

# REGIONAL NOTES

CENTER FOR TROPICAL AND SUBTROPICAL AQUACULTURE

## Meeting sets plan for FSM's aquaculture industry

By Simon Ellis

On September 27-28, 2000, CTSA sponsored a two-day meeting titled "Developing Aquaculture in the Federated States of Micronesia". The purpose of the meeting was to set priorities and actions for the development of economically viable and environmentally sustainable aquaculture in the Federated States of Micronesia (FSM).

Participants came from all over the FSM and Hawaii. Three delegates from each state in the FSM (Kosrae, Pohnpei, Yap and Chuuk) were sponsored to travel to Pohnpei to attend the meeting held at the College of Micronesia, FSM's new campus at Palikir. One delegate from each state represented education, the public sector and the private sector. In addition, three members of CTSA's Board of Director's were in attendance, John Corbin, Dr. Dean Smith and Dr. Singeru Singeo. Between 30 and 40 people at-

### Developing Aquaculture in the Federated States of Micronesia



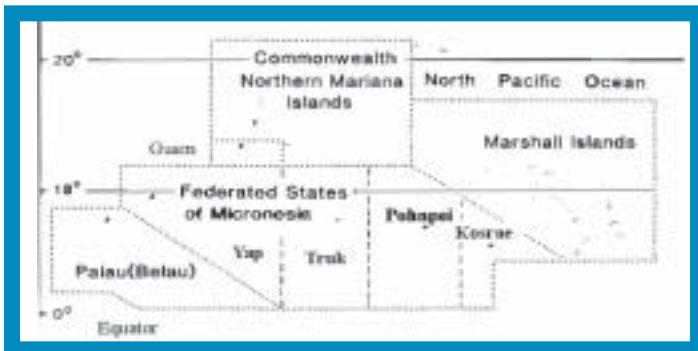
Some meeting participants in Pohnpei - Photo courtesy of Simon Ellis

During the afternoon, participants broke into working groups to provide information on the status of aquaculture and to develop priorities for each state of the FSM.

The second day of the meeting focused primarily on aquaculture development starting with a talk on CTSA's role in aquaculture development in the region by Dr. Lee. This was followed by presentations on the development of Hawaii's aquaculture industry by John Corbin, business related aspects of aquaculture development by Jerry Linville of the Pacific Business Center and aquaculture education programs at the Pohnpei Agriculture and Trade School by Eileen Ellis. In the afternoon, a general roundtable discussion was held to set priorities and courses of action for selected species in the FSM.

On Day 1 of the meeting, delegates from the different states prioritized black pearls, marine ornamentals and sponges as key areas for development. Other species chosen for consideration were finfish, seaweed and trochus. While many issues were raised regarding development constraints, unanimous concerns were the lack of capacity and education in aquaculture, lack of funding, infrastructure, legislative and transport constraints, and limited extension assistance.

Discussion on Day 2 centered on the prioritized species groups of black pearls, marine ornamentals and sponges. For all species groups, constraints to development were identified as limited resource assessment, extension and training, poor knowledge of the industry and marketing and a shortage of readily available capital



tended each day.

On the first morning of the meeting, Deputy Secretary for Economic Affairs for the FSM, Mr. Patrick McKenzie gave the opening remarks. Presentations focused on the technical aspects of aquaculture development in the FSM. Presenters included CTSA Director, Dr. Cheng-Sheng Lee addressing the crossroads the FSM has approached in aquaculture development, Economic Development Specialist, Richard Fassler discussing the latest developments in the world pearl industry and Regional Aquaculture Extension Agent, Simon Ellis giving an overview of pearl oyster, sponge, giant clam and coral culture.

(See Pohnpei meeting on page 5)

## Letter from the director



At our Board of Directors meeting held in January, we discussed the feedback we had been receiving on our operations procedures. In an effort to reflect these concerns, we have implemented some procedural changes. The changes will be presented to our communities and implemented this year.

We hope our new procedures will improve the accountability and impact of CTSA's projects by addressing the issues that really affect the industry effectively and in a timely manner. Additionally, the policies will reduce the paperwork required of our PIs enabling them to use their time more efficiently.

Our overall goal in implementing these changes is to effect the level of quality from our projects and administration of which we know we are capable.

I encourage everyone to voice their concerns in the future and together we can continue to build a sustainable aquaculture industry.

*Cheng-Sheng Lee*



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# AQUA CLIPS

## **Guam working out Norwegian fish farm deal**

*By Adrienne Loerzel, Pacific Daily News – Monday, November 2, 2000*

A group of investors has visited Guam several times to look into the possibility of building a salmon farm here [in Guam]. GEDA officials have said the investors are definitely interested in the project, but they are working out the details with the local agency. GEDA officials are interested in developing new industries here [in Guam] and have touted the fish farm as an important project that could employ as many as 120 people. The farm could also provide a boost to the island's economy by creating a product that can be associated with the island, officials have said. The fish farm would include processing equipment and possibly a restaurant or tour option, investors have said.

## **Aquaculture, marine ornaments cited as viable Pacific industries**

*By Eileen O. Tabaranza, Marianas Variety News and Views – Thursday, October 5, 2000*

Pacific legislators have found out during the "Aquaculture and Marine Ornamentals Conference" sponsored by APIL and Pacific Islands Development Bank held in Chuuk in June this year [2000] that aquaculture and marine ornamental industries fit within the framework of sustainable development to which each island nation in the Pacific region strives. Aquaculture involves giant clam, sponge and seaweed farming, pearl oyster cultivation, marine aquarium fish, trochus harvesting, among others. The committee noted that there are several advantages to the development of aquaculture and marine ornamentals industries in the Pacific Island states. The committee also finds that the development of aquaculture and marine ornamentals industries is appropriate to the geography, culture and history of our Pacific Islands.

## **Marine resources money 'is no longer in the mail'**

*By Adrienne Loerzel, Pacific Daily News – Tuesday, October 24, 2000*

The group, known as the Marine Resources Pacific Consortium or MAREPAC, includes representatives from Palau, the Federated States of Micronesia, the Commonwealth of the Northern Marianas Islands and Guam. In March, federal authorities promised \$200,000 to help MAREPAC begin working on a regional Sea Grant program, according to Pacific Daily News files. "After months of waiting, the check is no longer in the mail. It is in the bank," Gov. Carl Gutierrez said yesterday. The money will be used to support a new Sea Grant program that will support research and education initiatives to promote sustainable development of marine resources.

## **Seaweed rip-off costs Wai'anae students**

*By James Gosner, The Honolulu Advertiser – Sunday, December 10, 2000*

Thieves with a penchant for ogo are raiding tanks of seaweed grown by marine science students at Wai'anae High School. Students at the school's Marine Science Learning Center grow the edible seaweed and sell it to area stores for \$2.50 a pound and at swap meets for \$3 a pound. They use the money to pay for an annual trip to the Big Island to see commercial aquaculture operations, and for an around-O'ahu sail in the spring. These two field trips may be canceled for the 44 students in this year's program. At least 400 pounds of ogo valued at about \$1,000 has been taken in the past two months.

## **Science mission finds new species: Discoveries rife on outlying isles**

*By Jan TenBruggencate, The Honolulu Advertiser – Thursday, October 19, 2000*

Sponges far more colorful than those in your kitchen grasp the walls of a 60-foot-deep sinkhole in the coralreef of Pearl and Hermes Atoll. Invertebrate zoologist Ralph DeFelice last week found 10 species new to science. They are just a fraction of the dozens of new species of life found by the Northwestern Hawaiian Islands Rapid Reef Assessment and Monitoring Program, he said.

## Call for pre-proposals

In response to some of the comments we had received since the last issue of the Regional Notes, we made a slight change to the format in which we wanted to receive the pre-proposals. Instead of a "pre-proposal" as termed previously, CTSA issued a request for suggestions, concepts or ideas for funding. It was to be much less formal than the pre-proposal previously outlined and brief. We received several good ideas and CTSA will present all of them to the Industry Advisory Council (IAC), which will meet on February 21-22, 2001.

From the concepts submitted, the IAC will develop priority areas that address the issues our industry faces today. Those priority areas will then be disseminated and posted on our website in the beginning of March 2001. Those interested in submitting pre-proposals should look over the problem statements and develop a pre-proposal based on his or her chosen area. The pre-proposal should be submitted to CTSA by March 26, 2001. We will forward your pre-proposal to both the IAC and the Technical Committee (TC). Once we receive their selections, the submitters of the selected pre-proposals will be notified to pursue a full proposal.

It is important to note that projects can be initiated directly with private individuals or commercial enterprises, but must be supervised financially by a public/nonprofit organization such as a university or research institution. Although CTSA welcomes ideas from any interested persons, first priority will be given to suggestions from the people who are oftentimes most aware of the needs of the industry – the farmers.

## Andrew Hashimoto joins CTSA's Board of Directors

CTSA's newest board member may have lived in Corvallis, Oregon for the past 14 years; but as he leaves his positions as vice provost for academic affairs and professor of bioresource engineering at Oregon State University, he is experiencing somewhat of a homecoming.



Dr. Andrew G. Hashimoto was born in Hawaii and lived here until he left to attend Purdue University where he obtained a bachelor's degree in civil engineering and a master's degree in environmental engineering. He went on to earn his doctorate from Cornell University in agricultural engineering. He then headed to Corvallis and 14 years later made a u-turn to come home. He was Head of the Bioresource Engineering Department before being named Vice Provost for Academic Affairs. Hashimoto was recently appointed

Dean of the College of Tropical Agriculture and Human Resources at the University of Hawaii and says "It is great to finally be able to come home and try to make a difference in Hawaii."

## Guidelines

### Suggestions should include the following:

- Proposed title or main idea
- Proposed objectives
- Background and justification of the problem to be addressed
- Description of how the project results could be applied and who will benefit
- Suggested participants
- Proposed budget (not required, but if submitted, include detailed justification)

### Format requirements:

- Typewritten on no more than two letter-sized pages
- Page margins - one-inch on all sides
- Font - at least 10-point Times New Roman

### Mail, fax or email your suggestion to:

IAC Priorities Year 15  
Center for Tropical and Subtropical Aquaculture  
The Oceanic Institute  
41-202 Kalaniana'ole Highway  
Waimanalo, HI 96795  
fax: (808) 259-8395  
email: [cslee@oceanicinstitute.org](mailto:cslee@oceanicinstitute.org)  
Please direct any questions to Kai Lee Awaya at [kawaya@oceanicinstitute.org](mailto:kawaya@oceanicinstitute.org) or (808) 259-3167



**Deadline: March 26, 2001**

If CTSA was looking for someone with some insight to the United States Department of Agriculture (USDA), they found him in Hashimoto. Hashimoto held professional positions at Cornell University and the University of Nebraska while working for the Agricultural Research Service of the USDA and was later a research leader of the USDA's Agricultural Engineering Research Unit.

Hashimoto's expertise includes bioconversion processes, ethanol fuels, and waste management systems.

CTSA is excited to have a member of such an exceptional quality join our Board of Directors. Welcome, Dr. Hashimoto.

## Farewell to Michael Harrington

Dr. Michael Harrington, the interim Dean of CTAHR was a member of CTSA's Board of Directors since 1997. Now that a dean has been appointed, we bid farewell to Dr. Harrington. We are grateful for his time and contributions.



## CTSA announces projects for Year 14

On January 11, 2001, CTSA's Board of Directors met and approved the Fourteenth Annual Plan of Work. The projects to be funded in CTSA's Year 14 beginning June 1, 2001 pending USDA approval are:

- Library Aquaculture Workstation, Year 14
- Disease Management in Hawaiian Aquaculture, Year 8
- Marine Food Fish Seedstock Production, Year 3
- Aquaculture Extension and Training Support for the U.S. Affiliated Pacific Islands, Year 12
- Aquaculture of Marine Ornamental Species, Year 2
- Black Pearl Culture in the Pacific, Year 1
- Publications, Year 12

The Center for Tropical and Subtropical Aquaculture's (CTSA) projects for FY00 are compatible with the priorities in CTSA's region and the National Aquaculture Development Plan (NADP). The NADP identified several key issues that must be addressed to further aquaculture development. These include disease management and development of seedstock production technology, regulatory impacts and chemical registration procedures. The NADP also identified the need for education and technical assistance for aquaculture ventures. The Center's projects directly address these issues.

The NADP documented that trained personnel and scientific and technical knowledge are insufficient to adequately address disease detection, prevention and treatment needs. Private aquaculturists often must rely on handbooks or leaflets to diagnose and treat disease problems, and no diagnosis or a faulty diagnosis can easily lead to loss of an entire crop. "Disease Management in Hawaiian Aquaculture" will take a multi-faceted approach to solving disease problems that seriously afflict the aquaculture industry.

The NADP reported that laboratory studies and small-scale aquaculture producers commonly obtain seedstock or fingerlings by spawning wild, gravid females. This is impractical for large-scale commercial ventures or for those located a considerable distance from sources of wild broodstock. Locating and capturing suitable wild broodstock frequently is difficult and expensive. In many cases, legal restrictions prevent commercial fish farmers from capturing broodstock. In other cases, permits or licenses are required. The aquaculturist usually has little expertise in the use of hormones or manipulation of temperature and light for controlled reproduction. The techniques for producing seedstock of some species are known, but a supply of seedstock or broodstock may be unavailable. Ideally, domesticated broodstock should be available for each cultured species.

"Marine Food Fish Seedstock Production" continues its third year to address this problem directly by developing and transferring to industry the technology for growout of Pacific threadfin (*Polydactylus sexfilis*), milkfish (*Chanos chanos*) and. Additionally, the project will produce seedstock to promote development of the industry in the region.

"Transitioning Hawaii's Freshwater Ornamental Industry" will conduct experiments on the pigmentation issue and assist interested farmers start hatcheries that will be able to supply the local industry on a long-term basis.

The new project, "Black Pearl Culture in the Pacific" is designed to address critical issues currently affecting pearl-farming development in Micronesia by developing technology for the farming of black-lip pearl oysters; thus encouraging the development and future success of black pearl production in the Federated States of Micronesia, the Republic of the Marshall Islands and Hawaii.

The new project "Aquaculture of Marine Ornamentals" will develop culture techniques for four popular marine ornamental species and transfer the technology to the commercial sector. The selected finfish species are the yellow tang (*Zebrasoma flavescens*), flame angelfish (*Centropyge loriculus*), golden gobi (*Priolepis, sp.*) and masked angelfish (*Genicanthus, sp.*).

Finally, the NADP stated that improvement and expansion of existing education and technical assistance delivery systems are needed to ensure orderly establishment and growth of successful aquaculture enterprises. This is particularly true in the Pacific Islands, where aquaculture is just starting and technical assistance in all areas of industry is limited. Several CTSA projects in the Pacific Islands deal with education and technical assistance.

"Aquaculture Extension and Training Support for the Pacific Islands" provides a regional extension specialist to expand the sponge industry and conduct on-site training in aquaculture of tropical species, including hard and soft corals, giant clams, black-lip pearl oysters, ornamentals. The regional extension specialist also provides technical assistance to island residents in his region, which includes the Federated States of Micronesia (FSM), the Commonwealth of the Northern Mariana Islands (CNMI), the Republic of Belau, the Republic of the Marshall Islands and American Samoa.

Industry development activities should include an extension element to transfer technical information from the research community to commercial producers. All projects in the CTSA FY00 program have extension elements. "Publications" will assist individual projects to produce quality publications.

"Library Aquaculture Workstation" focuses on transfer of bibliographic information and documents to producers and researchers throughout the region. This year the project will continue to expand the Pacific Island Gray Literature database and provide their established services, including document search and delivery and user education programs.



## Jim Brock's resignation a big loss for CTSA



Dr. Jim Brock, PI of the CTSA-funded *Disease Management for Hawaiian Aquaculture* project, resigned from his aquaculture disease specialist position at the Aquaculture Development Program of the Department of Agriculture in Honolulu, Hawaii. Dr. Robert Bullis of the Oceanic Institute will temporarily undertake Brock's duties while a replacement is sought.

Brock was instrumental in the identification of gill-fouling diseases in intensively cultured marine shrimp and has been a tremendous asset to CTSA's mission. We have consistently been told what an outstanding job he does during his workshops and training sessions. Although Dr. Brock will still be on the island, the loss to CTSA is remarkable. Thank you for your hard work and dedication, Dr. Brock. Good luck with your new job.

## Have something you want to tell everyone?

**Tell us** and we'll do the rest! If you have an idea for a story or an event you would like announced or *anything* else you would like to see in a future issue of the *Regional Notes*, let us know and we will see what we can do. Send suggestions to:

**Kai Lee Awaya**  
**Editor, Regional Notes**  
**Center for Tropical and Subtropical Aquaculture**  
**The Oceanic Institute**  
**41-202 Kalaniana'ole Hwy.**  
**Waimanalo, HI 96795**  
**Fax: (808) 259-8395**  
**E-Mail: [kawaya@oceanicinstitute.org](mailto:kawaya@oceanicinstitute.org)**



## CTSA Calendar of Events

January 11, 2001	Board of Directors approved Year 14 Annual Plan of Work
January 31, 2001	Year 14 Plan of Work submitted to USDA for final approval
February 21-22, 2001	Industry Advisory Council Meeting
March 1, 2001	Request for Pre-proposals will be disseminated and problem areas will be posted on our website
April 1, 2001	Preliminary Plan of Work for CTSA Year 15 submitted to Board of Directors for approval
April 15, 2001	Proposals solicited for CTSA Year 15
June 15, 2001	Proposals due to CTSA
July – August 2001	Proposal review process
September 13, 2001	Technical Committee Meeting
November 1, 2001	Program Review Delegation
November 30, 2001	Final revisions for CTSA Year 15 proposals due to CTSA



## Other Happenings

March 2, 2001	HAA's 2001 Hawaii Aquaculture Conference, <i>Kaneohe, Hawaii</i>
April 1-4, 2001	1 <sup>st</sup> North American Fisheries Economics Forum, <i>New Orleans, Louisiana</i>
April 21-22, 2001	Second Warmwater Aquaculture Conference, <i>University of Queensland, Australia</i>
April 26 –28, 2001	Acquacultura International 2001 – Exhibition and Conference, <i>Verona, Italy</i>
May 28-30, 2001	Tilapia 2001, <i>Kuala Lumpur, Malaysia</i>
May 31-June 3, 2001	Aquarama 2001, <i>Singapore</i>
June 17-20, 2001	Open Ocean Aquaculture IV, <i>St. Andrews, New Brunswick, Canada</i>
June 21-23, 2001	3 <sup>rd</sup> International Fair for Aquaculture, Fisheries & Fish Products, <i>Culturepark, Izmir, Turkey</i>
July 22-24, 2001	Aquaculture Waste Management Conference, <i>Roanoke, Virginia</i>
July 25-27, 2001	Design and Operation of Aquaculture Facilities Workshop, <i>Roanoke, Virginia</i>

# AQUA TIPS

## Economic results of Pacific threadfin culture

**Francisco J. Martinez Cordero, University of Hawaii, Department of a Natural Resources and Environmental Management**

**Lotus E. Y. W. Kam, University of Hawaii, Department of Molecular Biosciences and Biosystems Engineering**

**PingSun Leung, Ph.D., University of Hawaii, Department of Molecular Biosciences and Biosystems Engineering**

**Anthony C. Ostrowski, Ph.D., The Oceanic Institute, Finfish Program**

*This article was written as part of the work for the project titled "Marine Food Fish Seedstock Production," 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.*

Successful results in the first experiences culturing Pacific threadfin (*Polydactylus sexfilis*) at a commercial level motivated a detailed cost analysis of the culture during the second phase of the program funded by the Center for Tropical and Subtropical Aquaculture. Based on hatchery technology developed during the first phase at the Oceanic Institute by the team headed by Dr. Anthony Ostrowski, the second phase devoted efforts to reduce the fry cost further, key to the success of ongoing operations, and to conduct economic analysis of commercial operations established in Hawaii.

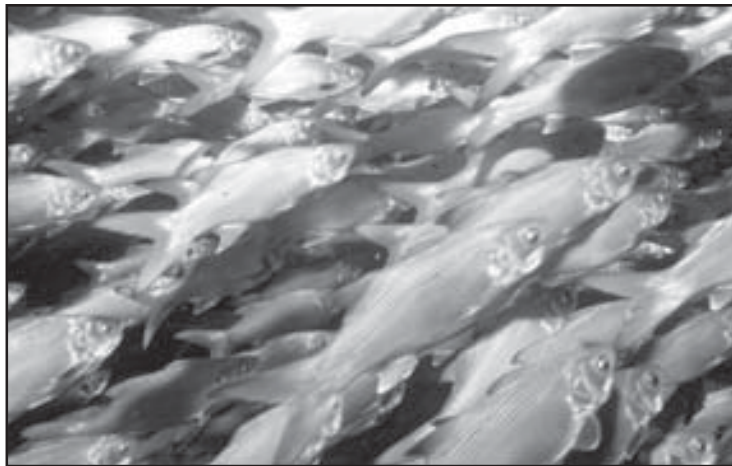
The analysis of production economics, carried out together with the economic team (Francisco Martinez-Cordero, Lotus Kam and Liem Tran) headed by Dr. PingSun Leung at the University of Hawaii-Manoa, evaluated the economics of culturing threadfin commercially along the whole biological cycle. The integrated appraisal begins with the economic analysis of commercial hatcheries at various production levels, continuing with the feasibility analysis of the growout culture both in inland facilities (tanks and Hawaiian fishpond) and offshore by means of a module of six submersible cages.

To carry out the appraisals, different systems were developed, including a Windows-based program (TPFM) and Excel-based economic models. The first one is the Threadfin (Moi) Production and Financial Model (TPFM) (Tran et al. 1998). Although TPFM can be used to evaluate the economics of other finfish, it is designed particularly for Pacific threadfin culture. TPFM is a stand-alone Windows-based program written in Delphi<sup>®</sup>, and provides the con-

ventional financial analysis including annual profit and loss statements, cash flows, and investment analysis. The Excel-based economic models exist for the hatchery system and for offshore operations. Both use detailed input information for General and Financial, Payroll, Energy and Supplies, Capital Expenditures and Production. The TPFM model has been distributed free of cost to threadfin commercial farmers in the state (Hawaii), providing them

with the opportunity to organize and analyze their production information at farm level.

The commercial hatchery analysis revealed size economies for variable levels of production. The commercial model was based on Oceanic Institute technology protocol and reflects relevant design and operating costs incurred by aquafarmers in Hawaii. According to a 20-year investment analysis, the commercial hatchery is profitable for fry sold at \$ 0.25. As suggested earlier, market demand is un-



*Photo courtesy of the Oceanic Institute's Finfish Program*

certain at this time. Consequently, threadfin hatchery farmers operating at lower levels of production may be obliged to seek efficiencies in order to remain profitable. In addition to measuring the effect of the production scale on profitability and highlighting the major components contributing to the fry cost structure, sensitivity analyses were performed on the base model to explore the impact of outsourcing or substituting live feed production modules and changes in the length of the nursery period. Enacting changes to such parameters should also consider the effect of viable substitutes on overall production, shipping and handling costs, and changes in the market climate in order to accurately evaluate the

potential impact on profitability.

Results of commercial operations show that under conservative considerations, much work is needed to improve the profitability of offshore operations. By contrast, the profitability analysis of culturing threadfin intensively in land-based tank systems and extensively in a Hawaiian fishpond shows that these systems are profitable under current considerations, based on a 20-year investment analysis. Interesting options for production systems were assessed, based on existing farm operations and experimental trials conducted in Hawaii: monoculture of threadfin using water purchased from an aquaculture park; and from private wells; joint culture of threadfin with flatfish using water purchased from an

aquaculture park; and a Hawaiian fishpond under monoculture conditions.

Market parameters such as the farm-gate price and seedstock cost influence the finan-



Photo courtesy of the Oceanic Institute's Finfish Program

cial results of the operations. However, the impact of these 2 variables in the offshore and inland facilities is variable: the selling price of the harvested threadfin has a greater impact on the profitability of operations, compared to the changes in fry cost. The land-based systems can afford a doubling of the fry sale price (currently suggested at \$ 0.25/piece), and remain profitable. The same conclusion is obtained when varying seedstock price in the 6-cage

modular system. The result of this later scenario is as expected, as size economies come into play when evaluating the offshore system for this and other variables.

The offshore cage production model defined the cost structure for cage-produced Pacific threadfin. Several avenues were explored that may improve production efficiencies and thus profitability. Analysis on production efficiencies including feed costs, FCR, growth rates, harvest density, and financial leverage were explored. Based on the changes in parameters that may be achieved by a specific enterprise, cage production systems can evaluate the parameters that will effect sizable changes to cost and profitability. Sensitivity analyses performed on the base model indicate that changes in harvest density, for example, may have a greater effect on profitability than reduction in feed costs and variations in fry price.

A reduction of the selling price to \$4.00/lb may leave all inland operations unprofitable, with the exception of the joint culture. This issue might have important consequences on the future of the industry in the state (Hawaii). Expecting declining market prices in the future for Pacific threadfin in the local market, operations depend on external market factors to be profitable. While the current local and export markets are still being defined, it is expected that all commercial systems will depend on production efficiencies to realize a profitable investment.

For more details on the economic model and its availability, please contact Dr. Anthony Ostrowski at [aostrowski@oceanicinstitute.org](mailto:aostrowski@oceanicinstitute.org) or (808) 259-3109

## Extension agent helps start aquaculture farm in Polle

Simon Ellis, regional aquaculture extension agent, often makes presentations throughout the U.S. Affiliated Pacific Islands describing the numerous options for people to enter into the field of aquaculture. During a two-day conference on marine ornamentals and aquaculture sponsored by the Pacific Islands Development Bank (PIDB), one of the participants became particularly motivated to start his own aquaculture venture and filed a business plan to PIDB to start the Polle Trading Post Aquaculture Farm (PTPAF), a multifaceted aquaculture operation.



Workshop participants with Simon and Eileen Ellis - Photo courtesy of Simon Ellis

To get his business started, Larry Bruton of Chuuk State asked Ellis to provide training to him and his staff in sponge, giant clam and coral farming, assist in surveying his reef areas and provide advice on

plans for developing his aquaculture business. His property is on the island of Polle, one of the main islands in the Faiu Chuuk archipelago within Chuuk lagoon. The island's population is approximately 2,000, spread throughout four villages. There are no roads, electricity or municipal water systems. Polle's economy is subsistence-based and relies on fishing and copra production.

Bruton will develop his business around sustainable aquaculture and a small retail store, which would boost the currently depressed state of Polle.



Simon Ellis demonstrates sponge collecting - Photo courtesy of Simon Ellis

Ellis traveled to Polle for a four-day training session in October. During those four days, Ellis provided training on sponges, giant clams and corals. Although none of the participants had any

background in aquaculture, Ellis feels that his lessons have prepared the employees for the basics of aquaculture farming. He anticipates returning soon to provide a follow-up training session.

## CTSA project to provide base for pearl-farming in Hawaii

Black pearl farming has been a common practice in French Polynesia since the 1970s and according to Dr. Maria Haws, Extension Specialist and Director of the pearl research and training program at the University of Hawaii at Hilo, a highly profitable business. The farming of Black-lip pearl oysters (*Pinctada margaritifera*) is worth approximately \$140 million (USD) per year in French Polynesia.

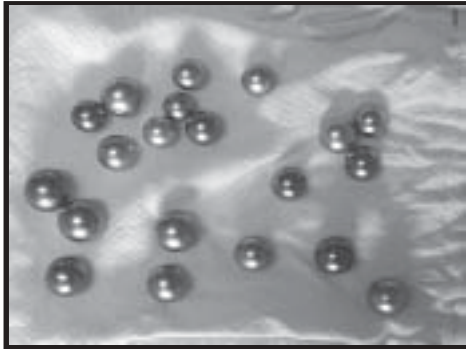


Photo courtesy of Maria Haws

In a CTSA-funded effort to foster the development of pearl farming, Haws will lead a team in a project designed to address critical issues currently affecting pearl farming development in Micronesia. This will include the Federated States of Micronesia (FSM) and the Republic of the Marshall Islands (RMI). The industry in the RMI is relatively mature compared to that of the FSM and Hawaii. Thus while the project will focus on the RMI and the FSM, Haws and her team believe that the technology developed by their work there will aid in the development of a pearl farming industry in Hawaii. The results from this work are directly applicable to challenges faced by the growing Hawaii pearl culture industry, for example, avoiding the problem of severe snail predation.

There are two industry partners supporting this work: Robert Reimers Enterprises (RRE) and Black Pearls of Micronesia. RRE, the first Marshallese-owned pearl farm, has been supporting CTSA research and extension efforts for over eight years and has generously shared their experience with other farmers and researchers.

Although the Hawaiian Islands provide a good environment for pearl culture, the formerly copious pearl oyster stocks in Hawaiian waters have long ago been severely depleted. Presently, the oysters can still be seen scattered throughout the Hawaiian reefs, but not nearly at the same abundance. Black Pearls Inc., a company based on the island of Hawaii is currently working on an initiative to construct a pearl farm in waters near the Honolulu International Airport.

Neil Sims, vice president of Black Pearls Inc., feels that the farm would not only boost Hawaii's economy by supplying local jewelers with the pearls rather than having to continue to import them from Tahiti, but will also help restock the oyster-rich Hawaiian waters. Sims is a co-PI on the project with Haws, ensuring that all information gleaned from the project will be communicated and used to ensure the future success of spat growout in Hawaii and the financial returns from the proposed farm in Honolulu.

The work done by Haws and her team of researchers will focus on improving pearl production techniques and increasing economic returns from pearl farming.

### *The objectives*

In the RMI, predation is high, occasionally resulting in a mortality rate of 100%. Snails and fish predation are the primary cause for mortality at the pearl farms in the RMI. Haws and her team of experts will attempt to reduce mortality at the juvenile and adult stages by identifying sites with low snail predation and by designing and constructing improved net panels for holding juvenile and adult



Mrs. Joan Rolls, a pearl jeweler from the Cook Islands, grading a pearl harvest

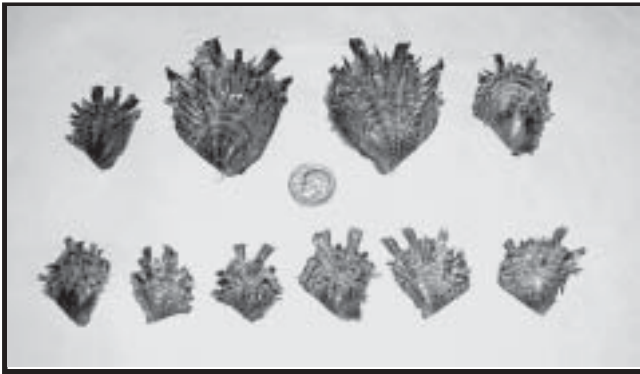
- Photo courtesy of Simon Ellis

pearl oysters. Because the first two years of pearl oyster culture is so laborious, profitability is seriously undermined when mortality occurs. It is estimated that labor costs alone can be up to \$60 (USD) for the first two years for each pearl.

The RMI component will also focus on creating a local capacity to manufacture equipment such as pearl net panels to supply the growing local industry. Currently, all materials are imported from the Mainland U.S. or Asia, although preliminary financial analysis suggest that local manufacture is economically feasible and will permit farmers to design and order custom made equipment to meet their specific needs. The project proposes to work with a local woman's group to manufacture equipment.

Spat collection is not a viable means to attain spat in most of Micronesia because there is not an abundance of pearl oysters. Thus the second objective of the project will be to investigate hatchery techniques for the production of spat. To do this, a small research and demonstration hatchery will be established at the Pohnpei Ag-

ricultural Trade School (PATS), where students are currently trained in aquaculture. The hatchery will “introduce and demonstrate the technology so that privately owned hatcheries can be established, while providing the means to train students in aquaculture”. There is a strong emphasis on training students as a strategy to produce a cadre of well-trained aquaculture professionals and farmers in Micronesia to eventually alleviate the need to depend on foreign technical assistance. The training has a secondary goal of preparing PATS students to become aquaculture farmers and good business people and complements other instruction at PATS in agricul-



*Black-lip pearl oyster spat*

-Photo courtesy of Simon Ellis

tural business.

With the realization that Hawaii and the other U.S. Affiliated Pacific Islands require unique marketing strategies because of their obvious differences to the mainland U.S., the project will develop production models to “assist farmers in optimizing strategies and to aid in decision-making related to marketing and buyer preferences”. The model will be a mathematical bioeconomic model that “incorporates and characterizes the dynamic stochastic interaction of production process and markets”. Dr. Quentin Fong, Natural Resource Economist from the University of Alaska Sea Grant Program, will lead this effort. RRE and Black Pearls of Micronesia will share years of data and their farming methods to produce a realistic and usable model. Hawaii pearl farmers can also make use of this simple and adaptable model. RRE initiated efforts to conduct the study, recognizing that economic efficiency is key to making Micronesian and Hawaii pearl farms a success since the information needed to make critical management decisions is sadly lacking due to the secrecy that generally surrounds the industry.

The success of this project will result in a sustainable pearl farming industry in Micronesia and Hawaii and innumerable benefits to the economy and the society.

Dr. Maria Haws is a well-known expert in Black-lip pearl oysters. She is currently working on the publication of two pearl manuals due to go to press sometime this year.

## Red snapper spawning achieved by OI researchers

The Oceanic Institute (OI) has always been a leader in aquaculture technology and they took another step forward last November. For the first time on record, spawning has been achieved outside the red snapper’s natural reproductive season. On November 21, 2000, the Oceanic Institute reached the goal several organizations had been working towards – natural spawns of the red snapper (*Lutjanus campechanus*) in captivity.

A consortium of research organizations has been working on stock enhancement for severely depleted red snapper populations along the Gulf Coast since 1996. Funded through the National Marine Fisheries Service, the group includes the Oceanic Institute, the University of Southern Mississippi’s Gulf Coast Research Laboratory (GCRL) and Mote Marine Laboratory in Florida. The focus of the project is to develop technology and tactics for using hatchery-raised fish to restore depleted marine fish populations.

Culture research efforts are being headed by OI’s Finfish Program under the direction of Dr. Anthony Ostrowski in a project led by Dr. David Ziemann. Dr. Charles Laidley and Dr. Robin Shields lead broodstock and larval rearing efforts, respectively. The goal is to develop intensive propagation capabilities for stock enhancement and then to trans-

fer that technology to the GCRL.

Spawning of captive red snapper was first achieved in 1978 by Arnold, et al. They were able to accomplish a series of small spawns of 2,000-3,000 eggs, but were unable to keep broodstock populations alive.

About a year ago, OI brought in Charles Laidley, a reproductive physiologist and Robin Shields, a larval physiologist to head two teams in OI’s effort. Laidley’s team’s goal was to spawn the red snapper, while Shields’ team tackled rearing the larvae. Not only did they get the fish to spawn, but they also got them to spawn outside of their natural reproductive season. However, Laidley says, “We have made some significant advances, but are really still in the early stages of development. This species is particularly difficult to work with due to the development of intense aggression in correlation with sexual maturity.”

The consortium’s primary objective is enhancement of the natural stocks. OI’s first obstacle was to establish quarantine protocols for working with a non-indigenous species and then to overcome the difficulties related to the constraints of working with transported animals over extended distances. In



Photo courtesy of Charles Laidley

(See *Red snapper*, page 11)

## OI project, a national model for offshore cage culture

By Angelos Apeitos, Jackie K. Zimmerman and Kai Lee Awaya

Participating with scientists at the University of Hawaii's Sea Grant College Program, the Oceanic Institute (OI) initiated an offshore cage culture research program, called the Hawaii Offshore Aquaculture Research Project or HOARP. To determine the feasibility of offshore cage culture in Hawaii, SeaStation 3000, a 50-by-80 ft bi-conical sea cage was set approximately two miles off Ewa Beach, Hawaii in 110 ft of water stocked with Pacific threadfin (*Polydactylus sexfilis*). The project is the first of its kind in Hawaii and is anticipated to be a national model for offshore cage-culture.

The culture of the threadfin was reintroduced to Hawaii's industry in 1994 by a CTSA-funded project headed by OI's, Dr. Anthony Ostrowski. Although the offshore cage project is not funded by CTSA, it was initiated as a follow-up study to the CTSA-funded Marine Food Fish Seedstock Production project.

There were two phases to HOARP. Phase I commenced in April 1999 and ended in October 1999. Approximately 70,000 fingerlings were stocked into the cage to yield approximately 40,000 lbs at the end of the harvest in late October 1999. In April 2000, the cage was restocked with approximately 120,000 fingerlings as an attempt to increase operation and harvest densities to commercial scales. Phase II of HOARP was completed in early December 2000 and yielded approximately 76,000 lbs of threadfin. The two phases differed from one another in terms of their general operations (stocking, feeding and harvest), densities and duration. Improved biological and environmental monitoring protocols were

established as well by staff of OI.

The top of the 50-by-80 ft bi-conical (diamond) shaped SeaStation 3000 (manufactured by Ocean Spar Technologies in Bainbridge, Washington), lies 40 ft below the surface of the water, out of the way of boating traffic in the area. The

base line of its growth performance, which determined the duration of the project and the feeding protocol was also established by OI. Furthermore, threadfin, called moi locally, is an indigenous species

to the islands and an accidental release of the fish from the cage would not significantly harm the fisheries around the island.

Species grown in other parts of the world are seabass and seabream (Mediterranean), salmon (USA, Canada, Chile, Northern Europe), yellowtail and amberjack (Japan, Mediterranean, Australia) and tuna (Australia). The cage technology can also be applied to freshwater aquaculture to grow catfish, tilapia and other freshwater commercial species. It is already established that there are high-energy costs involved in onshore growout of the Pacific



Two divers clean the outside of the SeaStation 3000, a 50-by-80 ft bi-conical sea cage - Photo courtesy of the Oceanic Institute's Finfish Program



Photo courtesy of the Oceanic Institute's Finfish Program

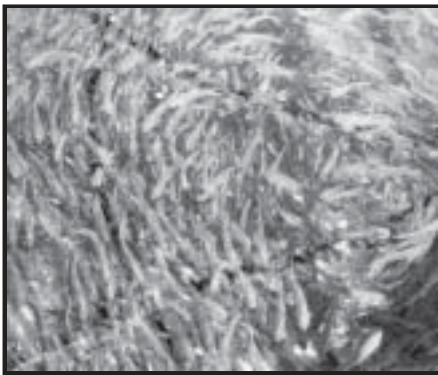


Photo courtesy of the Oceanic Institute's Finfish Program

cost of the cage, which includes installation costs, ranges from \$80,000 to \$100,000. Species selection for the cage was based on availability and the requirement for use of indigenous species.

The Pacific threadfin was a prime candidate due to the research funded by CTSA and conducted by OI's Finfish Department. The research discovered ways to produce threadfin in high numbers. A

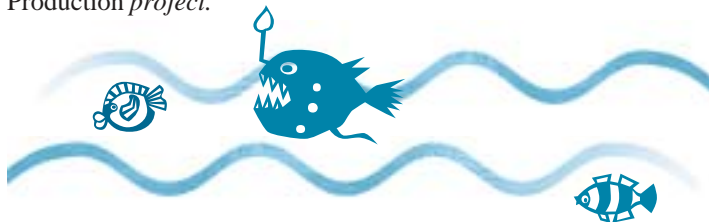
threadfin as well as other commercial marine finfish. These high costs limit the margin of profit for the farmers as well as the drop in prices of finfish to the consumers. To add to all the cost concerns by the farmers, environmentalists and state agencies are concerned with the highly polluted effluent that enters near-shore waters from farm sites. Phase I results of the HOARP project determined little to no impact to the surrounding water quality. Phase II water samples are still being processed.

The Oceanic Institute, in cooperation with the University of Hawaii, is investigating the socioeconomic impacts of the cage in the state of Hawaii. None of the fish from either one of the two phases were distributed commercially in the state to avoid competing with local farmers. Instead, with the help of the State's Aquaculture Development Program, new overseas markets were exploited

and created due to the high influx of harvested fish from the cage. Harvest techniques enable harvests of at least 9000 lbs at one time depending on the size of the harvest vessel.

Since these projects are the first of their kind in the state, further research needs to be conducted on operational, biological and economic aspects of offshore cage culture before its feasibility and sustainability is determined. OI is currently analyzing results of HOARP Phase II, results of which will be available later this year. Researchers at OI anticipate further research in the very near future pending the award of funds.

*Angelos Apeitos and Jackie Zimmerman were an integral part of OI's research team in this project. They are both research assistants heading the finfish growout department and offshore development. Ms. Zimmerman handles all environmental and some biological aspects of the cage. Together, they led the team in cage operations. Additionally, both are responsible for fingerling distribution to the farmers through CTSA's Marine Foodfish Seedstock Production project.*



## Red snapper

(continued from page 9)

early 2000, research on transport methods led to greater survival rates for both larvae and broodstock. Although the initial focus of the research was to develop transport protocol for successful transfer of larvae, the natural spawning achieved has, according to Ostrowski, "given us great confidence that we will be able to produce eggs and larvae that will more rapidly advance research and the objectives of the consortium."

Thus having successfully created a more effective transporting system, the OI team focused on developing a technology with which they would have more control of the larval rearing process. This would allow them to provide larvae and fingerlings when they wanted it and as many as they needed.

The spawns produced eggs that were up to 78 percent fertile over a period of about one month. Many of the spawns produced over 150,000 fertile eggs each. Laidley anticipates that OI will be able to do even better in the future. The goal is to create technology to produce spawns of over a million eggs on demand.

When rearing larvae, most institutions are unable to get their fish to even reach mature stages. OI's team was able to rear the red snapper to maturity. This brought them to the same point the researchers had reached in the 1970s. However, through their research they discovered preliminary evidence that aggressive behavior emerges as the red snapper reaches adolescence. The animals become so aggressive that eventually they all kill each other. It was this behavior that halted the research in the 1970s, but not OI's. Through good husbandry protocols, water-quality and feeding practices, OI was able to overcome some of the problems encountered in the 1970s and 80s by other research teams.

Now the OI hatchery team is attacking the obstacles associated with the first-feeding stages of the larvae when in captivity.

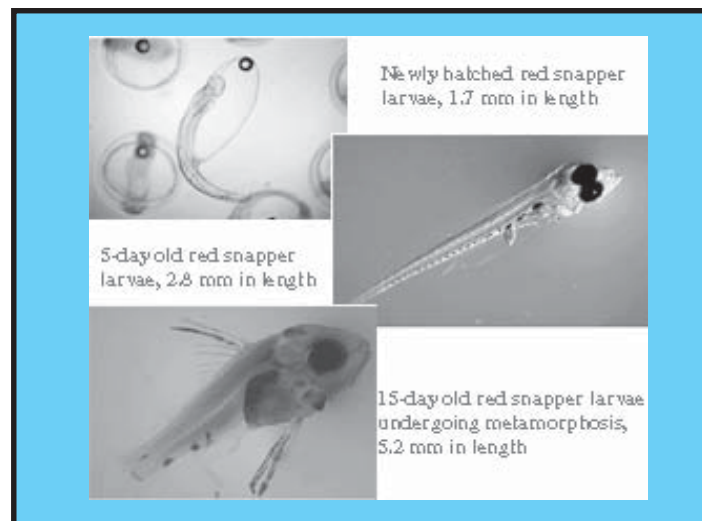
## Meeting in Pohnpei

(continued from front page)

for starting farms. Specific constraints for black pearls were primarily a shortage of spat supply. Specific constraints for marine ornamentals were related to transportation and the lack of local wholesalers to market product. Broodstock shortages topped the list of constraints for sponge farming.

CTSA is acting quickly to tackle some of the constraints to aquaculture development in the region. Starting in June 2001, CTSA-funded projects in the region will include pearl oyster hatchery work and sponge nursery and extension projects. In addition, the full-time CTSA-sponsored, regional aquaculture extension agent, Simon Ellis, will be working to increase aquaculture awareness, technology transfer and coordination through a regional newsletter and localized training. Other projects up for consideration by the CTSA Industry Advisory Council this year will be geared to improve marketing assistance to the region and continue work on marine ornamental industry development.

*Simon Ellis is the CTSA-funded regional aquaculture extension specialist for the U.S. Affiliated Pacific Islands. He is stationed in Pohnpei and works year-round to assist in the development and permanence of the aquaculture industry. To contact Mr. Ellis, please email him at [sellis@mail.fn](mailto:sellis@mail.fn) or call 69-1-320-2462*



Photos courtesy of Robin Shields

The larvae are so tiny (0.7 mm) that the artemia and rotifers usually fed to larvae are too big for them to eat. Initial studies by the GCRL show that the plankton-rich brown-water found in the Gulf of Mexico is optimal when filtered and condensed. However, because the natural environment is hardly reliable, OI is developing protocol for the culture of the plankton needed by the red snapper.

OI's success also puts a bright spot in the future for farmers. Techniques to ensure year-round spawning and mass culture methods of the larvae (which are difficult to rear) to provide a reliable source of fingerlings are likely to be developed as an outcome of their breakthrough.

# 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 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 pri-

orities. 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.

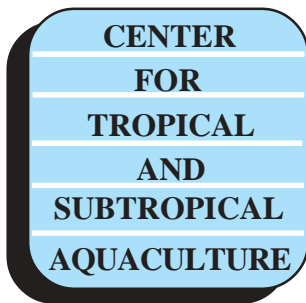
CTSA is jointly administered by The Oceanic Institute and the University of Hawaii and is located at The Oceanic Institute's Makapu'u Point site on the island of Oahu in Hawaii.

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).

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