

# REGIONAL NOTES

CENTER FOR TROPICAL AND SUBTROPICAL AQUACULTURE

## *The black pearl industry moves closer to being in the black*

In recent years, producing black pearls has been discussed with increasing enthusiasm as an economic development tool with tremendous potential for the Pacific Islands. With two private farms in the Marshall Islands and two government-run farms in the Federated States of Micronesia, the fledgling industry appears to be making its move.

In Majuro, Ramsey Reimers Enterprises last year had its largest harvest to date with a value of approximately \$50,000. With increasing productivity and a big step towards commercialism, RRE hopes this year to harvest twice. Black Pearls of Micronesia, the other farm in the RMI has around 15,000 oysters and recently built another farm on Arno, another atoll in the Marshall Islands. They are also in the process of setting up a farm near Honolulu International Airport offshore of the island of Oahu.

The big news this month though is that Nukuoro Pearls, which is owned and operated by the Nukuoro Municipal Government, just completed a harvest and held its first farm sale. The Nukuoro farm was started in 1995 with help from CTSA, Sea Grant and the Australian Embassy. Simon Ellis, CTSA regional extension agent based in Pohnpei, has worked extensively with them and helped Nukuoro Pearls attain their harvest with his involvement in all facets of farm operation from advising on day-to-day operations, planning seeding hut design, marketing and sales. Ellis also acts as a seeding technician liaison. Seeding is the most important step in black pearl oyster farming and is often extremely expensive, so getting a reliable and experienced technician is imperative, making Ellis one of the most essential cogs in the machine.

Nukuoro Pearls' farm sale was held on May 15<sup>th</sup> in Pohnpei and sold \$12,600 worth of loose pearls at an average of \$60 per pearl. As a government-run facility, once Nukuoro starts earning profits, the money will be used to benefit the community. Nukuoro Pearls, located on an outer atoll of Pohnpei called "Nukuoro," has approximately 4,400 oysters currently seeded. These should be harvested sometime in June or July, at which time they also plan to seed 10,000 new oysters. Ellis anticipates in the future that Nukuoro Pearls will be able to seed 10,000-15,000 shells per year. Some of the pearls that were not sold at the sale are currently being set for pendants or earrings to be sold at the Micronesian Games in July.

It took a fairly long time for Nukuoro Pearls to get to the stage they are at now, but it might have taken even longer without the help of individuals, companies and institutions committed to jumpstarting this industry. Maria Haws of the Pearl Aquaculture and Coastal Resources Center in Hilo, Hawaii and C.L. Cheshire of the Pacific Business Center in Honolulu, Hawaii provided marketing and pricing advice to the startup farm. Believing that cooperation between farms is key, Ramsey Reimers and Peter Fuchs, both of RRE, also helped Nukuoro by sharing the trials they had already completed, along with errors they had already made and providing specific details on marketing methods and strategies. Marketing will continue to be a challenge for

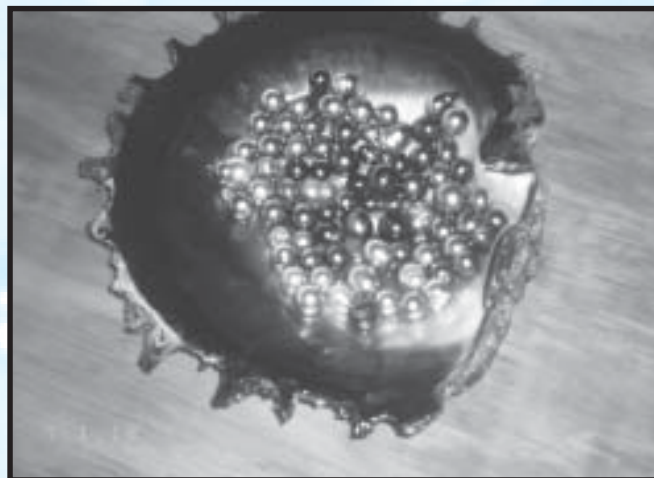


Photo courtesy of Maria Haws



Photo courtesy of Simon Ellis

## Letter from the director



CTSA has taken one more step in upgrading the quality of our proposals. Thank you to those who participated in the review of the problem statements submitted to CTSA for consideration for the Year 16 Plan of Work. With your input, the project working groups will be able to prepare a proposal that meets the needs of the industry in our region. During the review process, we found that a strategic planning meeting for each priority area was also needed prior to the preparation of each proposal. By working together with stakeholders, the project working group can truly address the problems the industry faces and discuss their approach with the industry. As in the past, CTSA cannot fully address the needs from the industry unless you, researchers and farmers, participate in our activities. Let's work together for the prosperity of the aquaculture industry in the region.

*Cheng-Sheng Lee*



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.



Editor: Kai Lee Awaya  
**Center for Tropical  
 and Subtropical Aquaculture**  
 The Oceanic Institute  
 41-202 Kalaniana'ole Highway  
 Waimanalo, Hawaii 96795  
 Phone: (808) 259-3167  
 Fax: (808) 259-8395  
 Email: [kawaya@oceanicinstitute.org](mailto:kawaya@oceanicinstitute.org)  
 www: <http://library.kcc.hawaii.edu/CTSA>



Printed on recycled paper

# AQUACLIPS

## Laboratory focuses on pearl research

*The Marshall Islands Journal - Friday, March 1, 2002*

*Papeete* - Construction this week began on a new laboratory that will be devoted to the research of pearl oysters, according to Jacques Calvas, head of the Ifremer Oceanologic Center of the Pacific. Ifremer, a French research institute focusing on the exploration of the sea, hopes to finish the building by November this year.

## Popular snapper fish, habitat subject of studies

*By Ka Mo'olelo Moana, The Maui News - Sunday, March 3, 2002*

Opakapaka, onaga and ehu are all part of the snapper family, biologically characterized by their medium to large oblong body shapes, large heads, a flat area about their snout and brightly colored bodies ranging from red to yellows. According to the [Hawaii State Department of Land and Natural Resources], onaga mature when they are approximately 26 inches long, or 4 years old. Onaga apparently must reach a large size before they spawn for the first time. Ehu mature at about 11 inches in length, when they are nearly 3 years old. Snappers are also known as bottomfish, living in deep water habitats ranging from hundreds to more than a thousand feet below the ocean surface.

## Pacific community reveals top 8 marine products

*Marianas Variety News and Views - Friday, March 22, 2002*

*Suva* - Top agriculture representatives from member states of the Pacific Community have chosen such commodities as seaweed, giant clams, coral, pearl oysters, tilapia, macrobrachium shrimp, milkfish and sea cucumbers as the "top eight" marine commodities that bear the highest potential for this region, the Secretariat of the Pacific Community said this week in a release.

## Taape may not deserve ill repute

*By Jan TenBruggencate, The Honolulu Advertiser - Monday, April 8, 2002*

Taape has limited marketability despite being a quality snapper. "It's nice, clean meat. It's a good eating fish," said Guy Tamashiro, vice president and buyer for Tamashiro Fish Market in Honolulu. Tamashiro said he can sell taape, but at a low price, because demand is low. Troy Wada at the Fish Express in Lihue said his fish store doesn't even bother trying to buy or sell taape. "It tastes good, but there's no market here," he said.

## Ceatech USA says sales increase and loss narrows

*By Dave Segal, The Honolulu Star-Bulletin - Thursday, May 16, 2002*

Ceatech USA Inc., benefitting from the doubling of its shrimp ponds to 40, said sales rose 14.6 percent in its 2002 fiscal year while its loss narrowed from 2001. Ceatech, which said it has lost more than \$7.4 million since inception in January 1995, posted sales of \$2.6 million in the year ending January 31, 2002, compared with \$2.2 million in the previous fiscal year.

## Shaun Moss to lead \$16.6 million shrimp initiative

*The Oceanic Institute press release*

Dr. Shaun M. Moss, Manager of the Oceanic Institute's Shrimp Program, was recently promoted to Director of Shrimp Technology. In this new capacity, Dr. Moss will manage a \$16.6 million joint-venture research project aimed at refining a super-intensive marine shrimp production process that will provide U.S. shrimp farmers with a competitive edge in the world shrimp farming industry. The joint-venture research project managed by Dr. Moss, "Biosecure Zero-Exchange Shrimp Technology: A Paradigm Shift for the U.S. Industry," is funded in part by the U.S. Department of Commerce Advanced Technology Program. The five-year project aims to develop an economically viable, environmentally responsible, and sustainable system for the production of disease-free shrimp in the United States. Joint venture partners include the Oceanic Institute, PIC USA, Inc., Zeigler Bros., Inc., and Kahuku Shrimp Company.

## Praise for PRAISE



Lois and Kris, deserve "praise" for the work they do

Do you wonder what the latest is on alternative feeds? Looking for marketing information? Thinking about diversifying your production and need some ideas? The Pacific Regional Aquaculture Information Service or PRAISE can help you find the knowledge you are seeking. The PRAISE staff, Kris Anderson and Lois Kiehl-Cain, will conduct online searches, supply articles and make suggestions as to where you can find what you are looking for. PRAISE can be contacted by phone at 808-956-2544, by fax at 808-956-2547, or email to [praise@library.kcc.hawaii.edu](mailto:praise@library.kcc.hawaii.edu). You can also check out the PRAISE website at <http://lama.kcc.hawaii.edu/praise>

PRAISE has been serving the Pacific aquaculture community since 1988. It is funded by CTSA to provide a resource for education and information delivery. We respond to all requests with search results and document delivery within 24 hours. Requests for journal articles are limited to the resources within the University of Hawaii's Hamilton Library but with our Ariel software, we can scan and send articles directly to your email.

The PRAISE website offers service request forms, links to current news and legislation, marketing information, and a collection of sites where you can do your own online research. We know aquaculture is a dynamic growth industry and we look forward to helping you swim ahead in the information pool.

The Marine Bioproducts Engineering Center (MarBEC) at the University of Hawaii invites you to attend a one-day workshop focused on the practical aspects of mass production of microalgae for the aquaculture industry. Come learn how simple changes to your algae production systems and processes can help you maintain sustainable, productive cultures, and save money. If your company depends on a microalgae food source for your product, this is an event you will not want to miss.

### Microalgae Production for the Aquaculture Industry Workshop Tuesday, June 18, 2002 University of Hawaii at Manoa Imin Conference Center

Registration: The registration fee of \$25 includes morning coffee, a box lunch, afternoon refreshments and all conference materials. Deadline for registration by mail or fax is Wednesday, June 12, 2002. For registration and general information call MarBEC at (808) 956-7385 or visit their website at <http://www.MarBEC.org>

## Aquaculture America 2003 Call for Special Session Papers

A session on Economic Impact on Aquaculture in the United States has been added to the program for Aquaculture America 2003 to be held in Louisville, Kentucky in February 2003. The special session aims to document the economic contribution of the aquaculture industry to the United States economy and bring together scientists working on aquaculture economics and impact studies. Topics to be covered will include, but are not limited to: regional and national level economic impact, international trade, and policy issues. Selected papers will be published in a special issue of the *Journal of Applied Aquaculture*.

Deadline for submitting the letter of intent and an abstract of the proposed paper is **July 1, 2002**. Please direct all correspondence to either Carole Engle or Aloyce Kaliba at:

Aquaculture/Fisheries Center  
University of Arkansas at Pine Bluff  
Mail Slot 4912  
Pine Bluff, AR 71601

Tel: (870) 543-8537/8791  
Fax: (870) 543-8129  
Email: [cengle@uaex.edu](mailto:cengle@uaex.edu) or  
[akaliba@uaex.edu](mailto:akaliba@uaex.edu)

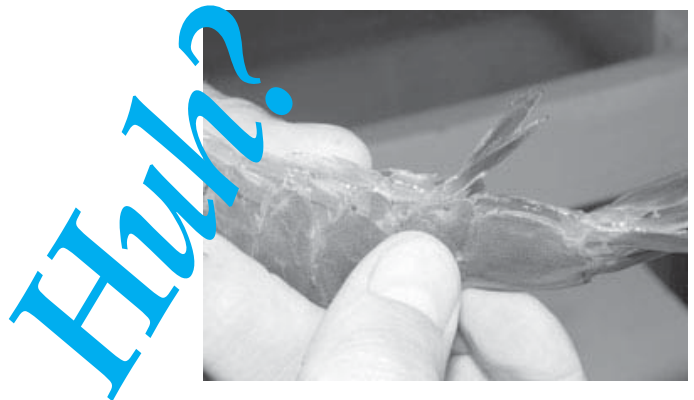


Photo courtesy of The Oceanic Institute's Shrimp Program

Seeing double? Researchers in The Oceanic Institute's Shrimp Program thought maybe they were when they went to tag one of their Taura Syndrome Virus resistant *Litopenaeus vannamei* and were surprised to find it didn't need another distinguishing characteristic – it had two tails. The right lateral section of the fifth abdominal segment was extended into a non-functional uropod, the human equivalent of having another foot on their right shin! Strange as it is, this 18-month male doesn't seem to be bothered by his natural mutation. The researchers are still unsure of what this extra extremity might mean, but are anticipating conducting further breeding work to see if more of these strange critters will be made.

# AQUA TIPS

## On the Use of Artificial Insemination for the Commercial Production of Lyretail Swordtails

Kathleen McGovern-Hopkins  
Glenn Takeshita  
Clyde Tamaru

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

*This article was written as part of the work for the project titled "Transitioning Hawaii's Freshwater Ornamental Industry, Years 1 and 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.*

The lyretail variety of swordtail was first developed by a Florida fish farmer during the late 1960s and has since been established through breeding as a distinct variety of swordtail. In this variety the upper and lower rays of the caudal fin are elongated, giving rise to the term "lyretail." Through the selective breeding process it has been determined that the lyretail trait is a dominant genetic characteristic which means that an individual only needs to be born with one dose of the gene to express the lyretail phenotype (Norton 1992). Interestingly, the elongation of fin rays is not restricted to the caudal fin as the dorsal and anal fins are also extended. This genetic change in the fins and specifically the over-development of the gonopodium, hampers the ability of the male swordtail to mate (Fig.1). The current method of reproduction is one in which the lyretail female is mated with a common male that does not possess the lyretail characteristic. Theoretically, only 50% of the next brood will possess the lyretail trait thus limiting the number of progeny that can be produced per generation.

A comparison of the estimated farm gate value of the red common and red lyretail swordtails at three different body sizes is presented in Figure 2. Clearly the value of the swordtails that possess the lyretail characteristic is significantly more. Development of methods that would result in higher production of the lyretail swordtail would have a significant impact for producers and therefore has become one of the main objectives of the current freshwater ornamental fish projects being supported by the Center for Tropical and Subtropical Aquaculture, Sea Grant Extension Service and the Aquaculture Development Program.

As with most of our efforts in the development of our freshwater ornamental objectives, partnerships are forged with the private sector. Fortunately, Hawaii is known to be the home of some of finest producers of livebearers in the country (Yamamoto and Takeshita 1998). These individuals represent a storehouse of knowledge and experience, which project staff tap to develop means to address a constraint, such as increasing the production of lyretail swordtails. Our project staff members have been receiving training in a method of artificial insemination of livebearers that has been used by avid hobbyist, Glenn Takeshita, (Fig. 3), for nearly three decades. The procedure has been described in detail (Takeshita 2001) and will not be covered here. Instead, the results of the work and its challenges and opportunities form the basis for this article.

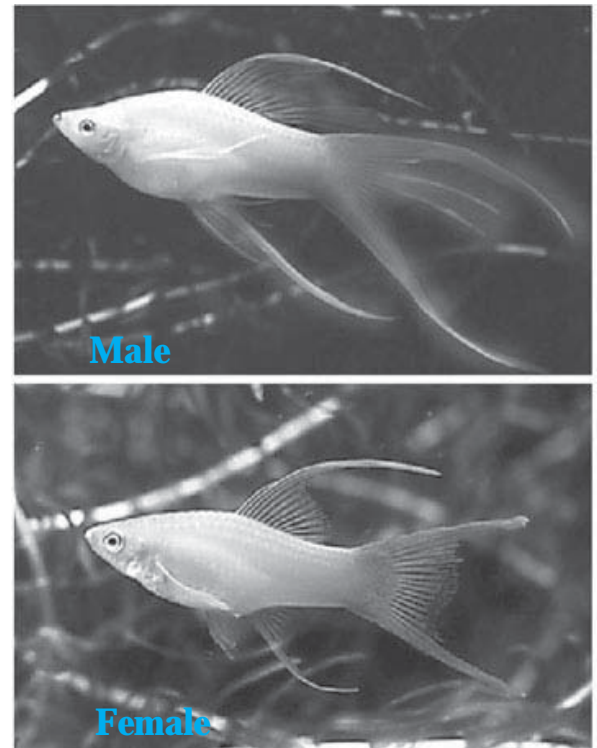


Figure 1. Male and female lyretail swordtails

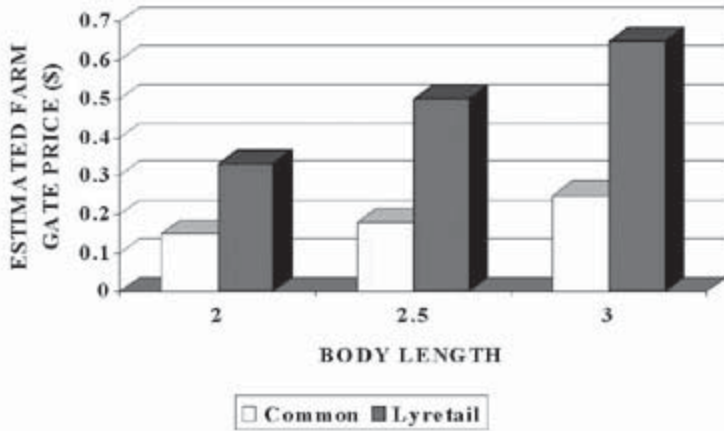


Figure 2. Estimated farm gate prices for common and lyretail red swordtails at three different sizes. Source: Sunny Aquarium 2000, Waimanalo, Hawaii.

common swordtails, the normal time period for fry production is four months after birth (Tamaru et al. 2001). The lack of fry production is consistent with previous reports that the lyretail male cannot mate with a female individual. The resulting virgin lyretail females were then used in the artificial insemination trials.

It is being hypothesized that an increased production of lyretail swordtails can be immediately realized if there was some way in which lyretail males and lyretail females could mate. We know that the gene that results in the expression of being lyretail is a dominant characteristic. We also know that because the only way lyretail individuals can be produced naturally is by mating a lyretail female with a common male, all lyretail individuals are heterozygous for the lyretail trait. By the Mendelian Law of Segregation of dominant and recessive genes, if a male lyretail and a female lyretail were to be mated we can expect 75% of their offspring to be lyretails. Artificial insemination allows transfer of sperm from a lyretail male into a lyretail female so the physical constraint is circumvented artificially. This was accomplished and at present we have five clutches of swordtail fry that have resulted from the artificial insemination of virgin lyretail females with the sperm from lyretail males. The crosses were made between November and December 2001 and offspring were produced between January and March 2002. Only until recently have some of the clutches of fry grown large enough where their phenotypes can be scored confidently. The observed and expected phenotypic results of three of the broods that could be scored are presented in Table 1. From the data presented all three clutches were found to have lyretails to common swordtail phenotypes that are consistent with the expected 3:1 ratio.

Clutch Number	Lyretails	Common
#1 Born January 15, 2002	Observed: 19 Expected: 20 Chi Square = 0.22, P>0.50	Observed: 7 Expected: 6
#2 Born February 18, 2002	Observed: 32 Expected: 38 Chi Square = 3.72, P>0.05	Observed: 19 Expected: 13
#3 Born March 8, 2002	Observed: 29 Expected: 32 Chi Square = 1.18, P>0.10	Observed: 13 Expected: 10

Table 1. Summary of observed and expected ratios of lyretail and common swordtails resulting from the insemination of lyretail mates and virgin lyretail females.

The work began with confirmation of the constraints of producing lyretail swordtails. Twenty adult marigold lyretail females that had already been impregnated by common males were stocked in a cage placed in a 500-gallon tank equipped with constant aeration and water exchange. These females were allowed to bear their offspring over a period of two weeks and were then returned to their original production tank. The fry that were produced were fed a diet of salmon fry starter feed for approximately two months. A total of 286 fry were sorted into common and lyretail groups and a ratio of 145 common:141 lyretails was obtained. According to the Mendelian Law of Segregation the expected ratio of common to lyretail individuals is 1 common:1 lyretail. The observed ratio is consistent with the expected 1:1 ratio (chi square = 0.06, P>0.50) of how the transmission of the lyretail genes to the next generation is being realized. The 141 lyretail swordtails were then stocked into a 500-gallon tank and were allowed to grow until they were five months of age. At this time the individuals should have been producing fry because, for com-



Photo courtesy of Mike Yamamoto

Figure 3. Glenn Takeshita artificially inseminating a swordtail.

Clearly the insemination technique can have an immediate impact but there is still an added dimension of the resulting production of lyretail individuals by using artificial insemination. By the Mendelian Law of Segregation of dominant and recessive genes, we can expect that of the lyretail offspring that have been produced approximately 25% of these should be homozygous for the lyretail trait. This would mean that the potential to further increase production of lyretail swordtails could also be achieved. The reason is that the mating of an individual that is genotypically homozygous for the lyretail trait will produce

## HAA spawns another success

The 2002 Hawaii Aquaculture Association meeting was held on May 8<sup>th</sup> at Windward Community College in Kaneohe, Hawaii. Many new faces were seen at the meeting, hopefully signaling the incoming of many new farms. As usual, the morning started with welcoming remarks from long-time HAA President, Ron Weidenbach. The rest of the day was filled with talks from representatives of various farms, businesses and institutions across the state. Participants heard the following presentations:

### Minimizing Disasters: How to fix it before it breaks

– Jeff Koch, Mokuleia Aquafarm

**Business Basics and Farm Management** – Linda Koch, Mokuleia Aquafarm

**Cage Culture: Hurdles to Harvest** – Gini Enos, Cates International

**Marine Ornamental Development** – Cindy Hunter, Waikiki Aquarium

**Captive Reproduction of Yellow Tang & Pygmy Angelfish** – Charles Laidley, The Oceanic Institute

**Freshwater Ornamental Development** – Clyde Tamaru, UH Sea Grant (See accompanying article Page 4.)

**PVC: Panacea Versus Chaos** – Jeff Koch, Mokuleia Aquafarm

**Water and Electricity: It's not just for breakfast anymore** – Mitch Smith, AquaSmith

**Predicting Temperature Conditions at New and Existing Farm Sites** – Jim Szyper, UH Sea Grant

**Hawaii Institute of Marine Biology** – Jo-Ann Leong, HIMB

**Nutrition: What and When to Feed** – Harry Ako, University of Hawaii

**Growth Limitation and Stocking Density** – Eri Shimizu, University of Hawaii

**Innovations in Feed Palatability** – Ian Forster, The Oceanic Institute

**Disease Prevention and Treatment** – Dee Montgomery-Brock, Anuenue Fisheries Research Center

**Overview of Ornamental Marketing** – Kevin Kelly, UH MarBEC

**Retail Marketing Strategies** – Ken Matsue, Petland

**Exporting Seafood: Thinking outside the rock** – Glenn Tanoue, Tropic Fish (Look for an article in the next issue of the *Regional Notes* outlining the talk given by Glenn Tanoue and Mary Maunupau, plus some extra hints from one of the island's leading fresh fish exporters.)

An abstract for a majority of the presentations is available. If you would like one, please contact the editor or email Dean Toda at aquacult@aloha.com.

Everyone's favorite part of the meeting – "A Taste of Hawaii Aquaculture" – began soon after the sessions. Chefs from Sansei Restaurant, Sunset Grill, Kapiolani Community College's Culinary Institute and Indigo Restaurant prepared farm-raised products donated from farms throughout Hawaii. Included in the dishes were abalone, prawns, crab, hiramé, moi, lobster, grass carp, ogo and tilapia – just some of the many products cultured by the aquafarmers of Hawaii.



*Chatting it up with Ron Weidenbach, HAA President (second from right) are (from L to R) Yasuhiko Akamine, Fred Mencher of Hawaiian Marine Enterprises and Bob Shleser of Aquatic Farms*



*Oskar Zaborsky (OI) and Sea Grant extension agent, Jim Szyper talk business*



*Dee Montgomery-Brock of Anuenue Fisheries and Sea Grant extension agent Kathy McGovern-Hopkins are in fine spirits after dining on delectable dishes from some of Oahu's best chefs*



*(From L to R) Sharon and Joe Tabrah (OI), Randy Cates, Cates International (CI), Tony Ostrowski (OI) and Rob Wennihan (CI) find that business and pleasure can be mixed*



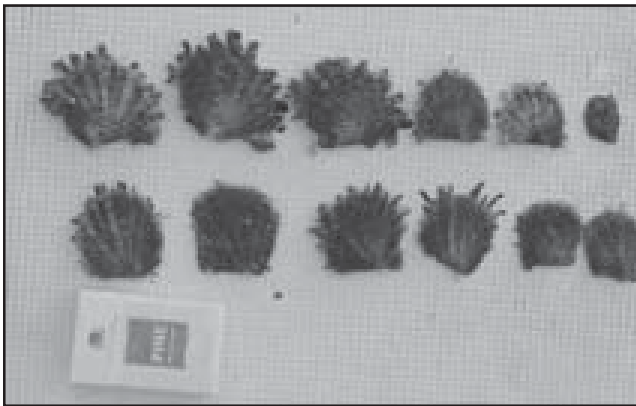
*Robin Cababa (OI) and Vernon Sato wait for the next session to begin*

## Black pearls cont'd from page 1

this industry as it grows to become an export market and will have to compete with the established and strong \$140 million Tahitian industry.

Another obstacle for the industry is the lack of a reliable supply of pearl oyster spat or baby oysters. Although Pohnpei has a readily available supply of wild-collected spat, many of the other islands in the region are not so lucky. Ellis has been working closely with the Ponape Agricultural Trade School (PATS) to build a demonstration and research hatchery, nursery and farm as part of the CTSA project "Development of Black-Lip Pearl Oyster Farming in Micronesia." The hope is that the hatchery will be able to help with the establishment of private hatcheries on islands where they are needed.

Photo courtesy of Masahiro Ito

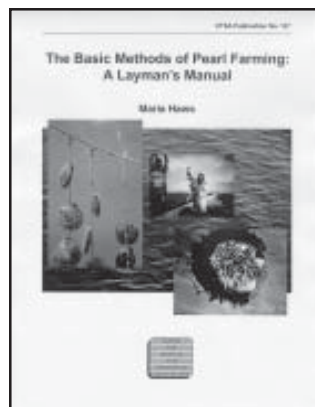


*Spat produced by COM Land Grant's system test run last year*

The College of Micronesia Land Grant has also been working on hatchery technology to reliably produce spat and has had a fully operational hatchery since October last year. Masahiro Ito, a Japanese researcher, spawned the oysters in September, February and April and is optimistic that spawns will also be obtained in August and November of this year. Ito and his team of two Micronesian trainees are excited. It means that they are moving closer to year-round spawning without in vitro fertilization, a worthy accomplishment for any type of aquaculture.

If you are interested in pearl farming, you may find newly published CTSA Publication No. 127 "The Basic Methods of Pearl Farming: A Layman's Manual" by Maria Haws useful. Because most pearl farmers hope to avoid competition by keeping their methods secret, the pearl farming industry has traditionally been one of the most problematic of aquaculture businesses to start from scratch. Although the basic methods are simple, beginning pearl farmers find it difficult to obtain the technical information needed to learn how to operate a farm. This manual describes basic methods of pearl culture used on small- and medium-sized farms throughout the Pacific. By using the proven methods described in the manual, the new farmer should be able immediately to start and operate his or her pearl farm.

To request a copy please contact Kai Lee Awaya at [kawaya@oceanicinstitute.org](mailto:kawaya@oceanicinstitute.org) or call (808) 259-3167 or you can download it off our website at <http://library.kcc.hawaii.edu/CTSA>.



## Lyretail cont'd from page 5

offspring that are expected to be 100% lyretail. The challenge that lies ahead is developing a method to identify these homozygous individuals.

While the results are very encouraging there is another limiting factor that needs to be addressed if the artificial insemination technique is to be used at a commercial scale. A typical intensive swordtail fry production module for just one strain of swordtail may consist of 1000 females (Tamaru et al. 2001). The constraint is not the physical insemination of female individuals, but obtaining enough sperm from selected male individuals. There are two methods in which sperm can be obtained, the simplest being the sacrificing of the male and excising the testis. The testis can then be minced in a saline solution and used for insemination. Although simple, this process is terminal for the male individual and results in a suspension of sperm packets that are at various stages of maturation. The more desirable method would result in the ability to milk the male repeatedly as well as having a large number of male individuals spermiating concurrently. Work that is being conducted in parallel on the use of androgen-laced feed is beginning to yield encouraging results in this area and researchers are confident that the artificial technique developed at the hobbyist level can be modified for use in a commercial setting.

The activities presented were partially supported by a grant from the USDA's Center for Tropical and Subtropical Aquaculture titled, "Transitioning Hawaii's Freshwater Ornamental Industry -- Years 1 and 2," the University of Hawaii Sea Grant College Program and the State Department of Agriculture's Aquaculture Development Program. The views expressed herein are those of the authors and not of the funding agencies or collaborative institutions.

### Literature Cited

- Norton, J. 1992. Fish genetics. *In*: AQUARIOLOGY, J.B. Gratzek and J. R. Matthews (Eds.) The Science of Fish Health, Tetra Press, Blacksburg Virginia USA. pp 95- 134.
- Takeshita, G.Y. 2001. Artificial insemination of fancy swordtails, variatus, moons and mollies. *Tropical Fish Hobbyist*, May 2002:108-116.
- Tamaru, C.S., B. Cole, R. Bailey, C. Brown and H. Ako. 2001. A manual for commercial production of the swordtail, *Xiphophorus helleri*. United States Department of Agriculture, Center for Tropical and Subtropical Aquaculture, Publication Number 128. 36 pp.
- Yamamoto, M.N. and G. Y. Takeshita. 1998. The development of fancy livebearers in Hawaii. *Tropical Fish Hobbyist*, January 1998:20-32.

# 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 [Palau] and the Republic of the Marshall Islands.)

In its thirteen years of operation, CTSA has distributed \$7 million to fund more than 130 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 Hawaii.

For further information on the CTSA program, contact Cheng-Sheng Lee, Ph.D., Director, by phone (808-259-3107), fax (808-259-8395) or by email at [cslee@oceanicinstitute.org](mailto:cslee@oceanicinstitute.org).

## FAST FACT

*In March 2002, the United States imported 81,497 metric tons of shrimp.*

*-- National Marine Fisheries Service*

The Oceanic Institute  
and the University of Hawaii  
41-202 Kalaniana'ole Highway  
Waimanalo, HI 96795



PERMITTED  
HONOLULU HI  
PAID  
U.S. POSTAGE  
NON-PROFIT  
PRESORTED