



Letter from the Director

Aloha,

I would like to take this opportunity to update you on the status of CTSA's FY12 plan of work development. In July, our Industry Advisory Council (IAC) and Technical Committee (TC) convened in their annual joint meeting to discuss the 25 Pre-Proposals CTSA received as part of our Call for Pre-Proposals. After careful consideration, the IAC selected seven Pre-Proposals to move to the next phase, and full proposals for those projects will be received early next month.

As with every year, the process of our annual plan development was competitive. CTSA's funding selections are dictated by the IAC, and it has been our experience that the proposals that are most often successful are those that will have the most immediate impact to regional and local aquaculture operations. We were happy to see the many innovative research suggestions in this year's Pre-Proposals, and we urge those researchers who were unsuccessful to try again next year.

In this month's issue, we present an update on the CTSA-sponsored Opihi project, which is aiming to introduce this valuable species into aquaculture. We also bid alohas to outgoing CTSA Board member Dr. Sylvia Yuen and incoming member Dr. Maria Gallo, CTAHR's newly-appointed dean.

Mahalo,

Cheng-Sheng Lee
Executive Director, CTSA

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Development of Aquaculture Technology for Opihi

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Developing aquaculture technology is essential for managing fisheries and sustaining aquaculture for opihi in the future. Opihi have been eaten as a delicacy in Hawai'i for centuries. According to lacchei, the major annual commercial catch decreased significantly from 68,000 kg in the 1900s to about 4,500 kg in 1978. The scarcity has driven prices up and it is reported (by NOAA and DAR) as being the fifth most expensive seafood harvested in Hawaiian waters, at \$6.80 per pound wholesale. To overcome these problems, the aim of this study was to develop aquaculture for giant Hawaiian opihi *Cellana talcosa* and later for yellow foot, *Cellana sandwicensis*. It was also included due to the danger of collecting the giant opihi in



Three common species of opihi

deep water where they exist, as many people have been swept away and drown while collecting opihi. For this reason, opihi have been called the "fish of death".

In our first year of study we have turned opihi aquaculture from an unknown to a standard aquaculture research object. We began our study with collection of animals from the wild. We first encountered high mortality (58%) within few days (3-4 days) after collecting. We presumed the mortalities occurred due to injury while prying opihi off the rocks. We tried to detach them quickly before they became alarmed and would cling more tightly into the rocks. We obtained 82% survivors by the fourth collection.

An additional high mortality of 53% occurred while transferring animals from one holding tank to another because the animals attached tightly to the wall of the tank and were hard to get off. We auditioned several tank liners. The one we settled on was sold as a dropcloth for painting (Fig 1). Later soft plastic colanders were used (Fig. 2). Both tanks overlaid with plastic liner or colanders reduced this mortality to zero in subsequent experiments because animals could be easily removed from the wall of the tank by gently deforming the plastic. They would fall off and could be picked up by hand.

We then focused on trying to deduce the preferred feed of opihi by investigated the natural food by stomach content analysis. Stomach contents contained benthic diatoms (about 30% of the materials seen), bacterial clumps and other un-identifiable particles. Twenty diatom species were seen and the most frequently seen were Bacillaria sp, Fragilaria sp, Melosira sp, Navicula, sp and Rabdonema sp. We subsequently were able to culture these algae and would hold the animals for a while feeding on the biofilm. Opihi fed at 0.47% dry matter/bodyweight/day on cultured diatoms.

We began our studies on artificial feeds with sea urchin feeds. We were not able to get the opihi eat enough to keep themselves alive. We tried other diets containing fish meal and soy bean meal. Fishmeal and soy meal tended to be preferred and betaine did not serve as a feeding stimulant (Fig. 3). Gamma aminobutyric acid (GABA), and dimethyl propiothetin (DMPT) and Spirulina did not enhance feeding either. Biofilm incorporation into the feed stimulated feeding.



Figure 1. Opihi on a plastic sheet covering the aquarium. It is noted that cultured biofilm grows on the plastic and opihi feed on this biofilm.



Figure 2. Feeding trial tanks with opihi on colanders

High fishmeal did not simulate feeding, and biofilm was required for good feeding (Fig. 4). The diet no-biofilm control was not eaten well. Porphyra purchased conventionally as "Nori" was a suitable for biofilm replacement. Other incorporated algae in the diets did not produce much added feeding.

The initial trials were followed by testing feeds preferred by abalone with our own modifications. Growth performance and feed consumption of ophi were tested with five different diets included soy/fish/corn gluten, alternating diet of soy/fish/corn gluten and a cultured biofilm, fish/soy/krill, fishmeal only, and biofilm. The fish meal and biofilm diets served as controls. The results revealed that there was a significant difference in weight gain among the diets after 10 weeks. The highest achieved weight gains of 28% and 33% BW in 10 weeks when ophi fed on the fish/soy/krill, alternating diets respectively and were different significantly ($p < 0.05$) higher than that ophi fed with other diets. Feed consumption was proportional to the growth rates of animals in most diets supporting the palatability hypothesis, except for that ophi fed with biofilm diet had surprisingly poor growth and high feed consumption. The highest feed consumption among the formulated diets was at 0.73% dry matter/body weight/day for fish/soy/krill diet and the alternating diet was eaten surprisingly poor (0.26%). This suggested that the live algae contain a growth factor. Thus, the two best diets of fish/soy/krill and alternating could be a potential formulated diet for aquaculture of ophi.

In summary, this study was the first to develop handling techniques and an artificial feed for the potential aquaculture of ophi. We hope they will spawn and allow us to do larval rearing trails.

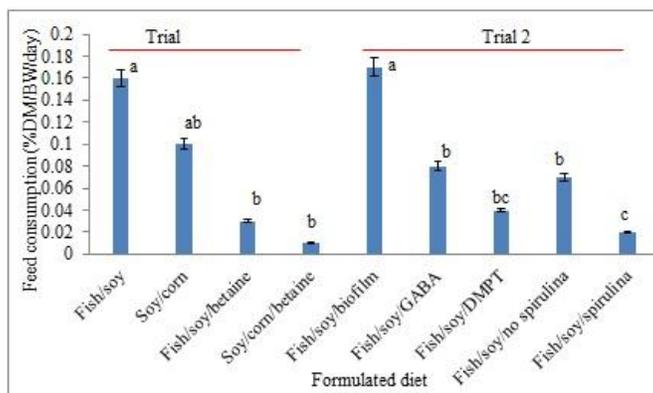


Figure 3. Feed consumption in different diets of various trials by ophi; ^{a,b,c}different superscript letters indicate significant difference ($p < 0.05$) within the same trial.

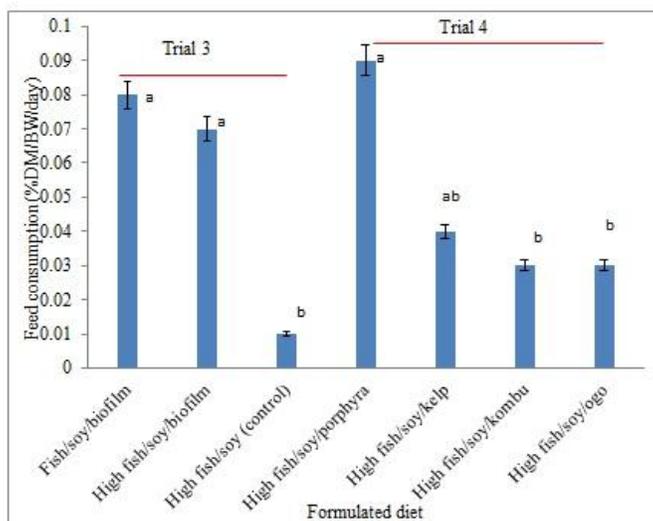


Figure 4. Feed consumption of additional algae diets; ^{a,b}different superscript letters are significant differently ($p < 0.05$).

CTAHR Appoints New Dean, CTSA Board Member



Dr. Maria Gallo, CTAHR Dean

The University of Hawaii at Manoa's College of Tropical Agriculture and Human Resources (CTAHR) has appointed Dr. Maria Gallo, a sugarcane biotechnology expert from Florida, as its new dean effective July 16. Dr. Gallo replaced CTAHR's interim dean and outgoing CTSA Board of Director member Dr. Sylvia Yuen. Dr. Yuen is now serving on President M.R.C. Greenwood leadership team as a Special Assistant, where her focus will include food security and safety, among other issues.

In an email to the UH newspaper Ka Leo, Dr. Gallo made the following statement: "I am excited about being the new Dean of CTAHR and having the opportunity to work with such skilled and dedicated faculty and staff. Agriculture in Hawai'i is critical to the health of our citizens, communities, industries and environment. One of my goals will be to continue to strengthen the college's public and private partnerships in Hawai'i, as well as nationally and internationally to tackle our challenges in developing sustainable food systems that provide safe and nutritious food. This will require discovery of new knowledge through both applied and basic scientific research and delivering that knowledge to our students, industries and producers, and the general public. CTAHR's mission has never been more relevant or needed than it is today." Dr. Gallo was previously a professor and chair of the agronomy department at the University of Florida in Gainesville.

The CTAHR dean has historically held a seat on the CTSA Board of Directors, and we look forward to welcoming Dr. Gallo at our next Board meeting in January 2013.

CTSA would like to take this opportunity to thank Dr. Yuen for her service to CTAHR and the CTSA Board of Directors. She was instrumental in our development process during her time on the Board, and was especially helpful in the planning and execution of CTSA's first-ever region wide stakeholder priorities survey earlier this year. We wish her the best in her future endeavors.

The following are links to additional articles about Dr. Gallo's appointment:

[Ka Leo - The Voice](#)
[University of Hawaii News Website](#)

NOAA/USDA Draft National Aquaculture R&D Strategic Plan Available for Public Comment Until August 27!

NOAA and USDA are announcing that a draft 'National Aquaculture Research and Development Strategic Plan' for the United States is available for public review and comment. This plan will provide a framework for federal agencies to develop programs for research and development that affect the production of aquatic organisms such as finfish, crustaceans, mollusks, and algae.

[Click here to view the draft National Aquaculture Research and Development Strategic Plan.](#)

[Click here for more information and/or to submit a comment.](#)

Announcements & Reminders

SRAC Releases Eight New Aquaculture-Related Fact Sheets

Please find below eight new aquaculture-related Fact Sheets available through the Southern Regional Aquaculture Center (<https://srac.tamu.edu/index.cfm/event/viewAllSheets>)

- [SRAC 0190: Production of Hybrid Catfish](#) by Rex Dunham, Auburn University and Michael Masser, Texas A&M University
- [SRAC 0240: Crawfish Production: Pond Construction and Water Requirements](#) by W. Ray McClain, Louisiana State University Agricultural Center
- [SRAC 4400: Introduction to Financial Management of Aquaculture Businesses](#) by Carole R

- Engle, University of Arkansas at Pine Bluff
- [SRAC 4401: Assessing the Financial Position of an Aquaculture Business: Using Balance Sheets](#) by Carole R. Engle, University of Arkansas at Pine Bluff
 - [SRAC 4402: Determining the Profitability of an Aquaculture Business: Using Income Statements and Enterprise Budgets](#) by Carole R. Engle, University of Arkansas at Pine Bluff
 - [SRAC 4403: Evaluating the Liquidity/Cash Position of an Aquaculture Business: Using Cash Flow Statements](#) by Carole R. Engle, University of Arkansas at Pine Bluff
 - [SRAC 4710: Herpesviruses in Fish](#) by Andy Goodwin, University of Arkansas at Pine Bluff
 - [SRAC 5005: Aquaculture and the Lacey Act](#) by Elizabeth R. Rumley, National Agricultural Law Center

Aquaculture Drug Update: Authorization Granted for the Immediate Release of Fish Sedated with AQUI-S®20E under INAD 11-741

Based on a recent request, the U.S. Food and Drug Administration (FDA) has granted amended authorization for the use of AQUI-S®20E, a sedative drug, to allow for the immediate release of freshwater finfish sedated as part of field-based fisheries management activities. The amended authorization comes under the U.S. Fish and Wildlife Service's Aquatic Animal Drug Approval Partnership (USFWS-AADAP) Investigational New Animal Drug (INAD) 11-741. Prior to the amended INAD authorization, all freshwater fish sedated with AQUI-S®20E were required to be held for 72 hours—a withdrawal period impractical for field use. The immediate-release provision is for field-use only; the withdrawal period remains at 72 hours for hatchery use.

[Click here to read the full announcement.](#)

Proposed 2013 Census of Aquaculture

Memo from the USDA - National Agricultural Statistics Service

The United States Department of Agriculture's (USDA) National Agricultural Statistics Service (NASS) is currently preparing for the 2012 Census of Agriculture. As part of its Census of Agriculture Program, NASS routinely conducts Special Studies to gather more detailed information on specific agricultural production. These studies, known as Census Follow-ons, are conducted in the years following the Census of Agriculture and include a sub-group of respondents that meet the criteria for the Special Study.

NASS is keenly aware of industry and data user needs for sound statistical data to make informed policy decisions. As a result of the previous Census of Aquaculture being suspended due to budget constraints, NASS has made this Census Follow-on a priority. In fiscal year 2014, NASS intends to conduct the 2013 Census of Aquaculture. However, the execution of the 2013 Census of Aquaculture is subject to sufficient budget appropriations.

About the Census of Aquaculture

The target population for the 2013 Census of Aquaculture is any commercial or non-commercial place from which \$1,000 or more of aquaculture products were produced and either sold or distributed during the census year. Commercial operations will qualify with sales greater than or equal to \$1,000. Non-commercial operations will include operations that produce an estimated value of \$1,000 or more of aquaculture products, but released or distributed their production for purposes of restoration, conservation, or recreation. Examples of non-commercial operations include: Federal, State, and Tribal hatcheries.

Tentative Schedule for the 2013 Census of Aquaculture

Activity	Date
Initial Mail Out	December 2013
2nd Mail Out (exclude Catfish States)	January 2014
Phone & Field Follow-Up (Catfish States)	January 2014
Catfish Production Release	January 31, 2014
Phone & Field Follow-Up (Non-Catfish States)	February - March 2014
Trout Production Release	February 28, 2014
Publication Released	TRD

AquaClip: New study helps predict impact of ocean acidification on shellfish

From www.esciencenews.com. August 6, 2012.

An international study to understand and predict the likely impact of ocean acidification on shellfish and other marine organisms living in seas from the tropics to the poles is published this week (date) in the journal *Global Change Biology*. Ocean acidification is occurring because some of the increased carbon dioxide humans are adding to the atmosphere dissolves in the ocean and reacts with water to produce an acid.

The results suggest that increased acidity is affecting the size and weight of shells and skeletons, and the trend is widespread across marine species. These animals are an important food source for marine predators such as tropical seabirds and seals as well as being a valuable ingredient in human food production. Consequently, these changes are likely to affect humans and the ocean's large animals.

UK scientists from the British Antarctic Survey (BAS) and the National Oceanography Centre (NOC), together with colleagues from Australia's James Cook and Melbourne Universities and the National University of Singapore, investigated the natural variation in shell thickness and skeletal size in four types of marine creatures living in 12 different environments from the tropics to the Polar Regions. Their aim was to get a clearer understanding of similarities and differences between species, and to make better predictions of how these animals might respond to increasing acidity in the oceans.

The effort required by clams, sea snails and other shellfish to extract calcium carbonate from seawater to build their shells and skeletons varies from place to place in the world's oceans. A number of factors, including temperature and pressure, affect the availability of calcium carbonate for species that produce carbonate skeletons.

There is already evidence that ocean acidification is affecting the ability of some marine species to grow, especially during their early life stages, and there is mounting concern about whether or not these species can evolve or adapt to cope with increases in acidity in the coming decades.

This study shows, over evolutionary time, animals have adapted to living in environments where calcium carbonate is relatively difficult to obtain by forming lighter skeletons. Carbon dioxide from fossil fuel combustion is altering seawater chemistry in the same way, in a process called ocean acidification and this is making it harder for marine animals to make shells and skeletons.

[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 2007-38500-18471, 2008-38500-19435, and 2010-38500-20948. 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.