

Sea Grant Fall 2022 Aquaculture Investments Project List

Early Stage Propagation Strategies for Aquaculture Species

Universal Hatchery System for Developing new Seaweed Strains for Land-Based Aquaculture Production

California Sea Grant

PI: Theresa Talley (California Sea Grant)

Total federal funding: \$697,313

Years: 3

Project summary: This project seeks to create and evaluate a novel modular hatchery apparatus that will consistently produce concentrated seedstock suspensions for mass production of kelp and sea lettuce in land-based seaweed production systems.

Research to assess the hatchery apparatus will occur at permitted academic and commercial land-based seaweed production facilities. Activities will involve native seaweed species and no work will be conducted outside of the land-based, controlled aquaculture facilities. Outcomes from this research will enhance the production and availability of seaweed seedstock. This will benefit seaweed aquaculture producers in expanding their operations and industry.

Addressing Bottlenecks and Refining Commercial Culture of *Amphiprion ocellaris*
Florida Sea Grant

PI: Matthew DiMaggio (University of Florida)

Total federal funding: \$749,267

Years: 3

Project summary: This project will use a series of experiments conducted in a laboratory setting to refine the culture methods and parameters for clownfish. The project team will optimize protocols for egg handling, larval rearing and juvenile growout; reduce or eliminate the use of live feeds; and identify the factors that influence the development of larval deformities in clownfish. Following the laboratory experiments, the team will conduct an economic analysis to determine the effects of these refined protocols on clownfish culture profit potential, conduct research on perceptions and purchasing behavior of ornamental fish wholesalers, and disseminate all of their results to a variety of stakeholders through workshops, webinars and publications.

Genomic Approach to Improve Reproductive Performance of Pacific White Shrimp,
Litopenaeus vannamei

Hawai'i Sea Grant

PI: Brad (Kai) Fox (Hawai'i Sea Grant)

Total federal funding: \$249,884

Years: 2

Project summary: This project seeks to develop and distribute lines of Pacific white shrimp (*Litopenaeus vannamei*) which exhibit high reproductive output to support U.S. shrimp genetic improvement companies and U.S. shrimp production. Activities will

consist of laboratory experiments focused on assessing and improving genetic traits of shrimp. Outcomes of project activities will enhance the reproduction performance of Pacific white shrimp, which will result in increased availability of shrimp post-larvae for grow out operations. This in turn will be of benefit to shrimp growers and the U.S. shrimp aquaculture industry.

“Cracking the Shell”: A Collaborative Approach to Developing Hatchery Production of the Atlantic Sea Scallop, *Placopecten magellanicus*

Maine Sea Grant

PI: Chris Davis (Maine Aquaculture Innovation Center)

Total federal funding: \$749,999

Years: 3

Project summary: This project will establish reliable best practices for larval rearing and settlement protocols for sea scallops, identify sea scallop hatchery microbiomes as they relate to health status, and examine the larval immunocompetence of sea scallops and its relevance to larval survival. In addition, the project will establish reliable best practices for sea scallop broodstock conditioning and spawning, evaluate the economics of commercial scale hatchery production, and engage with stakeholders to create a community of practice.

Domestication and Breeding of Lumpfish to Accelerate Successful Commercialization and use for Sea Lice Biocontrol in the Northeast US

Maine Sea Grant

PI: Stephen Eddy (University of Maine Center for Cooperative Aquaculture Research)

Total federal funding: \$234,487

Years: 3

Project summary: Lumpfish (*Cyclopterus lumpus*) are used in Norway, Scotland and Eastern Canada as cleaner fish for biological control of parasitic sea lice on farmed salmonids, primarily Atlantic salmon. The project seeks to establish a geographically diverse, self-sustaining U.S.-sourced breeding colony of lumpfish from wild caught juveniles by refining lumpfish broodstock capture and husbandry protocols, conditioning fish for out-of-season spawning, establishing and refining lumpfish hatchery production and protocols, and screening fish for pathogens and microbes. By the end of the project, the researchers will have established a diverse broodstock population sourced from wild fish captured from Maine territorial waters in the Gulf of Maine. Broodstock reproductive timing will be manipulated in captivity with photoperiod and temperature for hatchery production of juveniles. The resulting U.S.-sourced supply of lumpfish juveniles will greatly benefit the U.S. salmon aquaculture industry.

Stress-Priming of Early-Stage Eastern Oysters to Increase Stress Tolerance and Consistency of Aquaculture Production in the Face of Climate Variability

Maryland Sea Grant

PI: Louis Plough (University of Maryland Center for Environmental Science)

Total federal funding: \$249,748

Years: 3

Project summary: This project seeks to improve eastern oyster tolerance to relevant environmental stressors (low salinity and low oxygen) in coastal regions via sub-lethal stress-priming and subsequent lab and commercial aquaculture field tests examining growth, survival and physiology of oysters in secondary exposures. Results of lab and field studies will determine the feasibility of stress priming as a new opportunity for oyster crop improvement that can be deployed by industry members in the future.

Probiotic-Induced Protection of Oyster Larvae Against Bacterial Pathogens That Impact Hatchery Production

Oregon Sea Grant

PI: Carla Schubiger (Oregon State University)

Total federal funding: \$711,474

Years: 3

Project summary: This project seeks to optimize probiotic application and delivery protocols to protect Pacific and Eastern oysters as early as possible in larval development and to develop methodologies to apply the probiotics in co-culture with microalgal feeds. Project activities will involve land-based commercial shellfish hatcheries in Oregon, Hawai'i and Maryland.

Developing Sporeless (Infertile) Breeds of Domesticated Kelp Species to Reduce Regulatory Barriers for Expanded Kelp Farming

University of Southern California Sea Grant

PI: Sergey Nuzhdin (University of Southern California)

Total federal funding: \$750,000

Years: 3

Project summary: This project seeks to enable kelp farming to be commercially competitive with domestic land-based farm production and ocean-based production abroad, and to fulfill strict regulations that protect the health and genetic diversity of native kelp populations in particular. Project activities include development of a breeding strategy to make best use of gametophyte ex situ seed banks developed by established breeding programs for growing sporeless kelp, verification of the complete inability of kelp sporophytes to reproduce due to natural mutations that prevent meiosis required for spore production, and utilize research facilities and commercial seaweed farming operations to evaluate and demonstrate sporeless technology. Outcomes of project activities will enable the production of sporeless kelp, which will increase its availability to seaweed producers and benefit the seaweed aquaculture industry.

Catalyzing Marine Finfish Aquaculture Through Public Aquariums

Woods Hole Sea Grant

PI: Matthew Charette (Woods Hole Sea Grant)

Total federal funding: \$748,283

Years: 3

Project summary: This project seeks to increase the knowledge base of early-stage propagation and rearing of novel marine finfish aquaculture species by opportunistically collecting eggs from animals spawning within the public aquarium network. Project activities will engage five aquariums (New England Aquarium, National Aquarium, Shedd Aquarium, Aquarium of the Pacific, and the three North Carolina Aquariums) in a collaborative effort to rear larvae and juveniles of selected marine finfish species that are breeding on exhibit for eventual return back to exhibit, to eliminate the need for wild capture of fish.

Marine Finfish Aquaculture: Juvenile Production Technologies

Maximizing the Quantity and Quality of California Yellowtail (*Seriola dorsalis*) Produced Consistently in Intensive Larval Rearing Systems

California Sea Grant

PI: Luke Gardner (California Sea Grant)

Total federal funding: \$628,234

Years: 3

Project summary: This project seeks to improve the production efficiency of California yellowtail by developing techniques for year-round production of high quality eggs and increasing the consistency in fish quality among surviving fingerlings. Outcomes of project activities will enhance the reproduction efficiency of California yellowtail and availability of juveniles for grow out operations. This will aid in the expansion of this segment of the aquaculture industry.

Resolving Impediments to Captive Longevity and Fecundity in Seriolids, America's Most Successful Offshore Marine Fish Species

Hawai'i Sea Grant

PI: Andre Seale (University of Hawai'i)

Total federal funding: \$999,999

Years: 3

Project summary: This project seeks to evaluate dietary and environmental manipulation strategies to improve the reproductive management of Almaco jack broodstock, their egg quality and larval development in support of enabling reliable production of juveniles. Outcomes of this work will improve and stabilize Almaco jack broodstock output, contributing to enhanced larval and juvenile production of this species. This will benefit the aquaculture industry focused on production of this species by improving production efficiencies and will potentially lead to expansion of this industry.

Nutritional Strategies for Improved Larval Production of Marine Finfish with an Emphasis on *Seriola* sp.

Maine Sea Grant

PI: Matt Hawkyard (University of Maine)

Total federal funding: \$709,093

Years: 3

Project summary: This project seeks to develop the capacity and knowledge to produce and refine microparticulate finfish larval feeds and evaluate the effects of diets on the performance (growth and survival) of larval California yellowtail and yellowtail amberjack. Outcomes of project activities will help increase larval performance and juvenile production of seriolids, which will aid in development and expansion of aquaculture of seriolids.

Sea Grant StriperHub: Commercial Striped Bass Hatchery, Fingerling Production, and Intensive Larval Rearing

North Carolina Sea Grant

PI: Eric Herbst (North Carolina Sea Grant)

Total federal funding: \$996,988

Years: 3

Project summary: This project seeks to establish a consistent juvenile distribution network for striped bass aquaculture that will contribute to industry expansion through effective distribution of seedstock. Project activities will involve evaluation of various larval and juvenile rearing strategies for striped bass, improving spawning of captive striped bass broodstock, and economic analysis of larval and juvenile production. Outcomes of project activities will enhance striped bass broodstock performance and availability of juvenile striped bass for grow out operations. This will aid in development and expansion of the striped bass aquaculture industry.

Advanced Aquaculture Collaboratives (Hubs): Continued Support Competition

Advancing Southern New England Shellfish Aquaculture Through an Engaged Public and Next Generation Decision Support Tools (Extension Through 2024)

Connecticut Sea Grant

PI: Tessa Getchis (Connecticut Sea Grant)

Total federal funding: \$424,999

Years: 2

Project summary: This project seeks to continue the collaboration of Sea Grant Programs in Connecticut, Rhode Island and Massachusetts, as well as Roger Williams University (RI) and key partners to address public perception and permitting and policy objectives, with a goal of supporting the growth of beneficial and sustainable shellfish aquaculture in southern New England and beyond. Project activities will consist of public outreach, including continuing to implement aquaculture-related educational materials and videos, expansion of state aquaculture entry-level workforce training offerings and expansion of coastal community aquaculture workshops. Outcomes of the project include increased shellfish aquaculture literacy, increased shellfish aquaculture development and increased training and workforce development opportunities. The project will benefit the general public, the shellfish aquaculture industry in the region and coastal communities and their economies.

Nurturing the Successful Growth and Maturation of a Domestic Seaweed Aquaculture Industry: Phase II

Connecticut Sea Grant

PI: Anoushka Concepcion (Connecticut Sea Grant)

Total federal funding: \$424,959

Years: 2

Project summary: This project seeks to extend efforts of the established Seaweed Hub to provide a comprehensive and collaborative mechanism to support the successful growth and maturation of a domestic seaweed aquaculture industry, with diverse species, product forms and uses. Project activities will consist of establishing and sustaining professional networking opportunities for stakeholder engagement via topical webinars, a second Seaweed Symposium and at least two virtual forums or networking opportunities. In addition, work will be conducted to develop and maintain publicly accessible and relevant resources on the Seaweed Hub website. Outcomes of this project will ensure that the National Seaweed Hub will continue to serve as a mechanism for providing publicly accessible, non-proprietary and evidence-based information, while fostering collaborative efforts among stakeholder sectors on a national scale.

Beneficiaries of this work include the seaweed aquaculture and its associated industries, coastal managers, coastal communities and their economies, and the general public.

Hawai'i-Pacific Aquaculture Consortium: Continuing the Expansion of an Aquaculture Development Program

Hawai'i Sea Grant

PI: Darren Lerner (Hawai'i Sea Grant)

Total federal funding: \$425,000

Years: 2

Project summary: This project seeks to expand an aquaculture development program through the establishment of an aquaculture-focused, collaborative program that engages in geographic and sectoral inclusivity across Hawai'i and the Pacific region. Project activities include formalizing current and new collaborative alliances to create integrated research, education and outreach efforts that foster the expansion of local, regional and indigenous sustainable aquaculture; supporting critical extension/technology transfer capacity in Hawai'i and the Pacific region; and promoting the development of a regional aquaculture education program that leverages curricula, training courses and extension materials for aquaculture audiences. Outcomes of the project will include development of the Consortium into a strong network of local, regional and national partners working together to revitalize and expand aquaculture development in Hawai'i and the Pacific region; development of research and education programs that foster the expansion of sustainable and Indigenous aquaculture at local and regional scales; enhanced opportunities for students, underserved communities and underrepresented groups to learn about aquaculture; enhanced workforce capacity through coordination and leveraging of education activities that support regional aquaculture education across the Pacific; strengthening existing alliances and creation of new alliances; and increased aquaculture literacy. The project will benefit the

aquaculture industry in Hawai'i and the Pacific Region as well as communities and their economies, and the general public.

Supporting Industry Needs Through Maine Aquaculture Hub

Maine Sea Grant

PI: Dana Morse (Maine Sea Grant)

Total federal funding: \$423,539

Years: 2

Project summary: This project seeks to continue work of the Maine Aquaculture Hub to support sustainable development of the aquaculture sector across the state by implementing activities identified in the newly released 10-year Maine Aquaculture Roadmap. Project activities will consist of outreach events, workshops and training activities. In addition, a needs assessment will be used to evaluate and document the needs of different demographic groups interested in training through the Aquaculture in Shared Waters program. Project outcomes will include maintaining and strengthening relationships between the Hub and members of the aquaculture sector, gathering feedback and insight from the industry on needs and future directions of interest for progress, engaging the Hub network as a whole through convenings, an updated economic impact assessment of the industry, implementation of aquaculture outreach and education needs identified by Hub participants, and strengthening and diversifying training programs. This project will benefit the Maine aquaculture industry, coastal communities and their economies, and the general public.

Continuation of Aquaculture Hub: Building Capacity of Land-Based Atlantic Salmon Aquaculture in the U.S.

Maryland Sea Grant

PI: Fredrika Moser (Maryland Sea Grant)

Total federal funding: \$424,998

Years: 2

Project summary: This project seeks to continue the ongoing activities of the Recirculating Aquaculture Salmon Network. Activities to be performed include expanding R&D support to the issue of RAS salmon product off-flavor mitigation, broadening workforce development by supporting two summer interns for two years, and implementing expanded communications initiatives that significantly supplement public outreach and education efforts, as well as targeted industry extension. The main outcome of this collaborative program will be the expanded efforts to resolve several of the highest priority challenges/issues identified by the salmon Recirculating Aquaculture System industry stakeholders. Intended beneficiaries of this project include stakeholders and practitioners of recirculating salmon aquaculture, and industry stakeholders who produce equipment or technology used in recirculating aquaculture systems.

Advancing the Great Lakes Aquaculture Collaborative

Minnesota Sea Grant

PI: Amy Schrank (Minnesota Sea Grant)

Total federal funding: \$425,000

Years: 2

Project summary: This project seeks to continue the ongoing activities of the Great Lakes Aquaculture Collaborative. Activities to be performed and expected outcomes are as follows. Objective 1: Continue to improve Great Lakes Aquaculture Collaborative's network leadership by maintaining collaboration among the Great Lakes Sea Grant programs and the Great Lakes Aquaculture Collaborative state and regional advisory groups, and use their feedback to pursue funding to develop and coordinate aquaculture research in Great Lakes states. Objective 2: Facilitate collaboration between producers and state aquaculture associations, link these state groups to national and regional aquaculture organizations, and support underrepresented producer, student and conference speaker attendance at state aquaculture association meetings. Objective 3: Deliver to state agencies, policymakers and legislators educational materials about aquaculture, the potential for successful aquaculture and aquaponics businesses in both rural and urban underserved areas, and information about how these groups can engage with and support the aquaculture industry in their state. Objective 4: Synthesize the existing aquaculture laws, regulations, policies within the Great Lakes states and ground truth these policies to determine how agencies interpret and implement these rules. Objective 5: Develop collaborations among private, state and tribal organizations including aquaculture producers, commercial fishers and seafood processors in the Great Lakes region to address food system and supply chain challenges. Intended beneficiaries of the project include aquaculture stakeholders throughout the Great Lakes region.

Continued Support for Expanding the Atlantic and Gulf Shellfish Seed Biosecurity Collaborative

New Jersey Sea Grant Consortium

PI: Pete Rowe (New Jersey Sea Grant Consortium)

Total federal funding: \$425,000

Years: 2

Project summary: This project seeks to expand the Atlantic and Gulf Shellfish Seed Biosecurity Collaborative beyond the original scope to cover needs identified with the ongoing project. Project objectives will consist of supporting increased hatchery participation by increasing the number of experts available to inspect shellfish hatcheries on the basis of best management practices, creating a system for managing hatchery records to improve access and availability, and investigating the potential for expansion of the project to the West Coast. Project activities will include site visits and online and in-person meetings. Outcomes of the project include development of a broader, geographically distributed corps of shellfish hatchery auditors, development of a document management system that will facilitate collection and controlled dissemination of hatchery biosecurity information and expansion of the collaborative to the West Coast. The project will benefit shellfish aquaculture seed producers and the shellfish aquaculture industry as a whole.

Enhancing the Sustainability of the East Coast Hard Clam Selective Breeding Collaborative (Hub Part 2)

New York Sea Grant

PI: Rebecca Shuford (New York Sea Grant)

Total federal funding: \$420,745

Years: 2

Project summary: The project seeks to develop a modern selective breeding program for the hard clam (*Mercenaria mercenaria*) via genomic selection that will enable the development of superior clam stocks more effectively than traditional breeding approaches. Project activities will consist of laboratory and field work to evaluate genomic selection using a cost-effective genotyping platform, contrast genomic selection with traditional selective breeding and test an off-bottom culture method for the hard clam. In addition, the Hub will continue its facilitatory role linking scientists, the aquaculture extension network, resource managers and the industry. Outcomes of this project include demonstrating genomic selection in hard clams using a cost-effective genotyping tool, identifying clam stocks resistant to disease and environmental stress, sharing the clam genotyping platform and superior clam stocks with the industry, providing new opportunities to farmers interested in growing clams for product diversification but who have limited or no access to bottom culture methods, and strengthening industry collaboration. The project will benefit the hard clam aquaculture industry in the U.S. and coastal communities and economies.

The Sea Grant StriperHub: Commercial Striped Bass Aquaculture Phase II

North Carolina Sea Grant

PI: Eric Herbst (North Carolina Sea Grant)

Total federal funding: \$420,238

Years: 2

Project summary: This project seeks to extend the ongoing activities of the North Carolina Sea Grant based project, "Striper Hub." Activities to be performed include establishing a Sea Grant Aquaculture Hub: A nexus to commercialize striped bass as a major aquaculture industry (The Sea Grant StriperHub); demonstrating seed stock production, distribution, growout and production economics of domestic striped bass aquaculture; developing marketing strategies, market economics, permitting clarity and business models for domestic striped bass aquaculture; and establishing communication, outreach, extension and training to support domestic striped bass aquaculture development. Expected outcomes include continuing to operate StriperHub's domestic striped bass seedstock and broodstock distribution program, implementing reduced frequency feeding regimes in RAS growout trials to reduce input costs and improve economic viability and sustainability of striped bass production, and identifying candidate pheromone compounds and husbandry conditions that may improve spawning efficiency. In addition, as the basic knowledge of striped bass culture, reproduction, production, growth, nutrition, feeds, genetics and breeding is understood and infrastructure exists to support its commercialization, completion of the revised "Culture of Striped Bass: 21st Century" manual, will greatly benefit this industry sector,

as well as the project team's continued outreach and extension efforts. Intended beneficiaries of the project are striped bass aquaculture industry stakeholders and interested potential practitioners of striped bass aquaculture.

Advancing the Cross-Pacific Indigenous Aquaculture Collaborative

Washington Sea Grant

PI: Russell Callender (Washington Sea Grant)

Total federal funding: \$423,240

Years: 2

Project summary: This project seeks to advance knowledge, implementation, outreach and education related to Indigenous aquaculture in the broader Pacific region and continue the activities of the Cross-Pacific Indigenous Aquaculture Collaborative. Project activities will consist of outreach, extension, communication and training, including site visits and hosting of a community event in southeast Alaska. Outcomes of the project include strengthening the Indigenous Aquaculture Collaborative community of practice; ensuring engagement of the collaborative with partner initiatives including the Swinomish Indian Tribal Community clam garden, the Northwest Indian College research and education programs, and Guam and other Pacific Islands communities; increasing participation of Indigenous people in the research process and STEM fields; and providing the public with comprehensive information about Indigenous aquaculture in the Pacific. The project will benefit the Cross-Pacific Indigenous aquaculture community as well as the general public.

West Coast Aquaculture Collaborative

Washington Sea Grant

PI: Russell Callender (Washington Sea Grant)

Total federal funding: \$422,741

Years: 2

Project summary: In this project, Washington, Oregon, California and Alaska Sea Grant programs propose to grow and maintain a collaborative unit to engage science and policy partners, industry and resource management agencies in tackling complex, regional barriers to sustainable aquaculture on the West Coast. Project activities will focus on biosecurity issues emerging along the West Coast in the shellfish industry, aquaculture farm preparedness for disasters such as the heat wave experienced in June 2021, and the exchange of information between farms in different regions, and will consist of a series of workshops, presentations, development of outreach materials and worksheets, on-site technical assistance and professional development opportunities for Sea Grant specialists and aquaculture growers. Outcomes of the project include increased awareness of industry stakeholders regarding biosecurity risks and best practices for their operations, as well as their prioritization; enhanced ability of stakeholders to prepare for disasters and to seek government assistance if affected by a disaster; and increased aquaculture literacy and professional development of industry stakeholders. Project activities and results will be of benefit to West Coast aquaculture

industry stakeholders, associated industries and coastal communities and their economies.

FY 2022 Aquaculture Information Exchange (AIE): Host Program

Virginia Sea Grant Aquaculture Information Exchange (AIE) Host Program: Providing Cutting Edge Digital Communications Capacity to Build Community
Virginia Sea Grant

PI: James Clark (Virginia Sea Grant)

Total federal funding: \$785,248

Years: 4

Project summary: This project seeks to design, host, maintain and monitor a web-based online community platform called the Aquaculture Information Exchange (AIE) for private and public sector individuals and groups with interests in the U.S. aquaculture industry and related topics. Project activities include establishing an AIE Advisory Group; building, designing and hosting the Aquaculture Information Exchange platform; recruiting membership for the AIE; hiring an AIE community manager; and ensuring AIE platform sustainability. Outcomes of the project include a strategy and marketing plan for promoting the AIE and recruiting members; marketing and promotional materials promoting the AIE platform; a comprehensive contact list of AIE members; establishment of collaborative partnerships with the National Sea Grant Office, state Sea Grant programs, the USDA RACs, and aquaculture-related associations, societies and nonprofits; and enhanced collaboration and the exchange of information between growers, researchers, hatcheries, industry, government agencies and other parties with an interest in aquaculture. This project will be of benefit to the entire U.S. aquaculture community, including researchers, extension personnel, resource managers, federal and state agencies, and various industry stakeholder groups.