

REGIONAL NOTES

CENTER FOR TROPICAL AND SUBTROPICAL AQUACULTURE

Evaluating Sturgeon Sex at Big Island Workshop

Determining if a person is a he or she may require some skill, but not a class. This is not the case with sturgeon. On March 10 and 11, Kevin Hopkins of the University of Hawaii at Hilo and Howard Takata, a retired state extension agent, organized the "Sturgeon Reproduction and Rearing Workshop" to teach participants basic techniques in handling and assessing sex and stage of maturity of Russian sturgeon broodstock. This was successfully accomplished with the added expertise of instructor Frank Chapman from the University of Florida, Gainesville.

The workshop was held at two locations and attended by 23 participants including educators, researchers, students, farmers, and extension agents. The hands-on portion of the workshop was held at Ho'owaiwai Farms and Garden just north of Hilo. The classroom portion which focused on general sturgeon culture was completed at the Pacific Aquaculture and Coastal Resources Center (PACRC) at UH Hilo. Participants worked on 26 Russian sturgeon (*Acipenser gueldenstaedti*) which were being held in a 1-acre pond at the farm site in water temperatures of approximately 20-21°C. These particular sturgeon were first imported into Hawaii in May 1995 and are owned by the Hawaiian Sturgeon and Caviar Co. Sturgeon from this initial batch were distributed among several sites. This species was chosen because it was available and is also one of the more warm water tolerant of the different sturgeon species.

Externally, sturgeon males are indistinguishable from sturgeon females. The only way to tell one from the other is by cutting the

fish open and extracting a sample of the gonad tissue or eggs - whatever happens to be present. This is not always as straightforward as it sounds, particularly in young or under-developed fish. The stage of females is based



Seining the pond



Weighing the sturgeon

on the size and color of their eggs. It is important to note that reproducible eggs are not the same texture as caviar eggs which come from earlier stage females.

At the workshop, everyone had the opportunity to handle the sturgeon and practice each step after Chapman first demonstrated the entire procedure. Chapman truly is an expert and has performed over 50,000 of these surgeries. Participant Brent Burkott, owner of Hawaii Farm Fresh Seafood on Oahu said, "the hands-on experience and having an expert right there to ask a thousand questions was great."

Participant Lisa King of the PACRC described the process as surprisingly quick with little struggle from the fish. First, the whole pond was seined and each fish had to be herded into a stretcher. A small crane was used to lift and weigh each fish. King said that two coffin-like tanks served as work stations. The fish were anesthetized, measured, tagged and fin clipped in one tank and then moved to a second tank for the surgery. The incision was roughly 1½ inches and the fish averaged 4 feet in length. The fish recovered in a corral before being released back into the pond.

The workshop is part of Hopkin's research project *Improving Sturgeon Hatchery Efficiency in Hawaii* which is funded by CTSA and a USDA IFAFS program project. The information gathered during the workshop clearly showed that Russian sturgeon do mature in Hawaii conditions. It also showed that these particular fish are maturing in two different periods, with one group being several months ahead of the second group.



Dr. Chapman identifies the sex of the sturgeon

Photos courtesy of Lisa

FAST FACT

The value of Hawaii grown aquaculture totaled \$22.2 million in 2001, unchanged from 2000.

--Hawaii Agricultural Statistics Service

On March 26, American Samoa's Governor Tauese Pita Fiti Sunia passed away.

CTSA would like to extend our sincere condolences to the people of American Samoa and the entire Sunia Family.

REGIONAL NOTES

REGIONAL NOTES is published four times per year by the Center for Tropical and Subtropical Aquaculture under a grant from the U.S. Department of Agriculture Cooperative State Research, Education, and Extension Service.



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AQUA CLIPS

Oceanic Institute dedicates biosecure marine shrimp breeding facility

The Oceanic Institute press release - Thursday, January 9, 2003

The Oceanic Institute (OI) dedicated the Nucleus Breeding Center for Marine Shrimp, a [\$2 million] biosecure and environmentally responsible research facility [funded by the USDA and U.S. Department of Commerce]. The facility will play an important role for the Institute in the development of Hawaii's shrimp exporting industry and the nation's shrimp farming industry. Working in collaboration with the U.S. Marine Shrimp Farming Consortium, OI developed and continues to produce selectively bred, Specific Pathogen Free (SPF) Pacific white shrimp to promote the expansion of a sustainable shrimp aquaculture industry in the U.S. The SPF shrimp bred at the Institute are certified to be free from nine different, principal viruses that are harmful to shrimp. Dr. Shaun M. Moss, Director of Shrimp Technology for OI, explained that the "biosecure production system [is designed to be] physically isolated from the natural coastal environment. Incoming seawater is disinfected and recirculated through filters. The amount of seawater used is drastically reduced and the environment is protected from the possible effects of system effluent."

Firm sees big future in shrimp

By Sean Hao, Honolulu Advertiser - Thursday, February 6, 2003

Moana Technologies LLC has big plans for the shrimp industry. Until recently, the 'Aiea-based company kept a low profile as it conducted research into breeding larger, healthier shrimp. That's changing with construction starting on five buildings worth \$750,000 on its 11-acre facility at the Natural Energy Laboratory of Hawaii Authority in Kona on the Big Island. Officials for the privately owned company said they are spending \$10 million developing a new [specific pathogen free strain] of Asian black tiger shrimp.

Hawaii's healthier shrimp find growing Asian market

By Terrence Sing, Pacific Business News - Friday, February 14, 2003

Hawaii's shrimp farmers are exporting a healthier shrimp whose redeeming quality is its disease-free status and state-certified clean bill of health. Last year, a handful of farmers here shipped brood stock to Asia worth an estimated \$1 million. Exactly how many shrimp and what price each sold for remain a trade secret – the state doesn't keep up-to-date reports. But Hawaii farmers, researchers and the state hope good science and geographic isolation will make production of the disease-free Pacific white shrimp a sustainable industry. "We basically are experiencing about twice the level of shipment in January and February than we did last year," said John Corbin, manager of the state Department of Agriculture's Aquaculture Development Program. "That says the demand for shrimp is really at a peak right now." In Asia – where shrimp is a multibillion-dollar-a-year industry that has been ravaged by disease – Hawaii-reared disease-free Pacific white shrimp are in high demand, Corbin said. Corbin estimates the number of shrimp farmers statewide at six or seven, a figure supported by Ron Weidenbach, president of the Hawaii Aquaculture Association.

Canadian company plans Big Isle butterfish farm

By Craig Gima, Honolulu Star Bulletin - Sunday, February 23, 2003

In a little more than two years, a favorite island delicacy – miso butterfish – may be available from fresh coldwater black cod raised on an aquaculture farm in the lava fields near Kona. A Canadian company [Unlimited Aquaculture Corp.] has received approvals to raise black cod, also known as butterfish or sablefish, at the Natural Energy Laboratory of Hawaii's ocean science and technology park off Keahole Point. If the rest of its financing falls into place, it could begin operations by early summer. Black cod thrive in waters near Alaska and in the North Atlantic where temperatures are near freezing. But sunny Kona has deep, cold ocean water pumped up from 2,000 feet below the surface into the NELHA technology park. The water's constant 43-degree temperature and relative purity from contamination make it ideal for cold-water aquaculture, said Don MacQuarrie, who with partner Ian Shand is putting the sablefish research venture together.

IAC lays foundation for CTSA Year 17

The CTSA Industry Advisory Council (IAC) met on March 17th and 18th to prioritize industry problems as identified from 37 concepts that were submitted in response to the Call for Concepts. CTSA will soon be sending out a Call for Pre-proposals to address the top priority areas. Those selected to become full proposals will make up CTSA's Year 17 Plan of Work. CTSA is only able to keep ten to twelve proposals open each year. It was a difficult task to choose between all of the concepts.

This year, the IAC used a 3-step process to select the priority areas. First, the members decided which ongoing projects should continue. Next, they shortened the list of new concepts by combining similar concepts and removing those that the majority agreed to. Lastly, each IAC member chose their top 5 new concepts, and the 6 concepts with the most votes became the priority areas for Year 17. Names of submitters and all other names were removed from the concepts to prevent bias.

The IAC used the following lists as suggested guidelines to review the concepts. 🐞

A good concept:

- addresses a problem that existing operations/ industries have.
- will benefit an existing industry that is very significant to the region.
- cannot be funded by other agencies.
- addresses an area with no available information in published literature.
- is endorsed by a society or association.
- will benefit the whole region.
- addresses a problem that can be solved in one to three years' time frame.
- will create a new industry if more information is available.
- will deliver important back end benefits and be cost-effective.

Letter from the director



During the past year, I continued to devote my time to ensuring that CTSA's mission of promoting sustainable and profitable aquaculture be a c c o m p l i s h e d throughout our region, particularly in the Pacific Islands. After consulting with stakeholders in the region and with the Board of Directors, we determined that CTSA should focus on the development of a regional black-lip pearl oyster industry. The College of the Marshall Islands, with the support from one of our grants, hired black pearl specialist Mr. Rand Dybdahl who will be responsible for producing spat for the industry and stabilizing the supply within two years. With the help and cooperation of other agencies and private industries, CTSA

anticipates that this will become another profitable industry like the giant clam farms in Majuro.

As for this year, the Board of Directors and CTSA staff will be closely examining three issues. We plan to develop a conflict of interest policy to remove any perception, real or imagined, that there are conflicts of interest throughout the process. Next, we will work on the priority development stage to further ensure that the IAC selects priorities that represent industry needs throughout the region. We will standardize the list of criteria for reviewing concepts to make it more objective. Lastly, we will reevaluate the proposal recruitment and review process. The field of researchers who respond to calls for proposals is expanding. This is a good situation to be in, but means the system will have to be refined. CTSA supports the RACs' multi-institutional approach to problems. We will facilitate cooperation between institutions to solve critical problems in industry development. Each project work group should generate one comprehensive proposal. I look forward to making these improvements and ask for your support and recommendations.

Cheng-Sheng Lee

Year 17 priority areas

Ongoing:

1. Sturgeon Culture – Year 3
2. Evaluation of Tilapia Species and Varieties for Establishment of a Tilapia Hatchery in Guam – Year 2
3. Aquaculture of Hawaiian Marine Invertebrates for the Marine Ornamental Trade – Year 3
4. Marine Ornamentals Culture – Year 2
5. Disease Management in Hawaiian Aquaculture – Year 11
6. Training and Extension Support for Black Pearl Oyster Culture in the U.S. Affiliated Pacific Islands

New:

7. Developing a Gene Marker for the Lyretail Trait in Swordtails
8. By-Product Development from Shrimp Waste
9. Effect of Biomass Loading on Water Quality
10. Transport Technologies for Greater Amberjack
11. Optimal Harvesting Strategies for Farmed Fish and Shrimp in Hawaii
12. Intensive Micro-Algae Production Using a Low-Cost, Plate Photo-Bioreactor System

A questionable concept is one that:

- should be funded by other agencies.
- addresses a site specific problem or a problem that applies to an individual farm only.
- addresses an unsolvable problem or problem that cannot be solved within three years.
- has already been done.

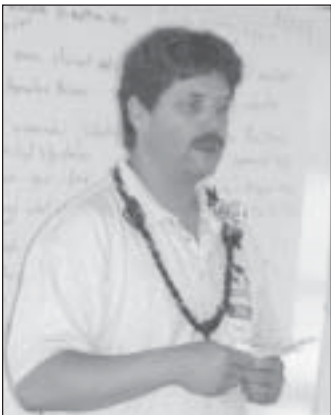
AQUA TIPS

Talk to the Experts about Marketing of Freshwater Ornamental Fishes

Clyde S. Tamaru, John Corbin and Kathleen McGovern-Hopkins

University of Hawaii, Sea Grant Extension Service and
Hawaii State Department of Agriculture Aquaculture Development Program

This article was written as part of the work for the project, "Transitioning Hawaii's Freshwater Ornamental Industry, Year 2" which was funded in part by the Center for Tropical and Subtropical Aquaculture under a grant from the U.S. Department of Agriculture Cooperative State Research, Education, and Extension Service



Mark Taylor

Hawaii's ornamental fish producers and hobbyists soaked up valuable information while attending the workshop series, "Aquatic Product Marketing for Coastal Communities and Talk to the Experts about Marketing of Freshwater Ornamental Fishes." The workshop series was sponsored by two projects: 1) the Center for Tropical and Subtropical Aquaculture (CTSA) supported project, "Transitioning Hawaii's Freshwater

Ornamental Fish Industry - Year 2" and 2) the USDA supported project, "Initiative for Future Agriculture and Food Systems."

The workshops were held at the University of Hawaii at Manoa and at Windward Community College from September 12-14, 2002. CTSA, the University of Hawaii Sea Grant Extension Service, the State of Hawaii Aquaculture Development Program, and the Pacific Aquaculture and Coastal Resources Center at the University of Hawaii at Hilo worked together to organize the workshops.

The overall goal of the workshops was to introduce marketing concepts to participants through the interactive process of developing a marketing plan and the practical exercise of examining case studies from the aquatic product industry. Some of the questions discussed were: What is marketing and what does it entail? What are the techniques and methods that one can use to be more competitive? What are the thought and planning processes that enable one to do so?

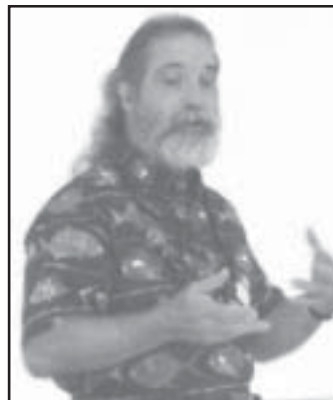
One wholesaler from Hawaii and one from the mainland discussed their respective companies, what their expectations were as potential repeat customers, and what it took to survive as a business in Hawaii. In addition, Dr. C.L. Cheshire of the University of Hawaii Pacific Business Center presented the results of a marketing survey conducted under the auspices of the Pacific

Tropical Ornamental Fish Project. A summary of these speakers' main points forms the basis for this report.

Mark Taylor, general manager from African Northwest Pets and Supply, provided insights on the current status of the ornamental fish market and on his experiences with purchasing freshwater ornamental fishes produced in Hawaii. African Northwest is a wholesale company in Seattle, Washington that has been serving retail pet shops, garden centers, nurseries, zoos, and aquariums since 1981. Taylor characterized the company as being a regional wholesaler of freshwater ornamental fishes and aquarium products. More information about the company can be obtained from its website at www.anw.net/contact.htm.

From his vantage point, Taylor considered the major change in the overall freshwater ornamental fish market to be the inclusion of large stores like Wal-Mart. These chain stores consume approximately 80 species characterized as the "bread and butter" varieties and consume them in very large quantities. Taylor feels that such chain stores are actually good for the industry as they generate interest in the aquarium hobby and increase demand. The independent pet shops follow with more information and specialty items that include fishes, plants, and aquarium products.

Freshwater ornamental fish from Hawaii are being purchased



Ron England

by African Northwest, and the most notable comment was about the excellent quality of the swordtails coming out of Hawaii. This underscored an advantage that Taylor saw for Hawaii producers and that was the limited disease problems he had experienced with Hawaii-grown fishes.

However, there are challenges that Hawaii's growers need to overcome to meet expectations and keep African Northwest as a repeat customer. The main challenges are to provide a wider variety of species, pay careful attention to the consistency in sizes, and

have reasonable expectations of prices. Clearly, if output from Hawaii increases, African Northwest would be interested in buying more product as it becomes available. The company does provide a list of fishes that it is interested in, and one of these has recently been made available to interested producers.

Ron England of Worldwide Aquatics has been operating out of Hawaii as a transshipper of freshwater ornamental fish and plants over the past 25 years. Because he has been conducting business in Hawaii throughout his tenure, his insights were also found to be very helpful to workshop participants. Twenty years

One of the first things that a person needs to do is answer the following questions:

- Do I want to be in the business of growing fish?
- Do I want to be in the business of selling fish?
- Do I want to be in both businesses?

ago, it was a lucrative business to transship freshwater ornamental fishes from Southeast Asia to the U.S. markets. The volume during the boom times averaged 600 boxes per month at a gross annual revenue of approximately \$750,000 per year. Changes in the global economy brought about dramatic changes in the sources of freshwater fishes from Southeast Asia. For example, Singapore was a major producer at one time, but currently it brokers approximately 50% of its fishes from other countries such as Indonesia.

A very large issue that has affected England's operations is airline transportation. The number of flight connections to Hawaii and ultimately to the U.S. mainland has been drastically reduced to the point that England no longer ships fish out of Hawaii. Both England and Taylor commented on how wholesalers and transshippers are totally dependent on the airlines, and that has been and will remain one of the more challenging issues that face the industry. Although there is a perception that FedEx might be one means of alleviating that constraint, both England and Taylor warned that it is not a cure-all. The change in flight connections has forced England to change his inventory, and he now deals mainly with aquatic plants and marine ornamentals.

Dr. C.L. Cheshire began by providing some very important points to consider for people who are interested in getting into the freshwater ornamental fish industry. One of the first things that a person needs to do is answer the following questions:

- Do I want to be in the business of growing fish?
- Do I want to be in the business of selling fish?
- Do I want to be in both businesses?

He emphasized that you need to know your own strengths, weaknesses, likes, and dislikes as these will ultimately determine for which activity you will be best. Every business has three tasks (i.e., production, marketing and financing) that need to be done all of the time. It is very rare to find a person who likes to do all three things, and it is in one's best interest to decide early on which of the tasks one likes to do and is best at doing. This point was echoed by the other two speakers.

Comparisons of what is involved if a farmer sells directly to a retailer versus selling directly to a wholesaler were provided to shed some light on the amount of work and associated costs that are involved in the marketing of a product. This was particularly evident in a break down of the price structure for a fish that is grown in Hawaii and being marketed through a consolidator/wholesaler, Table 1, and ultimately being bought at a retail outlet in Colorado Springs. In addition, the change in the retail price when adding 1 and 2 cents to the farm gate price is also provided to illustrate how a small change in price will amplify the ultimate retail price. This underscores the comment made by Taylor about

having reasonable expectations of the prices that wholesalers offer as the producer often does not realize the associated costs that are involved with taking their product to being sold.



C.L. Cheshire

Dr. Cheshire provided summaries of a marketing survey conducted under the auspices of the Pacific Tropical Ornamental Fish Project in collaboration with Hawaiian Marine Enterprises and funded by the National Sea Grant Program. A total of 221 stores in seven western states were polled with regard to market penetration and acceptance of Hawaii's freshwater ornamental fishes.

Of the stores that were surveyed, 26% have bought fish from Hawaii with 60% of these stores in California and 33% in Oregon and Colorado. Hawaii's fish were rated as "good" by 50% of the stores, "average" by 19% and 33% did not respond to the question.

It would appear that Hawaii's freshwater ornamental producers have begun to make some market penetration that can definitely be built upon. A sound growth strategy if one decides to produce for a consolidator would be for Hawaii's growers to insure a higher quality product. An increase in variety and volume will ultimately equate to more sales, revenue and net profit (i.e., expansion of the industry). The major take home message for Hawaii's players is to understand where in the freshwater ornamental fish business they should be. 🗣️

Table 1. Changes in prices of an ornamental fish from the farm to the consumer (Cheshire, 2002)

STEPS	Price (\$)	Price + \$0.01	Price + \$0.02
Farmer	0.11	0.12	0.13
Interisland Freight	0.12	0.13	0.14
Broker/Consolidator	0.17	0.19	0.20
Domestic Freight	0.19	0.21	0.22
Trans-shipper	0.39	0.44	0.45
Freight to Denver	0.43	0.48	0.51
Denver to Wholesaler	0.88	1.00	1.05
Freight to Store in Co. Springs	0.97	1.10	1.15
Retail Price	\$3.95	\$4.50	\$4.65

First annual CNMI tilapia cook-off



A first ever Tilapia Cook-Off at Saipan's weekly Garapan Street Market generated interest in aquaculture among four new clients, according to Northern Marianas College Aquaculture Specialist Anthony Benavente. On August 8, 2002, tourists and locals alike turned out in dramatically increased numbers to feast on the creatively prepared tilapia dishes. The event successfully showcased a variety of ways to prepare tilapia locally, and more than 200 cookbooks were printed and distributed to the community during the event.



Congratulations to the winners:

- 1st Place: Ricardo Silvestre, Hyatt Hotel
- 2nd Place: Evangeline Bailen, Saipan Nikko Hotel
- 3rd Place: Sugeng Pribadi, Hyatt Hotel



Photos courtesy of Anthony Benavente

UPDATE

Pacific Islands extension position to move to Majuro:

When the annually based contract for extension agent Simon Ellis ended in May 2002, the Board of Directors and various stakeholders reassessed the situation in the Pacific region to determine the most effective home site for the extension project. It was decided to move the position from Pohnpei to Majuro with a greater focus on black pearl culture. The College of the Marshall Islands will take over as the host institution for the project. The position was first offered to Ellis, but he respectfully declined it. Black pearl specialist Rand Dybdahl recently filled the position. CTSA would like to commend Ellis for doing a wonderful job during his five-year tenure and hopes to maintain a collaborative relationship with him in his present role as a private consultant.

Aloha and mahalo to Kai Lee:

In July 2002, CTSA Information Specialist Kai Lee Awaya resigned to pursue another career opportunity. Despite her busy schedule, she graciously continued to do part-time work for the Center over a period of six months. The CTSA director and staff would like to express their heartfelt gratitude to Awaya for her dedication and exemplary service. CTSA also welcomes Debra Sasaki, who joined the Center staff on February 6, 2003.

CTSA publications staff to join CTAHR:

The CTSA Publications Specialist position (formerly known as Information Specialist) is now administered by the University of Hawaii. The specialist is temporarily stationed at the CTSA administrative center located at the Oceanic Institute. The move into the College of Tropical Agriculture and Human Resources (CTAHR) Publications and Information Office will likely take place by this summer. It is anticipated that the new location at CTAHR will offer access to more resources and better technical assistance.

First trip to Micronesia and the Marshall Islands for CSREES/USDA's Dr. Gary Jensen:

CSREES/USDA National Aquaculture Program Leader Gary Jensen and CTSA director Cheng-Sheng Lee visited Pohnpei and Majuro from March 19-26, 2003. It was Jensen's first trip to the islands. On Pohnpei, Jensen was finally able to see, instead of read about, the progress of the black pearl oyster growout demonstration sites at Parem Farm No. 1 and 2. In Majuro, Lee and Jensen met with stakeholders to discuss the black pearl oyster hatchery situation. Representatives from the College of the Marshall Islands, Marshall Island Marine Resource Authority, and Robert Reimers Enterprises discussed the role of the newly-hired extension agent who was also present at the meeting. All parties sought to define and carry out all necessary measures to restore hatchery operations.

Sturgeon cont'd from page 1

Hopkins hopes the results of this ongoing research will give local farmers more options. Sturgeon are prized for their meat and caviar. Although growout to produce a meat product takes at least two years and growout for caviar production takes a minimum of four to six years, it has the potential of being a lucrative business. Hopkins has enlisted eight farms to collect data for this project. Six of these farms will receive standardized systems in which to rear the sturgeon.



Releasing the sturgeon

There is no guarantee that researchers will be able to spawn the fish in time for the first trials. As discovered during the workshop,

some of the female fish will be ready in two to three months, but it is not known if the males will be ready at the same time. There is also a question about the viability of the eggs. Sac fry will probably have to be flown in from the mainland in order to start the experiments at each test site at the same time. The work is still in the early stages and there is a lot to be learned about culturing sturgeon in a tropical climate. Hopkins said that the whole sturgeon culturing movement in Hawaii is an extremely collaborative effort between the private sector, state extension agents, researchers and institutions in Hawaii and Russia, and organizations like CTSA.

If you are interested in attending aquaculture workshops, please visit the Pacific Aquaculture and Coastal Resources Center website at www.uhh.hawaii.edu/~pacrc/aquatech.html or contact Lisa King by telephone at (808) 933-0706 or email at volcanolisa@hotmail.com.

MAY 7, 2003

For more information please contact Dean Toda at:
587-0030
aquacult@aloha.com

Hawaii Aquaculture Conference



UNIVERSITY OF THE VIRGIN ISLANDS

5th annual

Aquaponics and Tilapia Aquaculture Short Course

**June 22-28, 2003
St. Croix, U.S. Virgin Islands**

Participants will be introduced to a variety of system designs that maintain water quality by various solids removal techniques and by hydroponic plant culture (aquaponics), a suspended growth process (greenwater tank culture) or fixed-film nitrification. Fish production instruction will be conducted using both Nile tilapia (*Oreochromis niloticus*) and red tilapia.

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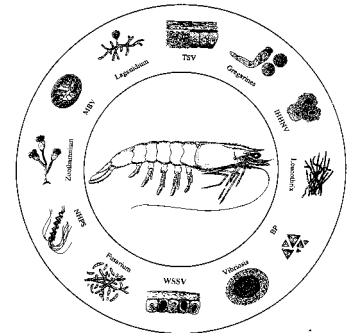
<http://rps.uvi.edu/AES/Aquaculture/UVIShortCourse.html>

Shrimp Pathology Short Course

The University of
ARIZONA

Disease Diagnosis & Control in Marine Shrimp Culture

**June 9-20, 2003
Tucson, Arizona**



The course will consist of comprehensive lectures and practical laboratory training on the current methods used to diagnose, prevent, and treat the principal diseases of cultured penaeid shrimp.

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CENTER FOR TROPICAL AND SUBTROPICAL AQUACULTURE

The Center for Tropical and Subtropical Aquaculture (CTSA) is one of five regional aquaculture centers in the United States established by Congress in 1986 to support research, development, demonstration and extension education to enhance viable and profitable U.S. aquaculture. Funded by an annual grant from the U.S. Department of Agriculture's Cooperative State Research, Education and Extension Service (USDA/CSREES), the centers integrate individual and institutional expertise and resources in support of commercial aquaculture development.

CTSA currently assists aquaculture development in the region that includes Hawaii and the U.S. Affiliated Pacific Islands (American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Republic of Belau [Palau] and the Republic of the Marshall Islands.)

In its fifteen years of operation, CTSA has distributed over \$7

million to fund more than 161 projects addressing a variety of national aquaculture priorities.

Each year, the Center works closely with industry representatives to identify priorities that reflect the needs of the aquaculture industry. After consultation with appropriate technical experts, CTSA responds with a program of directed research with objectives that focus on these industry priorities. A Board of Directors is responsible for overseeing the programmatic functions of CTSA. Results of CTSA projects are disseminated through its print publications, hands-on training workshops, and Web site.

CTSA is jointly administered by The Oceanic Institute and the University of Hawaii and is located at The Oceanic Institute's Makapu'u Point site on the island of Oahu in Hawai'i.

For further information, contact Cheng-Sheng Lee, Ph.D., Director, by phone (808-259-3107), fax (808-259-8395) or email at cslee@oceanicinstitute.org.



*God Bless Our
Troops*

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