) and has a higher capacity, smaller footprint, and uses 50% less energy than the traditional depuration processes. Up until the late 1990s, Alabama waters consisted of vast expanses of native oyster reefs. Due to hurricanes, salinity variations and natural predators, the reefs disappeared. Ancillary benefits of this industry include the creation of habitat for juvenile shrimp, crabs and fish. The farmed oysters filter the water of excess nutrients and plankton.

Proposal #: 21SER038-020

Project Title: A Fishers-Operated Queen Conch (*Strombus gigas*) Hatchery for Growout of Sustainable Seafood for Local Markets in Puerto Rico

Applicant: Florida Atlantic University, Harbor Branch Oceanographic Institute

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

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: \$299,283

Abstract: The queen conch *Strombus gigas* (renamed *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 seafood. The project goal will use the S-K NOAA supported Puerto Rico Queen Conch Hatchery and Nursery to produce conch juveniles for growout in coastal pens for local seafood markets. The fishers will assist with the aquaculture operation. In partnership with chefs, new conch menu items will be developed to increase the market value of conch, which will provide added income to the fishers. This project will serve as a model that can be transferred to other fishing communities in Puerto Rico.

Potential Commercial Benefits to the Fishing Community of the Research Results: The benefits to the fishing community include incomes for the fishers that work at the conch aquaculture operation. The Naguabo Fishing Association benefits from the conch hatchery being located as part of their working waterfront. The partnership with the chefs and restaurant owners that

develop and serve new menu items will result in the fishers being able to sell their harvested conch at a higher price. Overall the participation of the Puerto Rican fishing community in developing aquaculture projects will strengthen the Puerto Rican queen conch fishery and enhance the supply chain value of conch products in the marketplace.

Proposal #: 21SER037-053

Project Title: Enhancing Marine Aquaculture in the Tropical U.S. Methods for Sustainable Commercial Co-Cultivation of Shellfish and Seaweed in Florida

Applicant: Two Docks Shellfish, LLC

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

Principal Investigator: Aaron Welch, President, Two Docks Shellfish LLC, welchaar@gmail.com

Amount: \$264,031

Abstract: We propose to develop a co-culture system for native shellfish and macroalgae in U.S. tropical/subtropical marine waters. Development of reliable co-culture systems using native species will encourage growth of the nascent U.S. seaweed industry, increase resilience of the U.S. shellfish industry, and provide nutrient remediation benefits that may help mitigate harmful algal blooms. Our target species are the sunray venus clam (*Macrocallista nimbosa*) and the economically valuable macroalgae, *Eucheuma isiforme*, although additional seaweed species will be explored. We will evaluate the system's performance by measuring the species' growth rates, tissue nitrogen and carbon content, water quality parameters, and post-freezing quality. Our project team is comprised of academic, industry, and extension professionals that will apply their expertise in sustainable shore-based hatchery and nursery systems, nearshore growout, open-water aquaculture, and business planning tools to the effort. Project results will be shared in workshops with existing and prospective growers, publicly available fact sheets, conferences, and a peer-reviewed manuscript. This project will directly address SK Priority #2 - Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting in a region that is underdeveloped and underutilized by developing the first commercial co-culture seafood operation in the state of Florida and tropical/subtropical U.S. waters.

Potential Commercial Benefits to the Fishing Community of the Research Results: This research will aid the commercial fishing and aquaculture industries by improving the techniques used to produce sunray venus clams and *E. isiforme*, both of which have significant commercial value. Adding species to the suite of products produced by the U.S. seafood industry increases the resilience of our fishing and aquafarming communities. Additionally, because *E. isiforme* is an assimilative species that relies on the uptake of N and P, development of macroalgae production systems on a wide scale could mitigate harmful algae blooms, especially blooms of *Karenia brevis* (red tide), which have devastated the Florida fishing industry in recent years.

Proposal #: 21SER022-027

Project Title: Refining Culture Methods to Improve Aquaculture Production of Hogfish
(*Lachnolaimus maximus*)

Applicant: University of Florida

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

Principal Investigator: Dr. Cortney Ohs, Associate Professor – Aquaculture, cohs@ufl.edu; CO-PIs: Dr. Matthew DiMaggio, mdimaggi@ufl.edu; Dr. Josh Patterson, joshpatterson@ufl.edu; Dr. Angela Collins, abcollins@ufl.edu; Casey Murray, casey.murray@ufl.edu

Amount: \$300,000

Abstract: Hogfish, *Lachnolaimus maximus*, are native to the western Atlantic Ocean and Gulf of Mexico and are highly valued as sport and food fish. NOAA stock assessments show many populations of hogfish are overfished and management strategies have been implemented. Despite high value, existing markets, and negative population trends, information regarding aquaculture techniques are not refined. We were funded (NOAA S-K 2018) and were first to establish captive volitional spawning populations, and first to culture larvae and juveniles past 50 days. One brood population spawned over 200 days. We repeatedly successfully cultured larvae and juveniles. Our research efforts represent the first success with hogfish aquaculture. The proposed research will build upon these successes and experiments will define optimal larval feeding regimes, juvenile feeding regimes, and growout methods to foodfish size. Additionally, salinity tolerance and standard marking techniques will be evaluated. Therefore, when hogfish are cultured for stock enhancement, methods to mark hogfish will be elucidated. The overall goal of this research is to define culture methods from broodstock to stock enhancement and foodfish size, and to disseminate results to aquaculturists. Results will provide private and state aquaculture hatcheries necessary information for future hogfish stock enhancement efforts and future foodfish production.

Potential Commercial Benefits to the Fishing Community of the Research Results: Results will define efficient culture methods for hogfish from broodstock to sizes for stock enhancement and foodfish markets. This includes efficient juvenile production with high survival and rapid growth; optimized larval feeding regimes maximizing survival and growth to metamorphosis; best tank size for larval culture; preferred substrate type, amount, and location within larval culture tanks; optimized culture methods for juvenile hogfish; defined juvenile growout protocols to foodfish size; known salinity tolerance and effects on growth and survival at different developmental stages; knowledge of digestive enzyme ontogeny to direct feeding protocols; and effective chemical marking protocols for hatchery produced juveniles.

Proposal #: 21SER034-036

Project Title: Promoting Gullah Geechee Maritime Cultural Heritage and Enhancing Economic Resilience through a Gullah Geechee Seafood Trail

Applicant: Gullah Geechee Chamber Foundation, Inc

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: Marilyn Hemingway; info@gullahgeecheefoundation.org

Amount: \$282,768

Abstract: The purpose of this project is to develop and establish a Gullah Geechee Seafood Trail to promote seafood businesses owned by members of the Gullah community in South Carolina, and to share maritime cultural heritage stories of the Gullah Geechee on a wider scale. Seafood businesses include fishers, harvesters, aquaculturists, seafood markets, and restaurants, and these businesses exist both formally and informally within the Gullah community. Tourism continues to grow in coastal South Carolina, and it is important that economic benefits are realized across the local socioeconomic and demographic spectrum. Beyond maritime cultural heritage tourism benefits, this proposed project is focused on sustainable economic uplift to benefit a historically bypassed community. Necessarily a part of this effort is capacity building to promote sustainable seafood practices and sound business planning practices among Trail entities that require this type of capacity building. Development of the Trail will be a stakeholder-led process, relying upon a network of existing people and organizations that preserve and promote the cultural heritage of the Gullah Geechee. The Gullah Geechee Seafood Trail will be actively managed, with a dynamic digital map hosted on a website, and promotional materials available in digital and print formats.

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

This project would directly benefit the Gullah Geechee fishing community by enhancing the marketing of small, mostly rural, minority-owned seafood businesses; including fishers, harvesters, aquaculturists, seafood markets, and restaurants. The enhanced marketing, visibility, and promotion that is provided by the Gullah Geechee Seafood Trail will increase the economic resilience of these businesses and the community at large, increase the potential for more entry into the seafood industry by community members, and will highlight important stories of Gullah Geechee maritime cultural heritage. Furthermore, capacity building efforts focused on sustainable seafood practices and sound business practices will be provided to Trail entities.

Proposal #: 21SER025-050

Project Title: Improving U.S. wild catfish market opportunities through improved cold chain management and packaging

Applicant: Louisiana State University Agricultural Center

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: Evelyn Watts, Assistant Professor/Seafood Extension Specialist, LSU AgCenter & LA Sea Grant, egwatts@agcenter.lsu.edu; CoPI(s): Julie Lively, LSU AgCenter & LA Sea Grant janderson@agcenter.lsu.edu; Catherine Liu, University of Maryland-UME Sea Grant, cathyliu@umd.edu;

Reza Ovissipour, Virginia Tech Seafood Agricultural Research and Extension Center ovissipour@vt.edu;
Abigail Villalba, Virginia Tech Agriculture Research Experiment Station villalba@vt.edu

Amount: \$299,598

Abstract: With the move from the U.S. Food and Drug Administration to the U.S. Department of Agriculture's Food Service and Inspection Service (USDA/FSIS), the USDA's final rule in 2015 required Siluriformes processing facilities to comply with USDA/FSIS inspection standards. In addition to required documentation, facilities are inspected once per production shift within a 40- hour week (Monday-Friday) at no cost. Small profit margins forced facilities to reduce days to process and pounds of fish to be processed. The main goal of this program is to allow the catfish fishermen & processors to adapt to the regulation restrictions and remain economically viable in the future while maintaining a sustainable fishery with improved market opportunities. The project will collaborate directly with catfish processors and fishermen. Fish quality and safety will be determined using current and best management practices, storing whole fish over 24 hours. Evaluation of market demand and improved packaging will encourage purchase of catfish and improve food safety. Findings will be transfer to the catfish industry. In addition, demonstration videos and social media kits will be developed to encourage consumption of wild-caught catfish.

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

The anticipated outcomes to this project are a) to allow US wild-catfish processors to receive fish after hours of operation, holidays, and weekends so they can process during approved hours of inspection; b) fishermen and processors will receive information about how an appropriate cold chain and packaging technologies can assist improve fish quality, safety and marketability; c) fishermen will be able to space out trips to the fish house to deliver their catch, increasing safety as fishermen can now pick the best weather and time to fish instead of when processors are open; d) premium cold chain management will result in a higher quality and safer product, gaining consumers trust; and e) promoting better business practices to increase demand and quality of U.S. wild-caught catfish fillets.

Proposal #: 21SER008-013

Project Title: Collaboration with local fish processing industry to convert fish trimmings and skins into value added fishmeal and fish oil to promote sustainability

Applicant: North Carolina State University

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: Michael Joseph, Assistant Professor and Extension Specialist, Prestage Department of Poultry Science, North Carolina State University, mvjoseph@ncsu.edu

Amount: \$265,625

Abstract: Fishmeal (FM) and fish oil (FO) are important ingredients used in aquaculture fish feed formulations, contributing essential amino acids and fatty acids. Both classes of compounds provide critical nutrients that support proper growth and development. However, these ingredients are expensive and rely on wild-caught fishery resources. We are interested in examining the efficacy of converting sustainably-sourced salmon processing waste (fish trimmings and skins; SBP) into similar by-

products as sustainable ingredient replacements. Each week, 37,400 lbs of SBP are generated from a North Carolina facility that processes aquacultured salmon into smoked fillets. Most of the SBP is currently disposed in a landfill. We propose to produce FM and FO from SBP that will be substituted in standard feed formulations at 0 (control), 25, 50, and 100% of normal commercial FM/FO ingredient inclusion rates. Fish feeds will be formulated to be complete diets, isonitrogenous and isocaloric. Feed ingredients and formulated fish feeds will be analyzed for physicochemical properties related to quality during a 6-month accelerated shelf life study. Palatability studies will be conducted using a commercial mariculture species (striped bass, *Morone saxatilis*). Then we will test the efficacy of formulated feeds during 18-week fish feeding trials.

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

This project will attempt to create a model improving utilization of fish processing waste generated by local fish processors. Converting wastes to useful FM and FO byproducts will prevent them entering landfills. This addresses two bottlenecks: 1) reducing current dependence on wild sourced FM/FO supplies from a few large commercial facilities and 2) expand economic opportunities for local fish processors through diversification into production and sales of important value-added by-products. If funded, this project will showcase opportunities to produce feed ingredients obtained from SBP on a small scale to address cost and sustainability challenges associated with traditional FM/FO sources.

Proposal #: 21SER006-034

Project Title: Evaluating the Effectiveness of Seafood Server Training Programs to Increase Sales of American Seafood

Applicant: Oyster South, Inc

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: Bethany Walton, Executive Director Oyster South, Inc., beth@oystersouth.com; Co-PI(s): Tom Bliss, Director, Shellfish Research Laboratory Marine Extension and Georgia Sea Grant tbliss@uga.edu; Adriane Michaelis, Post-Doctoral Research Scientist Auburn University, akm0084@auburn.edu; Daniel Petrolia, Professor Mississippi State University, d.petrolia@msstate.edu; Leslie Sturmer, Extension Specialist IV University of Florida, Inst@ufl.edu; William Walton, Professor & Extension Specialist Auburn University, billwalton@auburn.edu

Amount: \$299,413

Abstract: Despite the recent expansion of oyster aquaculture in the southern US (especially from North Carolina around to Louisiana), lack of knowledge about the quality of these farm-raised oysters and even negative perceptions about southern farm-raised oysters continue to persist, especially in regions outside of the southern US. Over two years, we propose to expand the existing pilot training program that targets seafood restaurant professionals (Know Thy Oysters) to 1) multiply the number of trainings locally in regional coastal communities through collaborations with Extension agents and 2) broaden the geographic scope to restaurants in other parts of the country in pivotal ‘food’ cities. We will also conduct formal quantitative and qualitative assessments of the effectiveness of this training program to estimate the causal effect of training on knowledge of and, ultimately, sales of southern farm-raised oysters. We propose to use this program as a proof of concept for other American seafood. Specifically,

we propose the following objectives: 1. Conduct at least 72 trainings of a total of at least 1,080 seafood food service professionals over two years across at least seven southern coastal states and six distinct 'foodie' urban markets, with a focus on southern farm-raised oysters. 2. Quantitatively assess impacts of the training in terms of changes in knowledge and, critically, changes in sales at both the server level (before and after training) and the restaurant level allowing evaluation of differences among restaurants and regions in terms of impacts. 3. Through interviews with chef and server participants, qualitatively detail and assess the nonmarket or non-material value of trainings, as well as obtain feedback for improvement of training sessions, need for tailoring the training by region, and the required frequency of trainings. 4. Share the specific results of this work with the southern oyster aquaculture community about how trainings of seafood service professionals might increase sales. 5. Share the more general lessons learned about training programs for seafood service professionals as a means of increasing sales with the Extension community.

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

Potential commercial benefits to the fishing community of this project include a substantial, measurable increase in sales of southern farm-raised oysters in near (i.e., during the project period) to mid-term. The project design includes an explicit quantification of these increased sales, which could be accomplished through a combination of restaurants beginning sales of southern farm-raised oysters as well as increased sales at restaurants currently offering these oysters. In addition, this project will also serve as the proof of concept of the value of training programs targeting seafood server industry professionals as a means of increasing sales of domestic seafood products in the mid- to long-term.

Proposal #: 21WCR003-019

Project Title: Development and testing of a fish oil diffuser as an alternative method of baiting crab pots

Applicant: University of Washington

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

Principal Investigator: Dr. Christopher Bassett Senior Mechanical Engineer University of Washington, Applied Physics Laboratory, cbassett@uw.edu; Co-investigators David Dyer, Principal Engineer Applied Physics Laboratory University of Washington, dyer@apl.washington.edu; Edward Poulsen Part-owner of F/V Patricia Lee and F/V Aleutian No.1, edwardpoulsen@gmail.com

Amount: \$67,283

Abstract: Fishing vessels targeting red king crab (*Paralithodes camtschaticus*) and Alaska snow crab (*Chionoecetes opilio*) in the Bering Sea harvest crab with traps or pots typically baited with either Pacific herring (*Clupea pallasii*) or Pacific sardines (*Sardinops sagax caerulea*). On average, vessels use approximately 10 pounds of ground up bait per pot and this represents a significant cost to vessels. Given the number of annual pot pulls this translates to approximately three million pounds of forage fishes being harvested simply to catch crab in the Bering Sea,

and sourcing of bait has become increasingly challenging. We propose to develop and test an inexpensive fish oil diffuser for baiting pots. Fish oil for such a diffuser could be readily sourced as a byproduct of groundfish processing plants in the significant crab fishing ports in Alaska. Successful development could decrease costs to industry, improve safety, and reduce the unnecessary reliance of the crab fishery on important forage fishes.

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

The primary beneficiaries of the successful development and deployment of a fish oil diffuser would be those that have a financial stake in or are employed in the red king and Alaska snow crab fisheries in the US and other pot fisheries globally. These benefits would include decreased costs through the use of byproducts of groundfish processing facilities and a reduced reliance of the crab fisheries on fully subscribed forage fish fisheries, thereby increasing the reliability in bait supply. Injuries attributed to baiting activities could also be reduced through the use of a fish oil diffusers. In addition, if catch rates are increased due to the diffuser, time on the water could decrease resulting in improved efficiency, lower exposure to injury and reduced expenses.

Proposal #: 21WCR006-013

Project Title: Increasing US fisheries yields by reducing bycatch: the potential of dynamic ocean management and other tools to adapt to climate change

Applicant: University of Washington

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

Principal Investigator: Ray Hilborn, Professor, School of Aquatic and Fishery Sciences, hilbornr@gmail.com

Amount: \$258,483

Abstract: This project will identify the potential to increase U.S. seafood production, and the extent to which this could be achieved by reducing bycatch. We will review the difference between the total allowable catch set by Regional Fisheries Management Councils, and the realized catches, and by interviews with regional experts determine where underutilization results from various bycatch constraints. We will develop methods to evaluate the potential for a range of tools that can be used to reduce bycatch to increase TAC utilization rates in regions where TACs are significantly greater than the landed catch. For specific regional case studies, we will predict how TAC utilization across species could be increased using each of these tools. We know from work we have already published that there is considerable potential to achieve fuller utilization. From work underway in our lab, we hypothesize that permanent closed areas are likely to prove an ineffective mechanism due to species distribution shifts from climate change and climate variability and that there is far more potential to increase TAC utilization

from various forms of dynamic ocean management, mixed stock fishing harvest policies and gear modification.

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

This work will identify where there is potential to increase U.S. fisheries production by reducing bycatch with direct benefits to fishing industry and fishing communities. We will also identify the fishery characteristics under which alternative bycatch reduction specific tools are likely to be effective. Initial estimates are that full utilization of TACs could result in an increase of a minimum of 200,000 tons of landings, and full utilization of ABCs over 1 million tons.

Proposal #: 21WCR013-016

Project Title: Expanding selective fishing operations and supporting management of opah off the California coast

Applicant: Pflieger Institute of Environmental Research

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

Principal Investigator: Chugey Sepulveda, PhD Senior Scientist, Chugey@pier.org; Scott Aalbers, Research Associate, Scott@pier.org

Amount: \$260,500

Abstract: This study will work with cooperative fishers, markets and managers to refine West Coast depth-based techniques to better target opah (*Lampris spp.*), an HMS resource with West Coast and Hawaiian market history. The work-plan will entail (1) the collection of new opah depth distribution data, (2) the modification of swordfish deep-set gear designs to better target opah and (3) the seeding of these findings into ongoing exempted trials through cooperative fisher involvement. All opah caught during the development work will be electronically tagged to collect area-specific depth distribution data for optimizing fishing operations and meeting management needs. The project will work directly with NOAA partners at the SWFSC, cooperative fishers and markets to increase domestic fishing opportunity and simultaneously promote sustainable U.S. seafood production. Findings will be provided directly to regional managers (NMFS; PFMC and Advisory Bodies) and will be directly seeded into the developing West Coast deep-set fishery. The project will entail a robust outreach platform that incorporates cooperative fisher involvement, helps markets develop a niche-market for opah and informs consumers on the importance of supporting domestic seafood operations. Findings will be documented in the form of presentations, management reports, scientific manuscripts and outreach materials.

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

This study aims to increase fisher opportunity by developing a sustainable domestic option for harvesting a local HMS resource that is largely imported to meet domestic demand. Products

from this work have the potential to directly benefit West Coast fishers by: (1) Providing increased access to a local resource, (2) bolstering domestic seafood production and associated revenues, (3) diversifying and increasing the resilience of the new deep-set fishery for swordfish, and (4) expanding domestic markets and informing consumers on the importance of supporting low-impact, sustainable domestic operations over foreign sourced products.

Proposal #: 21WCR012-029

Project Title: Understanding Triploid Pacific Oyster Mortalities on the U.S. West Coast

Applicant: Pacific Shellfish Institute

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

Principal Investigator: Bobbi Hudson, MSc, Director, Pacific Shellfish Institute, bobbi@pacshell.org; CO-PIs: Dr. Dan Cheney, Pacific Shellfish Institute, cheney@pacshell.org; Dr. Joth Davis, Pacific Hybreed, jothpdavis@gmail.com; Dr. Dennis Hedgecock, Pacific Hybreed, dennis@pacifichybreed.com; Dr. Ralph Elston, AquaTechnics Inc., ralph@aquatechnics.com; Molly Jackson, Taylor Shellfish Farms, mollyj@taylorshellfish.com

Amount: \$300,000

Abstract: Focused research is urgently needed to address catastrophic shellfish mortalities, especially among triploid Pacific oysters (*Crassostrea gigas*). Significant mortalities of Pacific oysters have occurred during the summer months over the last sixty years, and currently are on the rise. These mortalities have a significant monetary impact on individual producers and US shellfish production. Reproductive condition in diploid oysters has long been associated with mortality events. Yet triploid oysters, while exhibiting reduced gametogenesis compared to diploids, are also significantly impacted during the reproductive season. Our research serves four specific objectives: 1) Partner with industry and consultants to develop and maintain a geo-referenced data platform to attribute non-proprietary mortality statistics to shellfish growing area. 2) Provide oyster health and condition diagnostic evaluation to shellfish farms, along with training for appropriately collecting and submitting shellfish samples. 3) Evaluate the performance (growth and survival) Pacific oysters at multiple sites within the critically significant oyster producing regions of Willapa Bay, on the coast of Washington, and Puget Sound. 4) Compare reproductive status and digestive gland condition in diploid and triploid Pacific oysters, over the growing season, on test plots arrayed across relevant spatial and temporal environmental gradients.

Potential Commercial Benefits to the Fishing Community of the Research Results: All aspects of this research will be conducted through close and constant collaboration with shellfish producers and hatchery managers. We will provide technical support and data management tools to industry and research partners, facilitating management solutions. Research outcomes

will isolate factors contributing to oyster mortality, such as poor growing conditions and environmental extremes, allowing selection of appropriate triploid and/or diploid Pacific oyster seed. Our research has implications for breeding programs for Pacific oyster, as well as selection of seed stock for specific growing conditions. Basing seed stock and outplant choices on research results will increase US shellfish production.

Proposal #: 21WCR004-009

Project Title: Building resiliency in tribal fishing communities: Using Indigenous aquaculture techniques to enhance clam production

Applicant: Swinomish Indian Tribal Community

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

Principal Investigator: Courtney Greiner, Marine Ecologist, cgreiner@swinomish.nsn.us,

Amount: \$299,060

Abstract: The Swinomish Indian Tribal Community (SITC) is reviving an ancient mariculture practice by installing the first known present-day clam garden in the United States. Clam gardens are intertidal features modified by coastal Indigenous people (e.g., creating intertidal terraces to alter beach slope and substrate) to enhance clam habitat for optimal shellfish production. Healthy and productive shellfish beds provide important local foods and ecosystem services as well as support for human well-being. Unfortunately, recent declines in native clam species in the Pacific Northwest have generated concern about the sustainability of these resources for future generations. To address these concerns, SITC plans to utilize clam gardens to promote the integration of traditional ecological knowledge in contemporary resource management, encourage local food security, and provide a model for other coastal fishing communities. The proposed activities will leverage funds to construct a clam garden and study socio-ecological change associated with clam gardening. Moreover, clam gardens are readily adaptable to sea level rise and may be used as a climate change adaptation tool. Thus, information produced by this project will be transferable to other fishing communities interested in increasing clam production while utilizing a unique adaptation strategy and promoting sustainable fishing practices.

Potential Commercial Benefits to the Fishing Community of the Research Results: The anticipated benefits of our project are multifaceted and far reaching for tribes and other coastal communities throughout the greater Pacific region who depend on shellfish for their livelihoods and cultural identity. We expect to increase production and harvest opportunities of native clam populations using an integrated, multi-trophic aquaculture technique; create a reproducible, real world example of a community-based restoration project that integrates traditional ecological knowledge and contemporary resource management; and, advance

research 2 into sustainable Indigenous aquaculture systems that benefit fisheries management and conservation at large.

Proposal #: 21WCR016-026

Project Title: From nuisance to profit: Monetizing seaweeds and cockles that foul shellfish aquaculture farms

Applicant: Puget Sound Restoration Fund

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

Principal Investigator: Betsy Peabody, Executive Director, betsy@restorationfund.org; Jodie Toft, Ph.D., Deputy Director, jodie@restorationfund.org

Amount: \$298,017

Abstract: Accidental aquaculture is already underway for seaweeds and cockles in the Pacific Northwest. These species grow as a by-product at intertidal shellfish farms. However, seaweeds and cockles are a burden to growers as they are thought to sully water quality and impede geoduck growth. Growers, therefore, remove the seaweed and cockles, incurring labor costs, with little to no remuneration. However, we have an opportunity to develop practices to harvest and process these marine organisms so that they generate, not subsume, profits. Further, given substantial challenges to expanding footprints of intertidal farms, finding ways to monetize crops – those intentional and accidental – can increase the value of the farmed area, and provide additional employment opportunities. Through this project, we will quantify the amount of fouling seaweeds and cockles on four shellfish farms in the Puget Sound region, assess impacts to water 2 quality and geoducks from the fouling seaweeds and cockles, respectively, and create proof-of-concept supply chains for each. We will work with experienced tribal and non-tribal shellfish growers to design a prototype seaweed harvest and transfer system and will work closely with the Suquamish Tribe to re-connect them to one of their preferred first foods – cockles.

Potential Commercial Benefits to the Fishing Community of the Research Results: The proposed project has myriad potential benefits for the aquaculture industry here and elsewhere. New supply chains and market channels for seaweeds and cockles create economic benefits, to be realized by existing and new members of the industry. These benefits accrue not only to the shellfish growers and others who actively work in the supply chain, but to numerous rural communities throughout the region, where shellfish farms are located. Promoting sustainable aquaculture of fouling organisms can have direct commercial benefits, also, as it is way for growers to diversify their portfolio of cultured species, thus building resilience in the industry.

Proposal #: 21WCR010-033

Project Title: Liposome-based micro particles for improved nutrition and production efficiency of marine fish larvae

Applicant: Oregon State University

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

Principal Investigator: Matt Hawkyard, Research Associate, Oregon State University, hawkyard@oregonstate.edu; Co-PIs: Chris Langdon, Prof. of Fisheries, OSU; Mark Drawbridge, Senior Research Scientist, HSWRI; Kevin Stuart, Research Scientist, HSWRI

Amount: \$299,962

Abstract: Currently available commercial-type micro diets have not been able to eliminate the need for live feeds in marine finfish hatcheries. This is largely due to 1) low ingestion rates of micro diets, 2) low digestibility and 3) high losses of water-soluble nutrients during suspension in seawater, i.e. nutrient leaching. In the proposed research we will evaluate the use of liposome-containing micro particles for the delivery of complete nutrition to marine fish larvae. In previous research we have shown that liposomes can be used to delivery water-soluble nutrients to fish larvae via enriched live feeds. We have also found that liposomes can be encapsulated within larger carrier particles, termed liposome-containing complex particles (LCP) which can be fed directly to marine 2 fish larvae and are capable of delivering a full suite of macro- and micronutrients. In the proposed research, we seek to build upon these successes by comparing LCP with commercial-type and Artemia replacement (liquid-type) diets in benchtop studies and larval feeding trials. California yellowtail (*Seriola dumerili*) will be used as the primary species in this project as it is a commercially viable marine finfish species in the US and early rearing and grow out strategies have been developed by team members at HSWRI.

Potential Commercial Benefits to the Fishing Community of the Research Results: This research will result in the development of new and unique micro particles that reduce the need for live feeds in marine finfish hatcheries. Diet technologies and other products from this research will be shared with feed manufacturers, hatcheries, other stakeholders through various outreach efforts. Ultimately, liposome-based complex particles could be used to efficiently deliver additional water-soluble compounds such as drugs, antibiotics and other bioactive compounds, to marine fish larvae. This research will have broad application in the improvement of diets for not only marine fish larvae but also other commercially important aquatic suspension feeders in both marine and freshwater systems.

Proposal #: 21WCR009-006

Project Title: The Local Fish Initiative: Developing a Hybrid Restaurant & Community Supported Fishery Model and Web-Based Marketing Tool Built for Fishermen and Consumers

Applicant: Saraspe Seafoods, LLC

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: Tanner Saraspe, tannersaraspe@gmail.com

Amount: \$299,494

Abstract: : The goal of ‘Local Fish Initiative’ (“LFI”) is to develop an industry-informed hybrid Restaurant Supported Fishery and Community Supported Fishery model, along with a complementary web-based platform (“LFI Platform”), to provide San Diego fishermen an adaptive marketing strategy for their local harvest, build resiliency to market disruptions, promote better business practices, and increase access and market demand for domestic seafood. The LFI Platform will serve as an innovative online marketplace and will provide a tool for fishermen to promote their catch, boost sales, and facilitate transactions in a transparent and efficient manner. LFI will cater to both restaurant representatives and ultimate consumers, providing a direct connection to source local seafood. The development of LFI includes promotion and marketing, conducting market research, establishing a Fishermen’s Advisory Committee, creating the LFI Platform, and developing a set of Guiding Principles and an Implementation Plan. The proposed features of the LFI Platform include: communication and marketing tools for fishermen; distinct vendor profiles for market retention; seamless messaging integration for fishermen and consumers; a logistics tool for fishermen to coordinate transactions with clients; and public resources including quality control standards, compliance requirements, and regulatory guidelines.

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

LFI will improve the value for locally-landed catch by increasing awareness around local species and optimize distribution and marketing opportunities for fishermen. LFI will promote better business practices for fishermen by creating quality control standards, improving traceability, and incentivizing sustainable harvest methods. Most importantly, LFI will diversify the fishermen’s portfolio of alternative markets and help mitigate impacts from market disruptions. The project is anticipated to result in a 30% increase in ex-vessel value for species sold on LFI compared to traditional wholesale outlets. The reach is anticipated to be upwards of 300 fishermen and 5,000 consumers throughout San Diego.

Proposal #: 21WCR018-017

Project Title: Developing Effective, Low-Cost Community Outreach Tools for Fishers and Seafood Farmers

Applicant: Aquarium of the Pacific

Priority Addressed Priority #1 – Promotion, Development and Marketing

Principal Investigator: Kimberly Thompson, Director, Aquarium of the Pacific/Seafood for the Future, kthompson@lbaop.org

Amount: \$240,139

Abstract: Poor public perceptions about fisheries and marine aquaculture, or seafood farming, can have detrimental impacts to livelihoods, economies, and the environment. Current efforts to engage ‘public’ audiences are aimed at consumers, but many of the social and political conflicts that come to light in permitting processes or debates over whether or not a fishery or farm should stay in operation

come from broader audiences who may or may not eat seafood. Without broader public support, it will be harder for the U.S. to increase seafood production in domestic waters. Fishers, farmers, and other stakeholders can play a critical role to share their stories and contribute to the narrative and efforts to educate broader audiences about responsible U.S. seafood and the role it plays in supporting a more nutritious and sustainable food supply. But outreach and communications can be expensive and time consuming. The goal of this project is to provide fishers, farmers, and other seafood stakeholders the tools and resources they need to help build trust and improve public perceptions about well-managed U.S. seafood, including fisheries and seafood farming.

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

Much of the narrative about U.S. seafood is currently shared with broader public audiences by other stakeholder groups including NGOs, media, and others who may or may not represent the U.S. seafood community. This project can provide U.S. fishers, farmers, and other seafood stakeholders with affordable and accessible tools and resources to share their stories, build trust, and contribute accurate information to the narrative about U.S. seafood. Stronger engagement from the U.S. seafood community can support ongoing efforts to improve public perceptions about and public support for expanding responsible seafood production in the U.S.
