CENTER FOR TROPICAL AND SUBTROPICAL AQUACULTURE

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# Letter from the Director

Aloha,

As we close out the celebration of World Ocean Month, I would like to remind our e-Notes readers that it is our sincere goal for CTSA to play an active role in providing our island communities with healthy ocean foods. To this end, the CTSA FY25 development cycle is well underway, and I am pleased that we received 25 pre-proposals addressing the priorities proposed by stakeholders across our region. I am especially excited to once again see several pre-proposals from new researchers! The package of pre-proposals now goes to our Industry Advisory Council and Technical Committee for their review and voting. While we wish we could fund all of your good ideas, CTSA does not have sufficient funds to support every proposed project. Those not selected to move forward are strongly encouraged to consider the comments that will be provided by our IAC and TC and resubmit your idea in the future.

As I have shared in recent letters, CTSA development this year is focused on supporting projects that expand the impacts of previous program investments in priority species and areas. It is our hope that this focus will lead to the commercial application of work started years ago, building on available resources to provide island communities with profitable economic opportunities and healthy aquaculture products. Utilizing available resources not only gives a project a foundational advantage in succeeding, but it also reduces waste, a global problem that I often discuss in this newsletter.

Take for example, fish waste. There are innovative operations in Asia that integrate the production of seafood with processing facilities, and they pull waste from fish processing back into aquatic feeds. This is a great model that we should aim to follow, as all resources are precious and should be recycled when possible. This includes operational resources, which brings me back to the unfortunate news I shared last month about Big Island Abalone (BIA). Prior to the closure of the facility (pictured above) in early June, I traveled to Kona and met with several employees. Some have been working at BIA for decades and have gained valuable aquaculture experience; I truly hope that another company will be able to utilize the facilities, provide jobs for the skilled workforce, and produce useful products. Otherwise, we run the risk of wasting major investments that have been put into our regional aquaculture industry. As always, I look forward to dialogue with our stakeholders about the best ways to solve these problems together.

Mahalo,
Dr. Cheng-Sheng Lee
Executive Director, CTSA

# Mid-Year CTSA Project Updates

CTSA recently completed the semiannual project update conference calls with each project's PI(s) and liaison to touch base and expand on the information in the project's midterm report. The following are some updates from four of the ongoing CTSA projects:

**Establishing an Aquaculture Workforce Development Program: Bridging the Education Gap in Hawaii**
*Co-P.I.'s Jeffrey Garvey, Waipahu High School; Maria Haws, University of Hawaii Hilo; Samir K. Khanal, University of Hawaii Manoa*
The overarching goal of this project is to improve

and expand aquaculture education across high schools, community colleges, and four-year colleges in Hawai'i by establishing a certificate program, as well as training educators and industry stakeholders. To date, the project has made good progress in developing a statewide aquaculture workforce development program. The group has launched a high school internship pilot involving 15 Waipahu HS students. As part of this experience, students completed an internship at the UHH Pacific Aquaculture and Coastal Resources Center (PACRC), where they learned hands-on husbandry skills for shellfish and finfish with Co-PI Haws. They also visited Co-PI Khanal's lab at UH Mānoa to learn about water quality analysis and the design of aquaculture and aquaponic systems. The internship also included tours of several aquaculture facilities, including the Hawaii Fish Company, Symbrosia, and Cyanotech. This program will be expanded to other high schools, college students, and teachers in the future. Through this program, students are gaining exposure to hands-on aquaculture training, including shellfish and finfish husbandry, water quality analysis, and visits to leading industry facilities. The group has also developed a new microalgae curriculum in collaboration with the Hawai'i Young Entrepreneurs Program. This curriculum has introduced students to value-added aquaculture products and developed entrepreneurial skills. These activities are helping bridge classroom learning with real-world applications and business opportunities in the aquaculture sector. In parallel, efforts to create non-academic certification pathways are advancing. Students participating in the summer internship will receive certification endorsed by HAAA, while longer-term plans for academic certification through UH continue. In addition, the work group has started work on a training-of-trainers curriculum, with a pilot session for educators planned for Year 2. They are also in ongoing discussions with several aquaculture businesses to host long-term school-year internships for teachers and high school seniors.

The workforce training program at the PACRC/UHH has been in existence since 2006 and has provided multiple year training to over 500 stakeholders, primarily undergraduate and graduate students. CTSA's support has enabled the training of eight additional students since the beginning of the project and allowed development of curriculum that will allow the program to expand training to community members. This will be operationalized in Year 2. Three new areas of emphasis have been added recently, including training in the operation of photobioreactors for microalgae production, sea cucumber production and marine ornamental fish breeding. In addition to hosting Jeff's students, the PACRC workforce program hosted 23 students and 4 instructors from Waianae and is preparing to host 15 instructors and coordinators for Upward Bound; they will be instructed in oyster culture, sea urchin work, and other areas to provide technical and basic biology background. The work group conducted an analysis of all aquaculture resources within and outside of the UH system, and is developing a 21-credit program that anyone at UH Hilo will be able to take. In the fall, they will go through the approval process for the certificate. Most of the courses will be delivered in a hybrid fashion, with online labs coupled with in-person experience.

**Developing Affordable and Efficient Photobioreactor and Biofiltration Systems with Fungal Filters to Grow and Harvest Microalgae**

*P.I. Zhi-Yan (Rock) Du, University of Hawaii Manoa*

The goal of this project is to develop an affordable and powerful photobioreactor (PBR) using low-cost and durable materials that can offer ultra-lighting and other growth condition controls for the aquaculture and algal industry. PBRs can control growth conditions, including light, temperature, CO2/oxygen, pH, and nutrients. To date, the work group has developed prototypes for algae cultivation alongside harvesting devices. They functionally have developed 6-8 different models; their recently established system using multiple 5-gallon buckets is working very well. They have developed similar designs for two systems -- seaweed and microalgae-- that can be put together as a matrix. The group has been testing efficiency with affordability in mind, and harvesting efficiency is 98-99%. The project is working with industry and also the P.I. of the Workforce project to setup bioreactors for microalgae at Waipahu HS. The project has also been working with restaurants to develop food using microalgae and seaweed products, and their 'Noodles from the Sea' were recently featured in Hawaiian Airlines' Hana Hou Magazine!

**Monitoring Inbreeding for Local Fish Farms by DNA Testing**

*P.I. Jinzeng Yang, University of Hawaii Manoa*

The goal of this project is to apply DNA-based testing tools for effective genetic management in a given population of fish. With these DNA testing tools, local fish farmers can carry out their own broodstock selections. The objectives for the two-year project are to 1) develop micro-satellite DNA markers and COI DNA barcoding methods for monitoring inbreeding or FDNA for tilapia, and some other locally valuable fish species used in fish farms, 2) collaborate with local fish farms for fish fin clip sampling for DNA testing and report DNA genetic variations and genetic coefficient of inbreeding (COI), and 3) apply DNA-based testing results for fish genetics and breeding to support broodstock management in collaboration with interested farmers or entities. To date, the project group has successfully established DNA isolation protocol from fish fin samples and tested PCR amplifications for a least 15 microsatellite DNA markers and COI primer sets. At least six sets of microsatellite markers are genotyping by DNA sequencing for two fish populations. The work group is still analyzing the data. In the meantime, other DNA methods based on whole genome SNP

are also being analyzed for better approaches in studying genetic diversity and monitoring fish inbreeding. In addition, the project collected fish fin clip samples from six sites and/or populations from local tilapia fish farms, with 60 samples from each site. The DNA isolation work and PCR amplification are ongoing, though it has been determined that there are genetic differences between farms and even variations between populations raised at the same site. SNP genotyping and related customer-based services in consultation with genomic serviced companies is in development stages for monitoring fish inbreeding. Once completed, this work will hopefully help farms understand the level of inbreeding and lead to intentional crossing of different populations.

**Commercializing kyphosids - refining weaning strategies and grow-out feeds for nenue (*Kyphosus vaigiensis*) to optimize economic viability**
*P.I. Armando Garcia Ortega, University of Hawaii Hilo; Co-P.I. Jennica Lowell-Hawkins, Ocean Era LLC*
The overarching goal of this project is to make Nenue (*Kyphosus vaigiensis*) aquaculture attainable to as many groups as possible by reducing uncertainty through the development of cost optimized hatchery protocols. The specific objectives of this work are to decrease reliance on Artemia and develop effective weaning strategies; test different diets that are formulated to specifically optimize Nenue growth and survival; conduct the first consumer taste test with farm raised nenue; and transfer the technology to interested parties through publications, presentations, and student worker training. To date, the project has attempted to produce nenue twice in the hatchery but struggled due to water quality issues. The project is working together with partners to mitigate the issues and is anticipating it will have nenue fingerlings for the feed trials within the next few months. The feed development group at UHH is awaiting the delivery of ingredients to develop the test feeds; once the feeds are developed and the trial at Ocean Era is stocked with juveniles, research will get underway.

## AquaClip: Students Learn To Farm Fish, Seaweed. But Where Are The Jobs?

Droplets of blood red algae dance in a bubbling beaker in a Waiʻanae High School classroom, as Leihōkū Elementary schoolchildren huddle around.

Recent Waiʻanae graduate Hyrum Tom and teacher Tyson Arasato tell the visiting children all about the algae, limu kohu, a popular edible species native to Hawaiʻi. The algae population is declining in the wild, so the school is trying to grow it in captivity to feed the community and help the wild limu recover. By next year, Arasato said, the school hopes to scale up from beakers to large tanks full of algae for the community to consume.

“Instead of them having to go out and pick it, where it’s not found as much, we’ll let it restore outside in the wild,” Arasato said. “Then we can actually supply people with the food that they need — that’s the goal of aquaculture.”

The Marine Science Learning Center is the only dedicated high school aquaculture center in the state, and it’s been expanding its operations in recent years to give students more hands-on experience cultivating and caring for species many believe could become the lifeblood of Hawaiʻi’s food system and economy.

The state’s aquaculture industry is expected to boom from a $90 million a year industry to $600 million a year in the next decade — according to the Department of Agriculture — and researchers say it will soon face a dearth of workers, which needs to be addressed if the industry is going to reach its full potential. But it’s something of a Catch-22: despite predictions of workforce shortages and future growth, few of the students who have gone through the Waiʻanae center have found jobs in the field. Part of the challenge is that many of the existing jobs require college degrees, something that less than one-third of Waiʻanae students pursue following graduation. A bigger issue is that jobs at any level of experience are limited at the moment.

“The big bottleneck is not that we can’t do workforce training,” said Maria Haws, an aquaculture professor at the University of Hawaiʻi Hilo. “It’s that we need to grow the industry.”

But the state has done little to invest in the industry in recent years and lawmakers have yet to heed calls from local industry leaders and researchers to encourage growth through regulatory reform or investments in infrastructure. Now, as a major aquaculture producer shutters on the Big Island and another sues the state for crippling its business, concerns are growing over whether Hawaiʻi can actually achieve its potential.

Despite the uncertainty, leaders and students at the Marine Science Learning Center are continuing to build upon the center’s decades of research. The school is now using grant funding to expand its footprint with new tanks, as part of its ultimate bid to boost Leeward Oʻahu’s food security and establish a hatchery for native fish to reestablish throughout the state. Those species include Waiʻanae’s namesake ʻanae — native mullet. Restoring mullet’s place on the Westside is intended to help students connect with their heritage and sense of place, but also as a way to boost food self-sufficiency and address the region’s food

insecurity, which is among the worst on Oʻahu.

“We need to get our fishponds functional again,” learning center coordinator Dana Hoppe said. “You want to talk about food security? That’s food security right there.”

Industry leaders have long said aquaculture is the most promising sector of agriculture for Hawaiʻi, a claim in line with global trends that show production and demand for farmed fish and other marine species is accelerating. Hawaiʻi, they said, has a key role to play in the U.S. and global aquaculture industries — but the state has to address multiple obstacles for that to happen, according to a 2024 state report. In addition to building a workforce pipeline, the state needs to simplify the regulatory landscape, to attract entrepreneurs and encourage more private and public investments in the sector.

The assessment, completed by an international aquaculture consultant group hired by the state, noted that the state needs to invest more in infrastructure to help foster that development, such as land and processing facilities. But the workforce was a key issue, one nearly every aquaculture business surveyed noted. They struggled to find well-qualified candidates within the state, while also finding it difficult to attract out-of-state talent. Without fixing the apparent workforce deficit, the report said, the state’s aquaculture outlook would only worsen. But the state has yet to show substantial support for the aquaculture industry and workforce development, according to Sen. Glenn Wakai, a longtime proponent for aquaculture in the Legislature.

The industry’s potential to grow to $600 million a year by 2034 requires dual efforts, happening simultaneously, to ensure jobs are there for young graduates, Wakai said. One idea is to build spaces for budding aquaculture entrepreneurs and businesses, like agricultural parks, while also attracting established businesses to conduct research in the state. But the model for such an effort — Hawaiʻi Oceanic Science and Technology Park in Kona — has run into problems with water supply and tenants are suing the state for damages related to water quality. Without the park, or more like it, graduates and the workforce will have nowhere to go but outside Hawaiʻi, Waikai said.

“Kudos to Waiʻanae,” Wakai said. “But when the kids all want to go to college, what kind of job opportunities will be here for them?”...

Source: Honolulu Civil Beat // Read Original Article

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This newsletter is written and prepared by the CTSA Information Specialist Meredith Brooks.
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CTSA was established in 1986 and is administered by the University of Hawaii.

**Center for Tropical and Subtropical Aquaculture**
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