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Letter from the Director

Aloha!

At CTSA, we often receive questions from industry stakeholders about the processes that define our organization and determine the projects we fund, and we are eager to share this information with you. Currently, we are in the middle of our FY10 Development Cycle. The following is a closer look inside the process:

Each year, CTSA develops a list of Funding Priorities based on suggestions or concepts provided and voted on by industry members and researchers. This list is used to form the basis of our "Call for Pre-Proposals," which occurs every March. Interested parties submit a 2-page pre-proposal, which is reviewed for technical merit by our Technical Committee (TC) and then ranked based on industry need by our Industry Advisory Council (IAC). Pre-proposals that receive support from at least half of the IAC are asked to submit full-proposals to be included in a working version of our annual Plan of Work. The amount of proposals accepted annually is determined by our budget. Each proposal is thoroughly reviewed, both externally and internally, and revised to ensure it is technically sound and meets the needs of the industry members it will serve. Once revisions requested by both committees and external reviewers are made, the Plan of Work is submitted to the Board of Directors for approval in January, before it is sent to the USDA for final funding approval in February.

The Center is interested in attracting researchers from across our region. Each year, the priorities defined by our IAC and TC may change depending on specific needs. Therefore, please do not be discouraged from submitting pre-proposals if you are a researcher who has previously done so and not been funded. Our next call for pre-proposals will be in March 2011.

In an effort to better serve the industry and increase understanding of how CTSA works, pertinent CTSA processess will be prominently featured on our new website, which is scheduled to go live within the next couple of months. In the meantime, I hope you enjoy this issue and, as always, if you have any suggestions, concerns, or comments, please do not hesitate to let us know.

Mahalo,

Cheng-Sheng Lee
Executive Director, CTSA

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CENTER FOR TROPICAL AND SUBTROPICAL AQUACULTURE

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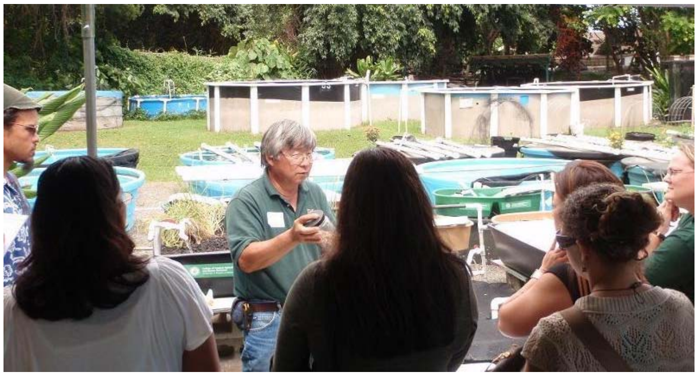
The Secret Garden of Aquaculture

by Meredith Brooks, CTSA



Dr. Clyde Tamaru explains the benefits of using black soldier fly larvae as fish feed to HDOE teachers at the CTAHR Aquaculture & Aquaponics Facility

Tucked in the back of Windward Community College, behind the administrative buildings and beyond a foliage-covered chain link fence, lies the secret garden of aquaculture: the University of Hawaii's College of Tropical Agriculture and Human Resources (CTAHR) aquaculture and aquaponics facility. Happily waiting to tour visitors are Dr.'s Clyde Tamaru and Bradley "Kai" Fox, two aquaculture scientists eager to develop and share their methodology and message of sustainability with the world.

Those fortunate enough to visit this facility step onto the field and are greeted by the sight and sounds of countless recirculating tanks, some featuring aquaponics grow beds teeming with vegetation and others holding newly imported pacu fingerlings or Chinese catfish. At the center of each aquaponics setup sits a fish tank, the lifeblood that sustains the entire system. It holds dozens of fish that create nutrient-rich water, which feeds the plants above and allows them to grow free from soil and fertilizer. In raft and cinder-filled grow beds lie an array of vegetables, including cabbage, green onions, herbs, tomatoes, kalo (taro), and even rice, products of what is perhaps the ultimate sustainable use of aquatic animal effluents.

Each tank is a mini-project, conducted by Clyde and Kai with a passion for sustainability and desire to advance industry knowledge. The pair, along with RuthEllen Klinger-Bowen and Kathleen McGovern-Hopkins, is conducting research and using replicated trials to test innovative ideas and solve questions industry stakeholders desperately want answered. While on-site experimentation is both exciting and unique among aquaponics aficionados, it is imperative to conduct the type of scientific research being undertaken at this facility to determine the most efficient technology for this growing sector of aquaculture, on both a commercial and backyard scale.

One research priority common across the aquaculture board is the desire to improve feeds and overall system functionality as they apply to economic and environmental impacts. Creating a science-based, completely sustainable system that runs on alternate power and is fed by locally available feed is a goal of current research the CTAHR group is conducting at the facility. Among ongoing experiments are trials to determine the value of black soldier fly larvae as fish feed, as well as the values of vermicasting and utilizing alternative energy sources to power the systems. In addition, the team is experimenting with alternate species to diversify the "aquaponics portfolio," which is currently dominated by the ultra-durable tilapia.

Outside of conducting research, the CTAHR team devotes a good amount of their time to aquaculture extension. They work closely with a variety of Hawaii farmers who use both aquaponics and/or traditional aquaculture systems. When they are not working with commercial producers, they are devoting their time to helping the Hawaii community at-large. They recently designed and helped implement a system for the Hawaii State Hospital, located adjacent to the Windward Community College campus. The system contains three modules, each consisting of a 300 gallon fish tank and three grow beds (one ebb and flow and two floating rafts), and fits beautifully on an old basketball court in the center of the hospital. While the fish tanks are all filled with the same fish, each grow bed is different; some are overflowing with green, while others are freshly planted, evidence of a recent harvest. A group of approximately 22 patients participate in a therapeutic vocational program to run and manage the system. Participating patients run all aspects of this mini-farm, and conduct daily tasks including weighing and administering the fish feed, maintaining the tanks, planting, harvesting, and vending. There is even someone to collect data and monitor water quality and fish health, which the CTAHR team reviews to ensure the system is running properly.

"A lot of patients were depressed before the program," stated Judy Dacanay, the Occupational Therapist who supervises the patients involved in the program. "When they see the fish and vegetables growing, it gives them hope. They feel important; like their lives are purposeful." Not to mention the fact that the useful hands-on skills these patients are learning can be applied to life outside the facility.

Dr.'s Clyde Tamaru (left) and Kai Fox (right) with Judy Dacanay of the Hawaii State Hospital

The CTAHR team has also been involved in helping various schools and educators. I had the pleasure of attending a workshop they put on for a group of enthusiastic Hawaii Department of Education middle school teachers earlier this month. The teachers converged on the facility to learn hands-on how they can incorporate aquaponics into STEM education curriculum. Several teachers excitedly described how aquaponics can help to teach often-difficult concepts in chemistry and biology, and how it can easily be applied to educate students and the general public about the importance of self-reliance in these islands. 16 participants have subsequently advised the CTAHR team they will be setting up systems at their schools.

Aquaponics is a relatively easy method of sustainable food production, especially for islands with scarce/depleted resources or those facing a decrease in fertile land space. In the Pacific, several islands have already begun to lose land historically used to grow taro, the staple starch of the Pacific. From Palau to Pohnpei, sea level rise has resulted in encroachment on and salinization of the land. In addition, depleted wild fish stocks have left communities searching for alternate sources of protein. Multiple projects are underway at a variety of organizations to assist these communities and transfer valuable technology. One such project is the NOAA Aquaculture Education project, conceived and run by CTSA. The project will develop an education program and accompanying curriculum for Pacific Island students, which will be implemented this winter in the Waialua school complex and at a school in Rota, the Commonwealth of the Northern Mariana Islands. The program and curriculum, which will be detailed in the January issue of Regional e-Notes, will utilize a CTAHR aquaponics system (partially funded by CTSA) to introduce students to aquaculture, the scientific process, and the importance of sustainability in an experiential learning setting.

CTSA is excited to be a part of the aquaponics revolution in the Pacific and worldwide. As with all other sectors of the aquaculture industry, continuous research and experimentation are imperative to its advancement. Thankfully, the ever-increasing practicality of these systems provides an opportunity to educate the public and our children about multiple important concepts in the process.

Summary of the CTSA-Funded Kahala Broodstock Project

Project participants: Dr. Charles Laidley, Oceanic Institute (Project PI), Dr. Chad Callan, Oceanic Institute, Mr. Ken Liu, Oceanic Institute, Mr. Neil Sims, Kona Blue Water Farms, Ms. Jennica Lowell, Kona Blue Water Farms

Amberjacks (Seriola spp.) are emerging as premier aquaculture species worldwide due to their adaptability to conditions of intensive culture, extremely fast growth, and high market value. At present the industry is primarily based in Japan where 140,000 MT of yellowtail (hamachi) and greater amberjack (kampachi) are produced annually. US imports (primarily fillets) are estimated at 5,000 MT and worth $58 million annually. The development of open ocean aquaculture in the U.S. offers an opportunity to substitute locally grown fish for these imports and help reverse the approximately $9 billion annual trade deficit in seafood.

The majority of the overseas production utilizes wild-collected fingerlings stocked in nearshore surface cages in bays and estuaries. This dependence upon wild fingerlings not only limits production but also puts substantial pressure on natural stocks. Efforts have been made in Japan, Europe, and elsewhere to establish more sustainable hatchery technologies to provide fingerlings for growout but challenges in establishing a reliable egg supply, limited hatchery output, and high fingerling costs have led to continued reliance on on wild collected fingerlings.

Longfin amberjack (Kahala)

Pioneering research conducted by the Oceanic Institute and Kona Blue Water Farms, LLC (both of Hawaii) have led to the successful establishment of captive culture technology for a locally important Seriolia species variously known as kahala, (Seriola rivoliana). This species is closely related to the slightly larger yellowtail (Seriola quinquadradiata), greater amberjack (Seriola dumerilli) and Australian kingfish (Seriola lalandi), and exhibits the same characteristics and market potential. Work at the Oceanic Institute established a captive breeding program and demonstrated the feasibility of hatchery based fingerling production methods for stocking in open ocean cages. Parallel efforts at Kona Blue Water Farms (KBWF) led to the development of the first large-scale commercial hatchery and open ocean growout of the species with production of 10,000 lbs per week of a high-value, sashimi-quality, ocean-raised fish, trademarked as "Kona Kampachi™".

Although kahala broodstock have now been successfully domesticated, egg supplies continue to be variable due to challenges in long-term broodstock maintenance and concern over the effects of environmental and dietary factors on egg quality. Therefore, the goal of this collaborative project between the Oceanic Institute (OI) and KBWF is to establish and optimize broodstock holding conditions to secure long-term broodstock health, and develop a more reliable year-round supply of viable eggs to facilitate year-round hatchery operations. In addition to assisting commercial operations at KBWF, results of these studies will assist other commercial startups in determining the best methods for maintaining valuable broodstock populations.

Under this project OI designed and commissioned two indoor two-tank broodstock holding systems (~20,000L/tank) maintained under artificial photoperiod and temperature control at OI. Two of the tanks were designed as flow-through systems (FTS) supplied with water that was degassed and mechanically filtered through pressurized crushed glass filtration units. The remaining two tanks were designed as recirculating aquaculture systems (RAS) under which water passing through the tank is passed through a fluidized sand biofilter, protein skimmer and UV sterilizer and resupplied to the broodstock tank. Due to higher than anticipated solids buildup in the system, we added an additional pressurized crushed glass prefilter to help mechanically strain solids from the system. In parallel KBWF commissioned two 45m^3 outdoor broodstock tanks, with one on flow-through using surface water provided by the National Energy Laboratory, and the second using RAS under which water passed through a crushed glass media prefilter, protein fractionator, and 450L bioball biofilter, and UV sterilizer before return to the broodstock holding tank.

The project demonstrated that kahala adapt quickly to each of these tank systems with excellent egg production soon after tank stocking. However, over time reproductive output slowed and egg quality appeared to deteriorate in the OI RAS system, possibly associated with high levels of suspended solids coming from the high lipid broodstock diets. Supplementation of the RAS system with a pressurized crushed glass filter helped clarify the water, but did not appear to improve spawning performance. The lower performance of kahala broodstock in the OI RAS was surprising in that the water treatment system was quite large for the relatively low broodstock densities tested in these trials. Further, the system appears to work quite well with a range of other marine finfish species including moi and yellow tang. The experience at KBWF was somewhat similar, with slightly greater than double the egg output and egg viability rates in the flow-through versus RAS maintained stocks. However, differences in origin, age and feed between treatment groups makes treatment comparisons difficult.

The project also examined the long-term performance of OI kahala broodstock on a formulated commercial salmon broodstock diet (Vitalis SA, Skretting) that was shown to yield excellent results in an earlier trial when compared with frozen fish, squid and shrimp feed. Although the commercial diet supported egg production throughout the duration of the project, egg quality in terms of viability, hatch and early larval development clearly was insufficient to meet the egg stocking requirements of a production hatchery. Therefore, after six months on the test diet we introduced a squid, vitamin and antioxidant supplemented broodstock feed (Vitalis CAL, Skretting) for two of the broodstock populations for the remainder of the project. The squid supplemented formulation increased viable egg production and yielded some improvement in hatch rates, from 3 to 22%. However, efforts to rear these eggs by both ourselves and commercial partners suggest that even the successfully hatched eggs yield inferior larvae that were not suitable for hatchery production.

One hypothesis is that the captive reared kahala broodstock may be impaired by high-fat growout diet formulations selected for optimal growth and fillet lipid composition making these production fish less than suitable for incorporation into commercial broodstock efforts. Indeed our earlier studies with wild-collected kahala along with ongoing efforts at KBWF has shown much higher egg quality from wild collected broodstock, suggesting a need to further research broodstock diet development with consideration of growout, conditioning and spawning phases. Indeed farm raised fish typically exhibit very fatty livers which may impair with critical physiological processes including growth and egg production. The challenge appears to be in finding broodstock diets with sufficiently high levels of essential lipids (DHA, EPA, arachidonic acid, etc.) and vitamins while reducing the overall negative contributions of high energy/high fat diets on general stock health and reproductive function.

Pacific Island Spotlight: Hawaii Farm wants waste-water dump permit

From the Honolulu Advertiser Newswatch. September 21, 2010.

Integrated Aquaculture, which operates a shrimp farm in Kekaka, Kauai, is seeking a state permit to dump up to 30 millions of gallons of waste water each day into the ocean, the Garden Island newspaper reported yesterday. A dozen residents toured the farm Thursday amid concerns that past problems will be repeated.

When the farm was in full operation several years ago under a previous owner, ocean currents dispersed foul-smelling waste water and shellfish remains to popular surf spots such as Kinikini and Majors Bay, drawing sharks.

After reaching a peak annual production of nearly 1 millions pounds of shrimp, the original owner, Ceatech, folded in 2004 due to an outbreak of the white spot virus. Sunrise Capital bought the farm in 2006 but suspended operations in 2008 because of a second outbreak.

Integrated Aquaculture purchased the shares of Sunrise Capital in 2009 and has worked to bring operations back to full capacity.

AquaClip: Kelp Waits to Take Its Place in America's Stomachs

by Wynne Parry, LiveScience Senior Writer, *from livescience.com, September 28 2010*

The leaves resemble brown lasagna noodles when they wash ashore on coasts around the world. Like many other seaweeds, sugar kelp has all sorts of uses. The leaves of *Saccharina latissima* provide a sweetener, mannitol, as well as thickening and gelling agents that are added to food, textiles and cosmetics.

But some believe its most important potential is largely untapped: as an addition to the American diet.
Seaweed is widely cultivated and consumed in Asia. However, in North America, where it sometimes is rebranded as a "sea vegetable," it is cultivated rarely and eaten infrequently. To proponents, this is the unfortunate oversight, considering it is a crop that can clean the water in which it grows, needs no arable land, and provide a nutritious food with traditional roots.

There is, of course, a matter of perception.

"You have to remember in Western countries, people say 'seaweed,' what do they think of? The glop that's on the beach. They don't realize there are resources sitting right in front of them," said Charles Yarish, a biologist at the University of Connecticut.

Yarish, a seaweed expert, is collaborating with a Maine company that sells seaweed cut as noodles, salads and slaw. He hopes to plant the seeds of an industry off the coast of New England, starting with the long brown fronds of sugar kelp.

Big business elsewhere

As a source of food for humans, the oceans have reached a tipping point, according to a 2006 report from the U.N.'s Food and Agriculture Organization. Fishermen have harvested the ocean essentially like hunter-gatherers for millennia, but traditional fisheries no longer can produce enough fish to keep up with the rising demand for seafood.

Meanwhile, aquaculture has increased and may have the potential to dramatically increase food production, in what has been called the Blue Revolution.

Seaweed is a part of this revolution. The cultivation and harvest of plants made up almost a quarter of the quantity of global aquaculture's output in 2004, according to the Food and Agriculture Organization. Increasingly, seaweeds and shellfish are being grown alongside fish or shrimp pens, where they can feed off the excess nutrients, becoming part of a system that produces an additional crop instead of a pollution problem.

Click here to read the full article.

The Center for Tropical and Subtropical Aquaculture (CTSA) is one of five regional aquaculture centers in the United States established and funded by the U.S. Department of Agriculture's National Institute of Food and Agriculture (NIFA) under grants 2005-38500-15720, 2006-38500-16901, 2007-38500-18471, and 2008-38500-19435. The regional aquaculture centers integrate individual and institutional expertise and resources in support of commercial aquaculture development. CTSA was established in 1986 and is jointly administered by the Oceanic Institute and the University of Hawaii.