

Regional  
e-Notes

## Letter from the Director

Aloha!

Sustainability has become a hot topic both locally and globally in recent years. It's in the news, it's in the supermarket, it's on the table, it's a part of CTSA.

Much of our sponsored research is attempting to facilitate dual benefits of sustainable food production and environmental conservation. Hawaii Public Radio recently interviewed CTSA-funded researcher Dr. Warren Dominy about his papaya waste project, which used discarded papaya rinds to replace up to 50% of imported protein ingredient mixtures currently used in aquatic feeds. Another CTSA project that began last month will integrate civil engineering with aquaculture research to reduce or resolve the problems associated with aquaculture effluents.

However, we want you to know that our Center is more than a mechanical tool to fund this research; we also work hard to encourage the sustainable development of our promising industry. Five years ago, I began to promote the benefits of bringing aquaponics to our remote island region. At that time, I took a trip the U.S. Virgin Islands to visit with Dr. Jim Rakocy and review his system. I am very happy to see that the Hawaii Aquaculture and Aquaponics Association has made aquaponics a key focal point of their annual meeting this year, which is highlighted in this issue.

As we move forward in a "greener" world, we are constantly looking for ways to improve our activities as they relate to the health of the people and environment around us, and hope you join this movement with us. Please enjoy this issue of Regional e-Notes 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

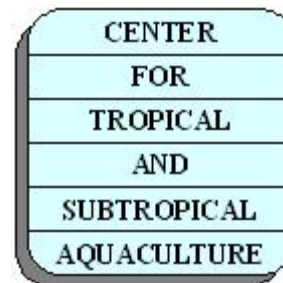
*Please note: the [Feb 2010](#) issue of Regional e-Notes featured an extensive article about the papaya waste project.*

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## Annual HAAA Meeting Attracts Local Farmers, International Speakers

by Meredith Brooks, CTSA

The Hawaii Aquaculture and Aquaponics Association (HAAA) held their annual

meeting at the Hilo Hawaiian Hotel on Monday, August 16; approximately 130 farmers and aquaculture industry stakeholders were in attendance. The meeting, which was the first part of a weeklong conference and workshop on aquaculture and aquaponics in Hawaii, began with opening remarks from HAAA president and CTSA IAC Chairman Ron Weidenbach. In his introduction, Mr. Weidenbach discussed how important it is for Hawaii's farmers to work together to mitigate problems facing the industry, citing that the largest impediment to local aquaculture growth is cheap imports, not local competition. With this in mind, he stressed the importance of the HAAA, and called for increased farmer enrollment before introducing the first meeting session.



Fish tank on Big Island aquaculture tour; Farmers Natalie (Olomana Gardens) and Linda (Island Aquaculture) participating in HAAA activities

### **Session 1: "Major Opportunities for Aquaculture in Hawai'i"**

The first speaker of the first session was Dr. Maria Haws of the Pacific Aquaculture & Coastal Resources Center (PACRC). In her presentation on bivalve culture in Hawaiian Fishponds, Dr. Haws discussed the opportunities for and necessity of the expansion of a bivalve industry in Hawaii, citing the ecological benefits that bivalves provide for water quality in integrated aquaculture systems. Under the CTSA-funded bivalve project, Dr. Haws and her research team are currently testing multiple local bivalve species for introduction into captive culture in four grow-out sites throughout the Hawaiian Islands. The project has had success thus far culturing the Hawaiian Oyster as a possible raw half shell project for local consumption, thanks to its favorable size and taste. However, Dr. Haws mentioned that there are still problems facing the expansion of the bivalve industry in Hawaii, and that the major obstruction to industry growth is shellfish sanitation. To this end, she was happy to report that the Hawaii Department of Health has committed to classify the growing waters of shellfish, a classification that was previously not required but is critical to shellfish sanitation.

The second presenter of the first session was Neil Sims, co-founder of Kona Blue and Ocean Stewards. The focus of Mr. Sims' presentation was mitigating factors that are hindering the progress of open ocean mariculture, namely public misinformation. A key factor to expanding the industry is getting people to understand exactly what is going on out in the ocean. Wild stock production is flat, and Mr. Sims argues that with 90% of the world's large fish species are gone from the ocean, "how can we continue to believe that we can continue to squeeze more blood out of this stone when the fish are gone. We have to find another relationship with the ocean. We have to move from treating the ocean as a strip-mining site to treating the ocean as a garden, as something that we would nurture."

Among his reasoning for the expansion of open ocean mariculture, Mr. Sims discussed the importance of seafood in a healthy diet and the limited ability of wild stocks as a means to provide essential nutrients for a growing world population. He urged people to think "B.S." or "beyond salmon," advocating that information dissemination should focus on the promising, sustainable aquaculture of marine fish (as opposed to anadromous species). He advised participants to review case-studies of European countries that cultured native species where they had once flourished but were subsequently wiped out, citing examples of sea bass farming productions that produce no known environmental impact. Aside from minor nutrient enrichment directly underneath the cage, Mr. Sims declared that his production has no harmful environmental impact. As part of the company's environmental assessment procedures, Kona Blue has conducted monthly water quality tests for the last five years and has found no detectable impact. While they have yet to develop a feed that is completely free of fish meal/oil, their current feed contains only 30%. Furthermore, the company is conducting ongoing trials to reduce the amount even further using byproducts including microalgae byproducts, fish peptides, and single cell proteins from food processing plants.

Mr. Sims stated that responsible open ocean mariculture is 60 times more ecologically sound than fishing the top of the food chain, as is practiced in commercial fishing. He determined this figure using a compounding scale that took into consideration life cycle efficiencies, trophic efficiencies, and by-catch efficiencies, stating that some capture fisheries have as much as 11 pounds of by-

catch for every one pound kept. In closing, Mr. Sims called on true revolutionaries to take this message globally, citing that it is a moral imperative of the aquaculture industry, which has the insight and ability to do so.

The session was closed by a presentation from Valerie Harmon of Cyanotech. Ms. Harmon discussed the company's microalgae products, primarily Spirulina, and the benefits and hardships of running an aquaculture business in Hawaii. In addition to outlining the details of the Cyanotech system, which has a capital investment of over \$8 million, Ms. Harmon spoke about the nutritional components of microalgae, including protein, omega-3 fatty acids, and multiple vitamins, as well as potential future markets for expansion, including medicinal compounds. She also shared results of a comparison study that looked at gallons of water used per pound of protein, and pounds of protein per acre of several food production industries. According to statistics, production of beef requires 14,000 gallons of water per one pound of protein, and produces 46 pounds of protein per acre; production of soybeans, eggs and corn requires 4,000 gallons of water per pound, and produces 400-550 pounds per acre; microalgae requires only 500 gallons per pound, and produces 8,000 pounds of protein per acre. Clearly, these results indicate that using microalgae for protein production is efficient.

Among the benefits of conducting business in Hawaii, Ms. Harmon cited that the local ideal climate allows for year round production, and high solar insulation allows for high growth. However, the preparation of the land and the high price of energy are costly impediments to production here.

## **Session 2: "Aquaponics Overview"**

Aquaponics guru Dr. Jim Rakocy led the second session of the meeting by discussing the design and setup of his world-renowned system, and listing several good practices for developing efficient aquaponics. In his presentation, Dr. Rakocy first mentioned the use of good construction materials. He stated that fiberglass, while expensive, is the best material for fish tanks, but concrete is also suitable (especially for developing countries); "Quick Tank," which is plastic liner supported by wire mesh, is another good option; metal and wood are the worst materials to use for a tank because they can rust or rot, respectively, and therefore require liners and waterproofing; round tanks are preferred to rectangular, as they are stronger and self-cleaning. Dr. Rakocy then went on to discuss his own best management practices, which include the following: delicately balancing the use of solids to mineralize nutrients, and removing them in time to maintain a healthy system; using fine mesh nets to ensure that fish remain separate from the hydroponic setup; maintaining appropriate levels of calcium, potassium, and iron; maintaining 5mg/L of oxygen to ensure that efficiency does not drop off; maintaining a water exchange rate of about an hour in an aerated fish-rearing tank (non-aerated tanks should have a higher rate); ensuring adequate bio-filtration; and carefully considering and limiting the use of aggregates, as organic matter generated in the system can clog aggregates.

Dr. Rakocy also showed several photos of different systems he and his team have helped to establish, including an 18,500-gallon system that is 30 feet in diameter with a minimal setup cost of \$1,800. To design their systems, his research team uses a feeding rate ratio amount of feed per unit per plant growing area; their research has shown that the optimum feed ratio should be 60-100 grams of feed per square meter of plant growing area per day. For systems with heavier plants, such as tomatoes, the feed ratio should be higher (closer to 100). As at least 25% of the feed becomes solid waste (dry weight), it should be removed before it enters the hydroponic component because it will adhere to plant roots and affect the system. To remove solids, Dr. Rakocy's team uses high-pressure water to clean the fine plastic mesh around the filter.

Wilson Lennard, consultant and founder of Aquaponic Solutions in Australia, was the second speaker of the session. In his presentation, Mr. Lennard discussed the design and construction of a system he developed for an experiment in New Zealand to answer the question if aquaponics can grow plants as well as hydroponics. His system, which utilizes a trickling design biofilter that aids in the oxygenization of water and runs on gravity, was similar in design to most other systems. However, as opposed to many of his colleagues and similar to Dr. Harry Ako, Mr. Lennard determined an exact feed amount based on the necessities of the system being designed (specific fish and plant nutrients, system size, etc).

As part of his presentation, Mr. Lennard shared the results of the comparison experiment. He used grass carp in his experiment, and compared the growth and quality of mostly baby leaf lettuces and herbs in aquaponics versus hydroponics systems. Analysis of experimental data showed that six out of seven heads of lettuce had significantly better growth in aquaponics; four herb varieties tested had exactly the same growth rates in both systems. Quality assessments determined that the quality of the lettuce was higher with aquaponics lettuce, indicating that aquaponics produce is just as good if not better than hydroponics produce.

Peter Boucher closed out the aquaponics session by discussing the history of aquaponics in Hawaii, and presenting photos and information on a plethora of current on-farm systems throughout the Hawaiian Islands. He stated that Hawaii is home to three large commercial systems, 25 medium systems, and, according to second-party information provided by Glenn Martinez (Olomana Gardens), 69 small systems on Oahu alone. The total volume of production from these systems is currently at almost 100,000 gallons of fish tanks and 33,000 square feet of grow beds. Boucher closed his discussion by mentioning his desire to resurrect an aquaponics group that meets quarterly at different facilities across the Big Island; if you are a Big Island aquaponics farmer and you would like to participate in this group, please contact him at [pboucher@hawaii.rr.com](mailto:pboucher@hawaii.rr.com).

### **Session 3: "Big Island Aquaculture"**

After a nice lunch at the hotel's Queen's Court Restaurant, the afternoon sessions commenced. The first session of the afternoon was led by Jan War of the National Energy Laboratory of Hawaii Authority (NELHA), who discussed options for expanding aquaculture business on the organizations' site next to the Kona airport. The property is 870 acres and has 42 commercial tenants and research projects, all of which lease land and buy water from the organization. In addition, NELHA has 2,940 acres of offshore lease area, allowing for expansive coastal and mariculture use. Multiple marine, fresh and brackish water species are currently cultured on site, due in large part to the extensive and efficient dual offshore pipeline seawater systems, which bring both warm and cold seawater (between six and 28 degrees Celsius) ashore. Each system has independent pumps and emergency valves, making the site an ideal location for aquaculture operations. For more information, please see [the NELHA website](#).

Kevin Hopkins of the PACRC extension program (run through UH SeaGrant) was the second presenter of the session. He reiterated the extension services available to farmers on the Big Island, including technology transfer (both onsite and through demonstration facilities) and fingerling distribution. Dr. Hopkins stressed that community outreach is an important component of his work, and that "the most important thing for improving attitudes towards aquaculture is that the community has to know what you're doing." PACRC works closely with schools and stewardship projects, and holds an annual Ocean Day open house that spreads the mission of aquaculture and aquatic resource management to the Big Island community.

Margarita Hopkins of Hawai'i County Research and Development, the final speaker of the session, discussed the Big Island's natural resources and potentials for local aquaculture development. She presented information about the different natural water resources/ditch systems on the big island, and encouraged the integration of aquaculture and agriculture for the most efficient use of scarce water resources. She stated that there are many substantial investments in NELHA, with an approximate investment of \$200 million in resources, as well as the PACRC. Mrs. Hopkins' stressed that the local government would like to encourage development of aquaculture on the Big Island, and has funded a study using GIS technology to determine the best potential locations for nearshore line culture and moored culture. Preliminary results have indicated that there are about 12,000 acres of readily available ocean that can be used for aquaculture. The comprehensive model used in the study accounted for good opportunities for aquaculture, as well as areas to avoid (including conservation and recreational areas). For more information on this study, please contact Mrs. Hopkins at [dayday@co.hawaii.hi.us](mailto:dayday@co.hawaii.hi.us).

### **Session 4: "Small-Scale Aquaculture and Aquaponics"**

Dr. Gideon Hulata, the first speaker of the last session, discussed the current status of biology, genetics, and selective breeding of tilapia. As most tilapia farmers are aware, the main problem in the culture of tilapia is the problem of uncontrolled reproduction, which causes an influx of smaller

fish that are unmarketable; much research has focused on mitigating this problem. Dr. Hulata stated that the key to solving this problem is monosex culture, which has been successfully completed by the production of YY males.

Dr. Hulata also discussed the genetic differences among species, and cited that the niloticus species has been found to be the best species for culture because of their higher growth rates and resistance to low temperatures, which is good for subtropical regions. More in-depth research into specific strains of species has also indicated that some strains of niloticus are better than others.

Dr. Hulata completed his presentation with a discussion on selective breeding for tilapia, which was initiated about 15 years ago. The first major attempt was the Genetically Improved Farmed Tilapia (GIFT) project, which developed a faster growing breed of niloticus. After five generations, genetic progress has been obtained and progeny have been divided into substrains, which are undergoing further improvement at multiple research facilities. Further selective breeding research is also attempting to mitigate the problems of tolerance to salinity and colder temperatures.

In a presentation about Food Safety, James Hollyer of UH Manoa's College of Tropical Agriculture and Human Resources (CTAHR) highlighted the key procedures for food safety on a farm, as well as important changes to food certification currently undergoing development and implementation. As confirmed by Mr. Hollyer, promoting to buyers that products are food safety certified is a very important marketing tool in today's consumer market. Given the fact that consumers want healthy food, and that legal watchdogs are cracking down on unhealthy or contaminated food growers and processors, this has become a business issue. Growers are responsible for the safety of their food, according to Mr. Hollyer, and must acknowledge that they are producing a product that people are putting in their mouths. To this end, the United States government is currently introducing legislation to ensure that the people handling and processing food are held responsible for its safety. The FDA Food Modernization Act, or Senate Bill 510, looks like it may pass in a couple of weeks and will change how both nationally grown and imported food is grown and sold at a commercial scale. In addition, the Child Nutrition Bill, which will look closely at what is being fed to children and enforce stringent rules for what can be sold to and consumed at schools, was recently signed into law. Also, new labeling systems on produce will allow consumers to trace the exact origins of their produce by scanning the barcode, and all organic product codes will begin with a nine.

There are several procedures that can aid farmers in preparing for these new mechanisms of checks and balances, the first being the implementation of safe handling procedures. Among his key recommendations, Dr. Hollyer suggested to always wash your hands between the handling of any warm-blooded and produce/consumable food; think about and mitigate every possible contamination of the edible portion of a crop; and ensure that irrigated water is free from contaminants, especially e-coli. For a full list of best safety practices, please see CTAHR's [food safety website](#). For information about the Hazard Analysis and Critical Control Point (HACCP) System to help farmers certify their products as safe, please visit the [HACCP website](#).

In the final presentation of the meeting, Dr. Harry Ako discussed the economics of his CTSA-funded aquaponics system (reviewed extensively in the [March 2010](#) issue of Regional e-Notes). Dr. Ako presented his system design, which is based on a nutrient flux approach, and shared his economic analysis results. His research looked at the production figures of multiple systems of different scales, and determined that a farmer with a small commercial system (capital cost of \$43,500) can produce 14 kg/week of tilapia, and 120 kg/week of lettuce, providing an annual projected profit of \$33,000. While that may not seem profitable enough to be the sole system of a farm, Dr. Ako noted the minimal amount of time required to manage such a system, affording the farmer time to manage other systems.

"Meetings like this are a great opportunity for farmers throughout the islands to meet and share information, and receive new information from researchers," stated farmer Glenn Martinez of Olomana Gardens. "Thanks to the generosity of the University of Hawaii, who was able to bring in three international speakers -- a top fish breeder from Israel, a top commercial aquaponics farmer from Australia, and the number one aquaponics guru of over 30 years -- this year's HAAA meeting was a great success."

For more information on HAAA, or to join, please visit the [association's website](#).

## New CTSA Website Needs Your Input

At CTSA, it is our desire to incorporate industry needs into the ongoing development of the Center. We are currently in the process of updating our website, and would like to hear from you on ways that we can improve it. Here are a couple of questions to ponder:

- How can we enhance our website to better serve your (industry) needs?
- What information would you like to see more of?
- What are some frequently asked questions you receive about aquaculture that we should be sure to include in our new FAQ section?

Please email your thoughts on these questions and any other suggestions to [mbrooks@oceanicinstitute.org](mailto:mbrooks@oceanicinstitute.org). We look forward to your input. Mahalo!

## USDA Approves CTSA FY09 Plan of Work, Projects Begin

The USDA has recently approved the CTSA FY2009 Plan of Work. Under this plan, six new projects will be funded, and year two funding for two continuing projects will be released. The new projects are as follows:

### **Aquaculture of Opihi, Years 1 and 2**

Led by Dr. Warren Dominy of the Oceanic Institute, the overall goal of this two-year project is to continue the expansion and diversification of aquaculture in Hawaii through the introduction of opihi culture. Due to overfishing, wild opihi stocks have been severely depleted and supply can no longer meet demand; the captive culture of the opihi is imperative to its sustainability as a high-value product.

### **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**

This project is a continuation of three very successful years of CTSA funding granted to the College of Micronesia to develop a local black pearl industry. This two-year project, led by Dr. Masahiro Ito, will continue to enhance production of half-pearls (hemispherical pearls) as a value-added product in Micronesia. A main focus of the project is the transfer of production techniques between Micronesians to ensure a sustainable local industry.

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

Dr. Jinzeng Yang, University of Hawaii, will lead this project with the primary objective of developing fast-growing tilapia by using existing strains and hybrids in Hawaii. This will be 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.

### **Collection and Health Certification of Coralgroupers Broodstock in the Mariana Islands**

The overall goal of this project, led by Dr. Hui Gong of the University of Guam, is to begin the process of establishing a domesticated, high health population of two species of Coralgroupers in Guam and the Commonwealth of the Northern Mariana Islands.

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

The primary objective of this project is to refine a small scale (50 m), modular tilapia and lettuce co-culture aquaponics system developed under the auspices of CTSA funding last year, and distribute it to interested parties in Hawaii and the Pacific Islands. Dr. Kent Kobayashi and his team will test other species for aquaponics culture, and will establish a commercial system on an American Insular Pacific Island.

### **Pacific Regional Aquaculture Information Service for Education (PRAISE) and Publications, Year 5**

This project is a continuation of services provided by both CTSA and the University of Hawaii for two decades. The overall goal of this project is to promote the transfer of information within the Pacific

aquaculture community, including the acquisition and dissemination of marine science information and data about the Pacific region, especially as it regards aquaculture, and to help develop instructional materials to be used in university level aquaculture education programs.

Each project has already begun or will begin within the next five months. If you have any questions about these or any other CTSA funded projects, please do not hesitate to let us know!

## Pacific Island Spotlight: Successful Rearing of Monkey River Prawn

*Author: Natalia Real. Source: [www.fis.com](http://www.fis.com). Thursday August 12, 2010*

The USP Seawater Laboratory has successfully reared the Monkey River prawn or *Macrobrachium* lar (M.lar) indigenous to Fiji and numerous Pacific Islands. The laboratory's achievement represents a landmark in aquaculture.

An article recently published in the SPC newsletter informed that the M lar has been researched since the 1970s in Hawaii to assess the species' potential for farming.

Researchers hoped to rear this prawn breed similarly to its cousin, the Malaysian giant freshwater prawn (*Macrobrachium rosenbergii*) responsible for an annual production value of some USD 1 billion in Asia alone.



Photo Courtesy of USP

The rearing from eggs through to the planktonic larval phase of the life cycle to the post larval stage of the prawns was co-supervised by SPC's Aquaculture Section.

Known locally as *ura dina*, the species possesses several positive characteristics for aquaculture, including its size, prevalent recognition among local communities as a delicacy and its robustness, which allows it to survive out of water for short periods.

Also importantly, it is indigenous to many Pacific Islands where interest exists in developing freshwater prawn farms.

[To read the full article, click here.](#)

## August AquaClips - Tuna Meltdown; is there an alternative?

*by Paul Greenberg, The Observer, August 1 2010*

Numbers of bluefin tuna are so low that the species is heading for extinction. But there is hope for this magnificent red-fleshed, warm-blooded fish. Salvation may come in the form of Kona Kampachi, which is abundant and has the sushi bite of bluefin. Isn't it time we changed the menu and got tuna off the hook?

...It was in answer to these questions that I set out trying to discover a truly thick-fleshed farmed fish that could fulfil the steaky category most seafood diners now expect to see on a menu. A fish that had the "bite" of tuna but might have a footprint more akin to that of a barramundi or a sea bream.

And so I found myself in a dive boat three miles off the coast of the Big Island of Hawaii, motoring across the cerulean blue of the South Pacific with a tall, highly optimistic Australian named Neil Sims. Eventually we neared the site of Sims's farm - a huge underwater ziggurat that is the centre of his company Kona Blue....

[To read the full article, click here.](#)

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.