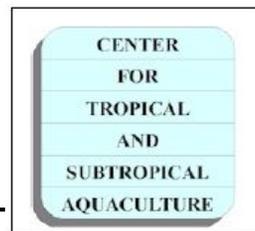


2010-2012 Summary of Funded Projects



The Regional Aquaculture Centers are funded through the USDA National Institute of Food and Agriculture with a history over 25 consecutive years. The combined five regional centers represent a national program that covers and reaches all states and territories in the US. The program is unique with the participation of aquaculture industry representatives appointed to an Industry Advisory Council who identify regional research and extension education priorities for project development and monitor progress and outcomes. Other project development and oversight bodies include a Technical Advisory Committee and Board of Directors.

This material updates past project summaries that covered the period 2005-2010. For more information about the listed projects as well as past projects, please visit the home page for each of the five Regional Aquaculture Centers that is referenced below.

Center for Tropical and Subtropical Aquaculture

Director: Cheng-Sheng Lee, The Oceanic Institute

Home page: <http://www.ctsa.org/>

Developing Diets for Hawaii Cultured Abalone with Normal Shell Color and High Growth Performance Using Local Algae and their Co-products- Years 1 and 2

Funding level: \$156,000
Project start date: June, 2012
Duration: 2 Years
Participants: Oceanic Institute (Lead Institution), Big Island Abalone, EN Hutchinson Ltd.

Abalone is one of the most-prized seafood products in the world and high demand for this delicacy has resulted in overfishing of wild stocks. Local cultured abalone producers are constrained by a dependence on imported, pelleted feeds that, unless fed in conjunction with supplemental algae, result in an abnormal-colored abalone shell. This project is aiming to develop a feed that can produce a normal shell color and result in good growth performance of abalone. The overall goal is to help Hawaii's abalone industry become independent of imported feeds.

Mitigating the Diseases of Freshwater Cultured Fish Species in Hawaii and the Pacific Region

Funding level: \$97,000
Project start date: May, 2012
Duration: 1 Year

Participants: University of Hawaii at Manoa

Francisella-like bacteria (FLB) is an emerging pathogen that is significantly impacting tilapia farmers in Hawaii and abroad. Results achieved under the auspices of CTSA's ongoing Biosecurity project have provided direct evidence and confirmation of the existence of asymptomatic FLB carriers that appear completely normal but contain FLB DNA in their spleens. In addition, preliminary evidence suggests that certain strains of tilapia are more resistant to FLB, and that feral populations of tilapia are apparently asymptomatic carriers. The main goal of the project is to obtain additional data on the epidemiology of the pathogen to provide details of its incidence and distribution. This is an essential part of developing a program to mitigate the pathogen and its resulting disease, francisellosis.

Pacific Aquaculture Development and Extension Support in the U.S. Affiliated Pacific Islands – FY 2011

Funding level: \$60,610
Project start date: July, 2012
Duration: 1 Year
Participants: College of Micronesia (COM, Lead Institution), Pakin Community Association, Pingelap Municipal Government, Pweniou Pearl Farm

A lack of local, skilled technicians has historically been a major bottleneck in aquaculture development in Micronesia. However, recent work under several CTSA projects has resulted in the development of a Micronesian aquaculture workforce in Pohnpei, who are now able to conduct technology transfer and skill-training programs in other states of Micronesia. This project emphasizes capacity building in the region and is a continuation of the extension project from FY10. There are several objectives of the project, including coordination of existing small-scale pearl and sea cucumber farmers and implementation of marketing and development strategies. In addition, College of Micronesia technicians from Pohnpei will conduct demonstrations and skill training in both pearl and sea cucumber aquaculture (particularly sea cucumber hatchery training) in Yap.

Economic Analyses of Aquaponics Systems in Hawaii and Guam

Funding level: \$112,408
Project start date: October, 2012
Duration: 2 Years
Participants: University of Hawaii at Manoa (Lead Institution), University of Guam

Aquaponics has been touted as a sustainable farming technology that has a minimal environmental impact and the potential to move Hawaii, as well as the Pacific region, towards food self-sufficiency. However, existing literature and reports do not reflect a consistent view of the economic feasibility of commercial aquaponics enterprises. Thus, it is imperative to assess the financial viability of this relatively new industry to guide current and potential investors. The

overall goal of the project is to provide crucial economic information as the basis for establishing and advancing commercial aquaponics enterprises throughout the CTSA region. Economic assessments will be conducted for both small- and large-scale systems, as well as different operating systems presently in use in Hawaii and Guam.

Establishing Bivalve Farming in Hawai`i

Funding level: \$71,182
Project start date: October, 2012
Duration: 2 Years
Participants: University of Hawaii at Hilo (Lead Institution), University of Hawaii Maui College

Hawaii does not have a cultured bivalve industry with the exception of two large hatcheries at the **Natural Energy Laboratory of Hawaii Authority**, located on the Big Island of Hawai`i, that export larvae and seed to other locations. The main impediment to developing commercial bivalve culture in the state has been the classification of shellfish growing areas. With recent developments, this obstacle is being addressed and the focus must now shift to planning and research to assure a commercially viable industry. The main goal of this project is to improve and/or develop culture methods for bivalve species with demonstrated potential for aquaculture in Hawaii. Strategically selected research components will provide information that will enable hatchery operators and farmers to make informed decisions about stock selection and culture of two, local bivalve species. This project will build on previous CTSA-supported work and will provide key information required to start a shellfish industry in Hawaii.

Aquaculture Information Service for the Pacific Region

Funding level: \$68,250 (current year)
Project start date: On-going
Duration: 1 Year
Participants: CTSA

One of the constraints for aquaculture development identified by CTSA in the region is the paucity of available and applicable information. To address this problem, the Center has invested over 20 years in the Pacific Regional Aquaculture Information Service for Education (PRAISE) project, managed by the University of Hawaii's Hamilton Library, and over 15 years in a Publications project managed in-house by the Center. These projects continue to be an integral part of technology transfer efforts in Hawaii and the U.S.-affiliated Pacific Islands. The overall goal of this project is to promote the transfer of information within the Pacific aquaculture community. This will be done by informing industry members, researchers, educators, and other key individuals of pertinent aquaculture information and updating them on the status of regional aquaculture through various media. In addition, the project will inform the aquaculture community and interested parties of the progress of CTSA and other Regional Aquaculture Center projects in relation to our mission through the dissemination of our own and other

publications, videos, and promotional materials, as well as conduct literature-search services for the regional aquaculture community.

Assessing Hawaii's Aquaculture Farm and Industry Performance, Years 1 and 2

Funding level: \$58,275
Project start date: September, 2011
Duration: 2 Years
Participants: University of Hawaii at Manoa

There is much interest in expanding the aquaculture industry in Hawaii to generate increased economic activity for the islands. However, the industry lacks essential information to help guide an effective strategy for growth. A necessary tool for future development plans is an analysis of the industry that explicitly evaluates aquaculture farm economic performance across individual farms and time. The overall goal of this 18-month project is to use farm-level information to assess performance of the aquaculture industry and its various subsectors during the past decade. Results from the assessment, which is currently under final review, reveal a wide variation in performance across farms, with industry profits being driven by a few large farms. In 2007, 45.2% of the aquafarms generated a profit, with 35.5% of the farms not being able to cover their variable cash expenses. In addition, the results demonstrated that Hawaii's labor cost-share for aquaculture enterprises is about 3.5 times greater than that found on the continental United States. The findings of this proposed work can serve to provide recommendations for increasing efficiency of the various subsectors, and provide industry leaders and policy makers an assessment of the strengths and weaknesses of the industry mapping out suggestions for future opportunities of growth.

Culturing Native Species of Macroalgae in Hawaii and the U.S. Affiliated Pacific Islands

Funding level: \$62,075
Project start date: September, 2011
Duration: 2 Years
Participants: University of Hawaii at Hilo (Lead institution), University of Guam, Marine and Environmental Laboratory of Pohnpei, Royal Hawaiian Sea Farms

Interest in seaweeds is growing rapidly with new uses being discovered frequently. Unfortunately, wild stocks are currently dwindling, invasive macroalgae species are proliferating, and only 3-5 species are cultured on a rather-limited basis in Hawaii. There is tremendous potential to develop new species so that Hawaii and the Pacific Islands are not left behind as macroalgal culture becomes even more important. Developing local species can help diversify the aquaculture industry, improve local food security, reduce imports, and increase the exportation of products. Development of new macroalgal species will also enhance the possibilities for integrated, multi-trophic aquaculture in the state, resulting in more production efficiency, better use of natural resources, and lower environmental impacts. This two-year

project is aiming to determine environmental and culture requirements for two native species of algae: *Asparagopsis taxiformis* (limu kohu) and *Codium edule* (limu wawae'iole). These species were chosen as model species due to their high value, export potential, input from industry members, value by managers of traditional Hawaiian fishponds, and initial successful culture trials at the Pacific Aquaculture and Coastal Resources Center. To date, reliable microalgae collection sites have been established and protocols have been developed for culturing various species. Varying levels of key environmental parameters are being tested to determine optimum culture conditions of *A. taxiformis* spores. A *Codium reediae* growth experiment was conducted and growth rates varied among light levels, resulting in recommended changes to culture procedures. If commercially feasible culture methods can be developed for these species, it will lay the foundation for future work with additional species and for technology transfer within the state and to the U.S. Affiliated Pacific Islands.

Marine Finfish Aquaculture Development in the Northern Marianas Islands

Funding level: \$69,482
Project start date: September, 2011
Duration: 1 Year
Participants: Oceanic Institute (Lead Institution), Northern Marianas College CREES

A drastic economic downturn associated with declines in tourism and pullout of the garment-making industry has led to economic recession in the Commonwealth of the Northern Mariana Islands (CNMI). This has created a need for greater diversification of the local economy. Aquaculture has been identified as one of four key industries with good prospects. The region offers essential resources including high-quality oceanic waters, a wide variety of high-value species, and close proximity to large Asian markets, which create prospects to launch marine aquaculture ventures. The primary objective of this project is to build marine finfish aquaculture capacity in the CNMI to help address food security and poverty reduction in the face of socioeconomic change in the region. A stakeholder workshop, held in the CNMI at the beginning of the project, resulted in the determination of multiple target species for local aquaculture efforts and was followed by a finfish hatchery workshop at the Oceanic Institute. Six aquaculture technicians from the western Pacific were trained in broodstock husbandry, live feeds production, and larval rearing over the course of the two-week workshop. A hatchery training manual was given to each participant and is currently being used in the establishment of a hatchery in the CNMI. The manual, CTSA Publication #159, will be available on the website www.ctsa.org. An accompanying training video featuring footage from the Oceanic Institute workshop is also in production.

Seed Production of Mangrove Crab (*Scylla serrata* Forskal) in Palau

Funding level: \$31,690
Project start date: November, 2012
Duration: 1 Year
Participants: Palau Community College (Lead institution), University of Guam

Mangrove crabs are a high-value seafood and widely distributed throughout the Indo-Pacific region. These crabs are considered an important source of income and fresh food for countless coastal communities, and in many places, are viewed as a luxury item appreciated for their taste and texture. The overall goal of this project is to verify and package a simple, reliable, and practical technology for seed production of mangrove crabs (*Scylla serrata Forskal*) in Palau.

Broodstock Management, Seed Production, and Grow-out of Rabbitfish, *Siganus lineatus* (Valenciennes, 1835) in Palau, Years 1 and 2

Funding level: \$73,524
Project start date: November, 2012
Duration: 2 Years
Participants: Palau Community College (Lead Institution), SE-Palau Aquaculture, Oceanic Institute

Locally known as Klesebuul, the golden-lined rabbitfish, *Siganus lineatus*, is an indigenous marine fish species in Palau that is considered a favorite foodfish by many Pacific Islanders. Earlier studies on rearing and larval development of *S. canaliculatus* and *S. lineatus* conducted in Palau revealed the feasibility of producing rabbitfish fingerlings in captivity and making them a candidate species for commercial production both for local and export markets. Several studies have been conducted on the breeding and seed production of different species of rabbitfish worldwide with only one conducted thus far for *S. lineatus*. At present, there is an increasing interest in producing this species of rabbitfish commercially in Palau. However, prior to commercial production, refinement of technology is essential to ensure sustainability in future commercial grow-out operations. Therefore, the primary objective of this project is to develop and package simple and reliable technologies for broodstock management, seed production, nursery, and grow-out of economically important rabbitfish *Siganus* in Palau.

Pacific Aquaculture Development and Extension Support for the U.S. Affiliated Pacific Islands of the Federated States of Micronesia, FY 2010

Funding level: \$47,157
Project start date: July, 2011
Duration: 1 Year
Participants: College of Micronesia (Lead Institution), Pakin Community Association, Pingelap Municipal Government, Pweniou Pearl Farm

This project signified the re-establishment of a CTSA Pacific Island extension agent. For several years, CTSA Extension specialist's services were unavailable yet urgently needed to cope with changing circumstances in aquaculture development in this region. Previous extension efforts by expatriate specialists, who had been employed repeatedly for technology transfer and skill training, resulted in very few local technicians with skill sets matching those of their foreign counterparts. However, this project significantly improved the methods by which technology and

skill transfer are conducted by relying on Micronesian technicians who have been trained under previous CTSA projects to become the trainers in both pearl and sea cucumber aquaculture techniques. The CTSA Extension specialist selected target commodities and locality carefully, adopted and implemented appropriate methodologies, and demonstrated and coordinated technology transfer under the auspices of this project, which was completed on June 2012. He continued ongoing sea cucumber and pearl aquaculture in Pohnpei, and traveled to Yap to establish a sea cucumber pilot system. While in Yap, the Extension specialist also demonstrated spawning induction and egg collection methods, and conducted a hatchery-based sea cucumber aquaculture training workshop.

Aquaponics for Hawaii and the U.S. Pacific Islands: Technology Refinement and Transfer to the Commercial Aquaculture Sector

Funding level: \$51,729
Project start date: January, 2012
Duration: 1 Year
Participants: University of Hawaii at Manoa (Lead Institution), Texas A&M University

The overall goal of this project is to assist commercial aquaponics farmers and other aquaponics farmers engaged in food security and to extend knowledge generated to the American Pacific Islands. Pacific Islanders are high-potential clientele for this kind of aquaculture because it generates income and healthy food on minimal land area and uses much less fresh water than traditional agriculture. While there are some technologies that need to be refined, the main effort of this project will be technology transfer through hands-on, one-on-one assistance that will be provided via numerous site visits. It is anticipated that solutions to problems will be farmer- and site-specific. In addition, the project will provide hands-on training for the CTSA Pacific Islands Extension specialist so that he may spread the technology to various sites across the Pacific. The major impact from this project thus far has been the ongoing assistance provided to four farms in the region. In addition, researchers have worked through issues related to the media for plant roots, biofiltration approaches, as well as the Nutrient Flux Hypothesis and oxygenation/denitrification issues.

Aquaculture of Opihi, Years 1 and 2

Funding level: \$100,000
Project start date: August, 2010
Duration: 2 Years
Participants: Oceanic Institute (Lead Institution), University of Hawaii at Manoa, Texas A&M University

Opihi, a small, edible limpet, is a high-value product in Hawaii, where an established niche market, bolstered by the need for opihi at Hawaiian gatherings, exists. However, due to overfishing, wild opihi stocks have been severely depleted and the supply can no longer meet demand. Therefore, captive culture of the species is imperative to its sustainability as a high-

value product. While some highly academic marine biology studies have been conducted, a concerted aquaculture research effort for opihi has never been attempted. This project is conducting the necessary research to develop cost-effective means of opihi culture. During Year 1 of the project, researchers were able to successfully overcome unexpected challenges in collecting and moving animals from container to container, and develop a holding facility. They formulated an artificial feed and conducted feed studies, which found that natural biofilm, or the commercially available algae *Porphyra* sold as “nori,” was needed as a palatability enhancer. Year 2 studies suggest that the artificial feeds support good growth rates, with a rate of about 30% in 10 weeks. Results also imply that opihi may be spawned and larvae reared without problems.

Developing a Value-added Product “half-pearls” from the Blacklip Pearl Oyster *Pinctada margaritifera* in Pohnpei (the Federated States of Micronesia), Years 1 and 2

Funding level: \$91,467
Project start date: August, 2010
Duration: 2 Years
Participants: College of Micronesia: Land Grant Program (Lead Institution), Pakin Community Association

Hemispherical pearls (“half-pearls,” or “Mabe” pearls as they are more commonly known) give value-added opportunities for the pearl oyster shells (mother-of-pearl shells) in jewelry and handicrafts. In Micronesia, where there exists a small, niche tourism market, half-pearls have potential to support a sustainable pearl business and rural development, particularly for small family and/or community-based enterprises. The College of Micronesia Land Grant Program (COM) has been training Micronesians for half-pearl seeding for several years. These local seeding technicians have been able to produce half-pearls by themselves, and under this project, have successfully transferred this technology to selected youths and pearl-farming communities so they may benefit from this new revenue stream. Under this project, 43 Micronesian technicians and 13 local youths were trained in half-pearl grafting. Approximately 3,000 pieces of half-pearls were produced and an estimated 10,000 pieces will be harvested in 2013. The half-pearls being produced by the local technicians have received attention from pearl industry professionals for their quality and unique colors of light blue or green peacock with high luster. Demonstration of half-pearl pendant and accessory making was also a large focus of the project, and was carried out by COM staff. 154 people were trained in accessory making and several core Micronesian technicians were trained in pearl grading. Half-pearl accessories were sold at a display sale in Pohnpei for an average price of \$20.

DNA-Based Identification and Selection of High-growth Tilapia in Hawaii

Funding level: \$100,000
Project start date: August, 2010
Duration: 2 Years
Participants: University of Hawaii at Manoa: Land Grant Program

The lack of genetically suitable tilapia seedstock has been a limiting factor for aquaculture of the species in Hawaii. Importation of tilapia strains to Hawaii has been challenged by environmental concerns and field-testing experiments. However, tilapias existing in the wild and on farms in Hawaii can be used as genetic resources for developing high-growth tilapia and negate the need to import new strains. Microsatellite genotyping and gene expression analysis have been proven as effective tools for genetic selection of superior animals with desirable production traits. The primary objective of this project is to develop fast-growing tilapia by using existing strains and hybrids in Hawaii. This is being achieved through the classification and identification of the tilapia strains and hybrids existing in the wild and captive populations utilizing DNA barcoding methods, and the development of DNA-based testing tools for selection of high-growth tilapia. Thus far, a total of 420 tilapia fin samples have been collected from 13 populations from local farm and wild population sites in Hawaii, and DNA has been extracted and used for PCR. Seven different tilapia species and one hybrid have been identified, including *Oreochromis aureus*, *O. mossambicus*, *O. urolepis*, *O. niloticus*, *Sarotheradon melanotheron*, *Tilapia rendali*, and *O. niloticus* × *O. mossambicus*. The results from this study confirm that *O. niloticus* and its hybrids exist in the wild and captive sites in Hawaii. This DNA-based tilapia species identification is the first report that has confirmed tilapia species identities in the wild and captive populations in Hawaii, and will help in the future development of high-growth tilapia in the state.

Collection and Health Certification of Coral Grouper Broodstock in the Mariana Islands

Funding level: \$56,256
Project start date: August, 2010
Duration: 1 Year
Participants: University of Guam (Lead Institution), Hawaii Department of Agriculture: Aquaculture Development Program

The purpose of this project is to begin the process of establishing a domesticated, high-health population of two species of coralgroupers, *Plectropomus leopardus* and *P. leavis*, commonly known as the Leopard and the Giant coralgrouper, respectively. Coralgroupers are among the most sought after and valuable food fish of the coral reef habitat worldwide. They are some of the highest-priced fish in the live food fish markets in Hong Kong, where they are imported from across vast regions of Asia and Oceania. As such, many are listed as vulnerable on the International Union for Conservation of Nature Red List, including the two target species for this project. They are suffering from overfishing on Guam to the point where their natural recruitment may be threatened and there is interest to restore the natural stocks of these two species. Furthermore, the aquaculture industry of Guam has a strong desire to develop a local, high-end product that can be marketed as a live, in-restaurant product to the tourist trade. At the beginning of the project, researchers experienced difficulties collecting the live grouper, but have since obtained the brooders and have become familiar with the species and their behavior. The group has established a lab and prepared for the viral disease diagnosis and other health-monitoring routines.

Adapting Aquaponics Systems for Use in the Pacific Islands, Years 1 and 2

Funding level: \$68,024
Project start date: August, 2010
Duration: 2 Years
Participants: University of Hawaii at Manoa

Aquaponics holds great potential in the Pacific Islands, where there is an interest in the local production of fish and produce. Extension of an existing aquaponics system has been attempted before in Saipan, but failed due to its reliance on expensive, breakage-prone, high-maintenance mechanical components and a lack of basic scientific knowledge to modify the system. Preliminary studies suggest that retro-engineering of complex recirculating aquaponics systems may be possible by achieving an understanding of the nutrient flow in the system and developing an integrated recirculation/anti-denitrification system. Promising results have been obtained with a small scale (50 m²), modular tilapia and lettuce co-culture system that uses minimal electricity and is comprised of one piece of equipment (designed under previous CTSA project). The primary objective of this project is to refine the technology of the system and distribute it to interested parties in Hawaii and the Pacific Islands. To date, three systems have been constructed in American Samoa. Produce from the systems is gaining local popularity due to its improved quality over imported vegetables and plans are in the works for expansion of one of the farms. In addition to extension work in Samoa, researchers are beginning to understand the biochemistry of aquaponics systems. They have also demonstrated that Chinese catfish can be a successful alternative fish for aquaponics and can help to improve upon denitrification problems suffered by some farmers.