

REGIONAL NOTES

CENTER FOR TROPICAL AND SUBTROPICAL AQUACULTURE

Pearl oyster projects produce promising results

Pearl projects at the College of Micronesia (COM) and the College of the Marshall Islands (CMI) are steadily making progress in their endeavors to establish pearl oyster hatcheries, provide training programs, and promote industry development in their respective regions. The vision of a sustainable pearl industry is shared by many agencies and institutions, and each does its part to further industry development. The following reports represent highlights from two projects.

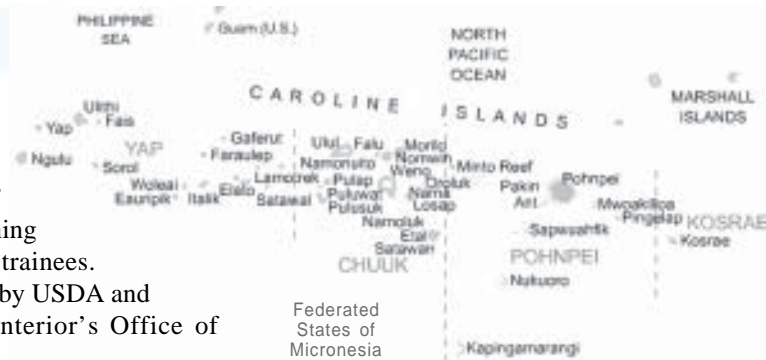
Federated States of Micronesia (FSM)

As the result of the COM Land Grant Program project "Development of Pearl Aquaculture and Expertise in Micronesia," there are now three black-lip pearl oyster demonstration grow-out farms in the FSM. Two farms are on Parem Island, and one is on Pakin Atoll. There are also more than 50 trainees from local communities participating in project activities. The core

staff, made up of "first-generation" trainees, are now training "second-generation" trainees. The project is funded by USDA and the Department of Interior's Office of Insular Affairs.

In the June 2004 *Micronesia Land Grant Update*, COM stated that Phase I of the project has been completed, and Phase II is now underway. Phase I activities included the establishment of a low-tech hatchery, spat production, and on-the-job training for local Micronesians. Phase II began during the fourth quarter of 2003 and is focused on pearl production and business development. Project leader and pearl expert Masahiro Ito conducted the first trial seeding in September 2003 using 2,000 oysters at the Parem farm. The second trial seeding was in July 2004, and the third seeding will be done at Pakin Farm.

Ito said he hopes "to strengthen the regional pearl industry by producing quality products through technological improvement." Therefore, in order to assess pearl formation and quality, Ito test-harvested 120 ten-month-old pearls in July 2004 as part of his federal Hatch research

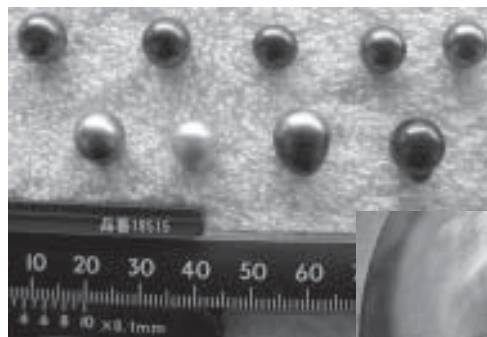


results from the test harvest were promising. The pearl quality ranged from the expected low level to a surprisingly high level considering the short culture period. The real harvest will take place next year after a normal 20–22-month culture period.

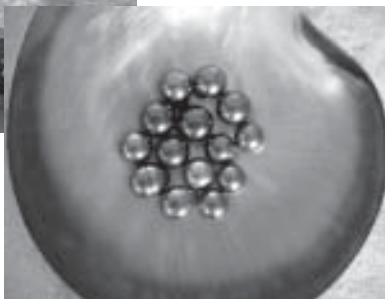
On July 29, 2004, the first Pohnpei Pearl Industry Development meeting convened and brought together national, state, and local government leaders to discuss the potential of this new industry. They were also able to view the ten-month old pearls from the test harvest. The August 2004 *Micronesia Land Grant Update* summarized that "there was a strong consensus that a pearl industry is viable in Pohnpei and the FSM, but all issues relating to the creation of a pearl industry should be well understood in order for the industry to be successful."

Republic of the Marshall Islands (RMI)

Beginning in April 2003, the project "Aquaculture Extension and Training Support for the U.S.-Affiliated Pacific Islands" has focused on stabilizing the black-lip pearl oyster spat supply in the RMI. The project is funded by the Center for Tropical and Subtropical Aquaculture under a grant from the USDA Cooperative



Ten-month-old Micronesian pearls from the July 2004 test harvest.



project titled "Improving Quality of Pearls from the Black-lip Pearl Oyster *Pinctada margaritifera* (Linnaeus) in Pohnpei, the Federated States of Micronesia." The

Letter from the director



CTSA invests much of its efforts determining research priority areas and would also like to concentrate equal attention to its projects' impacts. Discussions at both the Industry Advisory Council (IAC) meeting and the semiannual Board of Directors meeting have prompted CTSA to take a more personal approach to reviewing project progress.

The IAC and the administrative center will work together more closely to monitor project success. In the past few months, I visited with several Principal Investigators (PIs) to specifically focus on step-by-step achievements or difficulties, as well as on the general status of their project. Industry liaisons have also been keeping up to date with their projects' progress and participating in reviewing project final reports. I commend those PIs who are diligent about updating their liaisons. I hope that we will all work together to ensure a more timely accomplishment of project objectives.

Cheng-Sheng Lee



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AQUACLIPS

Guam's agriculture devastated by storm

By Katie Worth, Pacific Daily News, Thursday, July 8, 2004

HAGATNA, Guam—Less than two weeks ago, farmer Victor Duenas had almost 25 acres of watermelons, bananas, cucumbers and long beans on his Inarajan farm, ripening in the warm island air. Now he has none. He is one of dozens of farmers who lost 100 percent of their crops in last week's torrential rains and island-wide floods, a loss that will cost the island's farmers between \$350,000 and \$500,000, according to Guam Department of Agriculture estimates. Agriculture Acting Director Paul Bassler said his department estimates that every farmer on island lost more than 50 percent of their crops to tropical storm Tingting, which brought 16 inches of rain to the island in a single day last week. Many lost everything, he said. "It was a serious blow to the farmers, no question," Bassler said. Fortunately for Duenas, he is enrolled in the U.S. Department of Agriculture's Non-Insured Crop Disaster Assistance Program, also known as NAP. While the program won't compensate farmers for the full cost of their loss, it should provide farmers with enough money to get back on their feet, said Tom Camacho of the USDA's Farm Service Agency. The USDA's assistance program has actually been in existence for many years, said Camacho, and is available to farmers in areas including Guam, where no farm insurance exists because of the frequency of disasters.

\$1 million released for new facilities for HIMB at Coconut Island

UH News, Monday, August 30, 2004

Gov. Linda Lingle recently released \$1 million of a \$2-million capital-improvement project appropriation made by the Hawaii State Legislature in 2002 for the design of a new marine research laboratory building at the University of Hawaii's Hawaii Institute of Marine Biology (HIMB) on Moku O Lo'e, also known as Coconut Island. The release of funds for the building design is the first step in obtaining a new wet-laboratory facility at HIMB. "The University appreciates the support of Gov. Lingle and the Legislature, and their recognition of the important and ground-breaking research activities taking place at the Hawaii Institute of Marine Biology," said UH Acting President David McClain. "New state-of-the-art facilities will allow scientists to not only continue this research but to also begin new studies that will aid Hawaii's marine environment and positively impact the state's economy." Current plans call for a new laboratory and visitor reception area that will include office and wet-laboratory space with navigable water access, its own seawater intake, field-equipment storage, and mooring for small boats. The new complex will also offer an improved gateway to HIMB and a comfortable and welcoming education center for use by Hawaii school students as well as members of the public who seek information on the university's activities on Moku O Lo'e and general marine education.

Sea Grant to provide workshop and training for giant clam and soft coral mariculture in American Samoa

Congressman Eni F. H. Faleomavaega press release, Friday, September 3, 2004

Congressman Faleomavaega today announced that, at his request, the University of Hawaii Sea Grant College Program will conduct a workshop for giant clam and soft coral mariculture in support of the local project titled, "Initiation of a Community-based Marine Ornamental Giant Clam Industry in American Samoa." The workshop engages the second phase of the project to establish grow-out clam farms. Also, the workshop is designed to bring technical expertise and training in giant clam and soft coral mariculture to ensure that resident participants have the skills and information to complete the project.

The workshop and site assessments are scheduled for October 8–18, 2004, and will be under the advisory of the UH Sea Grant Program in conjunction with the local organization Native Resources Developer, Inc.



Bruce Anderson

Anderson selected as Oceanic Institute president

On August 2, 2004, former state health department director Bruce Anderson dived into his new position as the Oceanic Institute's president. After a nationwide search for candidates, the Oceanic Institute Board of Trustees selected Anderson to succeed previous president Thomas E. Farewell, who resigned in March 2004. The Institute's Senior Vice President of Research and Development Gary D. Pruder served as interim president during the transition period.

As the Oceanic Institute's new president, Anderson is intent on making the U.S. aquaculture industry stronger as well as finding ways to support local industry. He said, "A key focus of our mission begins right here at home by helping Hawaii's aquaculture industry grow and thrive. Oceanic Institute wants to work closely with all of Hawaii's aquaculture companies to help them better compete in a highly competitive global aquaculture market." 🌿

Pearl oyster continued from page 1

State Research, Education, and Extension Service.

Principal investigators Rand Dybdahl and Manoj Nair conducted two hatchery runs at CMI's Land Grant pearl oyster hatchery in Arrak. They produced 1.07 million spat during the first run in July 2003, as reported in the September 2003 issue of *Regional Notes*. They produced 260,000 spat during the second run in May 2004 and supplied the two local commercial pearl oyster companies, Robert Reimers Enterprises and Black Pearls of Micronesia, with 125,000 spat each. The rest of the spat are being held at the Arrak campus for research purposes.

Project staff used a newly designed settlement substrate during the second hatchery run. The design was a modified version of the substrate used successfully by Masahiro Ito in Pohnpei for the above-mentioned COM pearl project. The substrate was made of shade cloth attached to a PVC pipe frame, which was constructed to fit inside the spat bag. A settlement slat was also placed inside the bag to catch and resettle any spat that were dislodged from the frames during transport. Spat bags containing the frames and slats were then suspended from longlines at the farm sites for grow-out.

Project staff also had the opportunity to train the first outer-island worker sponsored by the Rongelap Atoll Local Government. The trainee received extension training in both pearl oyster hatchery and farm grow-out husbandry. His training was the result

of several requests made by outer-island communities interested in spat grow-out as a way to lessen dependence on copra as a source of income.

Training funds are being sought for next year's hatchery runs to foster the initial development of spat grow-out units on three other outer atolls. Each spat growing unit would be developed as a family-based or community-based enterprise that would raise spat supplied by the CMI Land Grant pearl oyster hatchery to a size that could be sold to established farms. This enterprise model, if proven successful, could then be replicated on other atolls where conditions are suitable for spat grow-out. The experience gained from raising the spat may also lead to these communities investing in pearl oyster farming in the future.

Outlook

CTSA also supports the new project titled "Addressing Some Critical Bottlenecks to Commercially Viable Hatchery and Nursery Techniques for Black-lip Pearl Oyster Farming in Micronesia and Population Genetics of the Black-lip Pearl Oyster (*Pinctada margaritifera*)."

This University of Hawaii project began in January 2004 and will provide additional contributions to the regional knowledge base.

The high quality of FSM and RMI pearls, evident in earlier 2003 harvests, as reported in the December 2003 issue of *Regional Notes*, points to tantalizing future prospects. CTSA looks forward to the day when black pearls will be a profitable industry in both the FSM and the RMI. 🌿



RMI trainees with one-month-old spat on slat and settlement frame



(From L to R) Tabwi Aine (CMI), Charles Isaiah (trainee), Jude Allen Anjan (Rongelap Atoll Government trainee), Manoj Nair R. (CMI), Virgil Alfred (BPOM), Rand Dybdahl (CMI), and Danny Reimers (RRE)

AQUA TIPS

Testing the efficacy of a long-term/low-dose hydrogen peroxide treatment on commonly observed ectoparasites of commercially raised freshwater fish in Hawaii

Dee Montgomery-Brock
Aquaculture Development Program, Hawaii Department of Agriculture

Ronald P. Weidenbach, Estralita P. Weidenbach, Christopher J. Knickerbocker, and Garrett McNaulty
Hawaii Fish Company

Jeffrey A. Koch
Mokuleia Aquafarm

This article was written as part of the work for the project "Disease Management in Pacific Aquaculture," 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.

Introduction

Ectoparasites have a long history of contributing to declining fish health in aquaculture. Two commonly observed ectoparasites on cultured freshwater fish in Hawaii are *Trichodina* sp. and *Gyrodactylus* sp. Both parasites cause damage to the epithelial cells of their host when they are temporarily attached to the surface of the skin or gills. *Trichodina* sp. causes damage by using its suckers to attach to the fish's skin or gills, and *Gyrodactylus* sp. causes damage with its hooks. The skin and gill tissue damaged by these parasites are then susceptible to opportunistic bacterial and fungal infections (Basson and Van As 1987).

CTSA has previously funded research to test hydrogen peroxide as a treatment for *Trichodina* sp. and *Gyrodactylus* sp. on Chinese catfish (Montgomery et al. 1997). During these preliminary trials, treatment was administered for 30 minutes at a dosage level of 150 ppm hydrogen peroxide. While this treatment regime proved to be effective for reducing levels of *Trichodina* sp. and *Gyrodactylus* sp. on Chinese catfish, fish mortalities were occasionally observed.

In an attempt to eliminate the occasional mortalities associated with this treatment, CTSA funding was requested to test the efficacy of a long-term/low-dose treatment of hydrogen peroxide against *Trichodina* sp. and *Gyrodactylus* sp. on commonly raised food and ornamental freshwater fish. The long-term/low-dose treatment regime is considered by some aquaculturists to be safer for fish populations given that there is less chemical added to the fish's environment (Ronald Weidenbach and Jeff Koch, personal communication, 2002).

CTSA funding was obtained, and trials were established to test the efficacy of hydrogen peroxide administered for a 24-hour period at a concentration of 25 ppm. Higher treatment

concentrations of 50 and 75 ppm were also included in the study because it was unknown what effect, if any, a 25 ppm treatment of hydrogen peroxide would have on *Trichodina* sp. and *Gyrodactylus* sp.

Three species of fish were selected to evaluate this objective: the striped snakehead (*Channa striatus*), the African cichlid (*Sciaenochromis fryeri*), and the Chinese catfish (*Clarius fuscus*). Fish of each species were selectively chosen for these trials based on the fish exhibiting clinical signs of ectoparasite infestation (discolored skin, slow movement, and "flashing" behavior).

Note: Hydrogen peroxide is currently classified as a low regulatory priority (LRP) drug by the U.S. Food and Drug Administration for the treatment of fungus on fish and fish eggs (Schnick et al. 2001).

TABLE 1. Average counts of *Trichodina* sp. on striped snakeheads before and after treating with hydrogen peroxide.

Treatment Group	Pre-treatment Counts (Range)	Post-treatment Counts (Range)
Control	4.4 (2-9)	21.4 (0-59)
25 ppm	0.4 (0-1)	6.8 (0-20)
50 ppm	3.4 (2-3)	5.8 (0-15)
75 ppm	3.6 (1-17)	8.6 (0-18)

(No mortalities were observed in any of the fish.)

Hydrogen peroxide is not approved for treatment of parasitic and bacterial diseases of fish.

Materials and Methods

A total of 20 fish were selected and separated into four groups of five fish for each trial: a control group (no treatment) and three treatment groups (25 ppm, 50 ppm, and 75 ppm hydrogen peroxide).

Mucus scrapings were collected from each selected fish, then placed on a glass slide in a drop of fresh water and examined at a magnification of 40x. For each sample, the entire mucus scraping was examined, and the total number of parasites observed on the slide were counted and recorded. Each fish was then placed into its treatment container. Hydrogen peroxide was added to each treatment container to reach the experimental dosage levels of 25, 50, and 75 ppm hydrogen peroxide. After a 24-hour period, the water in all containers was replaced with clean fresh water. Mucus scrapings were again collected from each fish, post-treatment wet mount exams were conducted, and parasite numbers if any, were again recorded.

The striped snakeheads and African cichlids were held in 60-liter plastic containers filled with 20 liters of fresh water. The Chinese catfish were held in 20-liter plastic buckets filled to a volume of 15 liters. The water temperatures in the containers were ambient and ranged from 25 to 27°C.

The hydrogen peroxide used in these trials was purchased at a local drugstore and characterized with an activity level of 3%. The accuracy of the hydrogen peroxide levels was confirmed with a commercial hydrogen peroxide test kit (Model # 22917-00 HACH Company, Loveland, Colorado).

Results

Striped Snakeheads

The pre-treatment levels of *Trichodina* sp. on the 20 fish examined averaged 3.65 per mucus scraping (Table 1). The post-treatment counts averaged 21.4 in the control group, 6.8 in the 25 ppm group, 5.8 in the 50 ppm group, and 8.6 in the 75 ppm group. There were no post-treatment mortalities observed in any of the snakeheads.

African Cichlids

The pre-treatment levels of *Trichodina* sp. on the 20 fish examined averaged 195.8 per mucus scraping (Table 2). The post-treatment counts averaged 200 in the control group, and 0 in the 25 ppm, 50 ppm, and 75 ppm groups. Mortalities were observed in all treatments: 20% mortality in the 25 ppm group, 60% in the 50 ppm group, and 80% in the 75 ppm group.

Chinese Catfish

The pre-treatment levels of *Gyrodactylus* sp. observed on the Chinese catfish averaged 9.5 per mucus scraping. (Table 3.) The post-treatment counts averaged 6.0 *Gyrodactylus* sp. in the control group, 10.0 in the 25 ppm group, 5.0 in the 50 ppm group, and 0 in

TABLE 2. Average counts of *Trichodina* sp. on African cichlids before and after treating with hydrogen peroxide.

Treatment Group	Pre-treatment Counts (Range)	Post-treatment Counts (Range)	% Mortality
Control	173.0 (100–500)	200.0 (100–300)	0
25 ppm	178.4 (92–500)	0 0	20
50 ppm	258.0 (91–500)	0 0	60
75 ppm	173.6 (83–500)	0 0	80

the 75 ppm group. There were no post-treatment mortalities observed in any of the catfish.

Discussion

Striped Snakeheads

The results from this trial demonstrate that the long-term/low-dose hydrogen peroxide treatment is not effective in treating *Trichodina* sp. on striped snakeheads. The fact that the numbers of *Trichodina* sp. actually increased in all of the groups over the 24-hour treatment period clearly indicates that this treatment regime is not effective for treating this ectoparasite on this species of fish.

African Cichlids

The outcome from this trial demonstrates improved results when compared to the striped snakehead trial. The long-term/low-dose treatment regime of 25 ppm hydrogen peroxide eliminated *Trichodina* sp. from the treated fish. However, this species of fish was not able to tolerate the higher treatment levels of 50 ppm and 75 ppm hydrogen peroxide, as indicated by the elevated levels of mortalities in these treatments.

The higher-than-anticipated mortality in the 25 ppm treated group (20%) could have been due to the fact that this population had an extremely high level of *Trichodina* sp. infestation, resulting in these fish being in a weakened state.

Chinese Catfish

The results from this trial were similar to those observed in the striped snakehead trial. The 25 and 50 ppm dosage levels of hydrogen peroxide did not eliminate the presence of the *Gyrodactylus* sp. However, for this species, the dose of 75 ppm appeared to completely eliminate the *Gyrodactylus* sp. from the skin of the fish.

Conclusion

The results from this study indicate that a long-term/low-dose hydrogen peroxide treatment of 25 ppm can be an effective treatment for ectoparasites on African cichlids and perhaps other similar species of fish. However, ectoparasites on striped snakeheads and Chinese catfish are more difficult, if not impossible, to treat using such a low dose of hydrogen peroxide. This may be

Continued on page 6

Testing continued from page 5

due to the high levels of mucus present on the skin of these air-breathing fish. Both of these species are able to tolerate rather high doses of this chemical for a prolonged period of time without adverse effects. However, the highest treatment level administered during these trials (75 ppm) was not sufficient to be effective in removing *Trichodina* sp. from the striped snakehead.

Acknowledgments

The research reported in this article was supported in part by the Center for Tropical and Subtropical Aquaculture through a grant from the U.S. Department of Agriculture (USDA), Grant No. 2002-38500-12039. This research was also partly funded by the USDA Small Business Innovative Research (SBIR), Grant No. X0336107927-99.

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- Basson, L. and J. G. Van As. 1987. Trichodinid (Ciliophora; Peritricha) gill parasites of freshwater fish in South Africa. *Sys. Parasitol.* 9:143-151.
- Montgomery, D. R., J. A. Brock, and V. T. Sato. 1997. Preliminary trials on the application of hydrogen peroxide for treatments of the ectoparasites *Gyrodactylus* sp. and *Trichodina* sp. on the Chinese catfish, (*Clarius fuscus*). Page 333 in *World Aquaculture '97: Book of Abstracts*. 19-23 February 1997,

TABLE 3. Average counts of *Gyrodactylus* sp. on Chinese catfish before and after treating with hydrogen peroxide.

Treatment Group	Pre-treatment Counts (Range)		Post-treatment Counts (Range)	
Control	12.0	(6-15)	6.0	(1-19)
25 ppm	8.3	(5-29)	10.0	(6-14)
50 ppm	8.4	(2-17)	5.0	(5-5)
75 ppm	9.3	(3-8)	0	0

(No mortalities were observed in any of the fish.)

Seattle, Washington. World Aquaculture Society, Baton Rouge, Louisiana, USA.

- Schnick, R. A., W. H. Gingerich, B. R. Griffin, and D. Erdahl. 2001. Progress of the Federal-State Aquaculture Drug Approval Partnership Project. *American Fisheries Society Fish Health Newsletter* 29:4.



CTSA received approval for its Year 17 Plan of Work on August 12, 2004. The projects approved thus far are

- Aquaculture of Marine Invertebrates for the Marine Ornamental Trade, Year 3
- Aquaculture Extension and Training Support for the U.S.-Affiliated Pacific Islands with a Special Emphasis on Hatchery Propagation of the Black-Lip Pearl Oyster (*Pinctada margaritifera*), Year 15
- Amberjack Fingerling Production, Year 2
- Marine Ornamentals Phase II, Year 2: Mass Culture Techniques for Pygmy Angelfish and Broodstock Management of Hawaiian Wrasses
- Disease Management in Pacific Aquaculture, Year 11
- Optimal Harvesting Strategies for Farmed Fish and Shrimp
- Evaluation and Propagation of Tilapia Strains for a Self-Sufficient Tilapia Industry on Guam, Year 2
- Publications, Information, and Library (PIL)



UPDATE

CTSA's Year 18 proposals in the process of being reviewed

CTSA sent out eight proposals for external review in late July. Reviews are expected to be completed by mid to late September. Selected proposals will make up CTSA's Year 18 Plan of Work.

CTSA's IAC and TC to discuss research priorities

CTSA will be holding a special joint meeting for its Industry Advisory Council and Technical Committee members on October 5 and 6. The main purpose of the meeting will be to select the areas of research CTSA should support in order to meet its mission.

Annual progress reports due November 1

Project principal investigators are required to submit one progress report each year for each active project. The reports are due on November 1 and cover the period from the project's commencement date to one month prior to the report deadline. These reports provide CTSA with information needed to complete its Annual Accomplishment Report, due to USDA/CSREES at the end of each year.

Congratulations to CTSA's newly appointed Industry Advisory Council & Technical Committee:

INDUSTRY ADVISORY COUNCIL

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University of Hawaii at Manoa

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Federal Flash

- **June 30, 2004:** EPA's acting deputy director signed a final rule to establish wastewater controls for concentrated aquatic animal production facilities (known as fish farms). To get a copy of the final rule, go to www.epa.gov/guide/aquaculture or contact the Water Resource Center at (202) 566-1729.
- **August 2, 2004:** The Minor Use Minor Species Animal Health Act of 2004 (MUMS) was signed into law by President Bush.



BIG ISLAND FESTIVAL

Hawaii's Big Island, November 3-7, 2004

Five days of
culinary
events, wine
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activities,
spa events
and golf.

Schedule of events includes:

New Waves at NELHA

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WWW.BIGISLANDFESTIVAL.COM

Big Island Aquaculture News

Check it Out!

Big Island Aquaculture
now has a Web site:
[www.uhh.hawaii.edu/
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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 Palau, and the Republic of the Marshall Islands.)

In its sixteen years of operation, CTSA has distributed over \$7 million to fund more than 165 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.

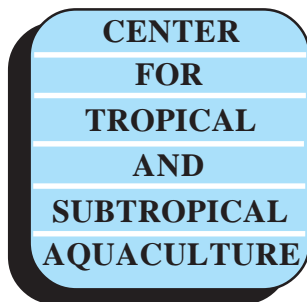
CTSA is jointly administered by The Oceanic Institute and the University of Hawaii. Its main office is located at The Oceanic Institute's Makapuu Point site on the island of Oahu in Hawaii.

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

FAST FACT

In the U.S., there were 6,653 farms that reported selling \$1,132,524,000 worth of aquaculture products during 2002.

*--2002 Census of Agriculture
www.usda.gov/nass/*



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