

# Hawai'i Aquaculture News

VOLUME 2 NUMBER 2

JUNE 2008



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*Readers' contributions are invited with aloha, and much appreciated. They should be emailed to the editor at [jszyper@hawaii.edu](mailto:jszyper@hawaii.edu), or discussed by telephone for other means of transmittal.*

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## ***Aquaculture Education: AQUA 106 Returns***

Many of our readers have heard of or had some contact with the undergraduate degree program in aquaculture at UH Hilo, in which students earn bachelor's degrees in Agriculture with Aquaculture Specialty. Just recently, Windward Community College on Oahu has resumed offering its single 3-credit course, Introduction to Aquaculture (AQUA 106). This course was first developed and taught by Jeff Hunt near the turn of the 1980's, later taught by others including your editor, but had been off the curriculum for a while until this past spring term. The course was taught by new instructor Mahealani Kaneshiro-Pineiro, a recent Master's degree graduate of the UH Manoa Zoology department, who previously earned a bachelor's degree in Marine Science at UH Hilo, had taken some of the aquaculture courses, and worked with Jim Szyper at the UHH farm as one of a long line of excellent student assistants. The assistants' work is also part of the educational opportunity offered at UHH. *(Continued on page 6)*

## ***An Excellent Introduction to Koi***

On this past May 9, the Big Island Aquarium Society (BIAS) in Hilo had as its monthly guest speaker Mr. Taro Kodama of Kodama Koi Farm on Oahu, who presented an excellent introduction to the world of koi in person, and generously brought fish for sale at "greatly reduced prices," as the newsletter stated. In the BIAS newsletter that came out as usual during the week before the meeting, editor Jesse Crawford provided the membership with an excellent introduction in print. He obtained and printed a history and background piece on koi from Wikipedia, and personally wrote a review of the book, "Introduction of Nishikigoi" by Mamoru Kodama, which is accompanied by a CD containing 300 photographs with discussion of judging criteria. The newsletter issue (May 2008) is available on the

BIAS web site [www.biashawaii.com/index.php?Newsletters](http://www.biashawaii.com/index.php?Newsletters). This monthly newsletter is distributed by email to paid members (\$15 per year) and accepts advertising by businesses at very low rates.



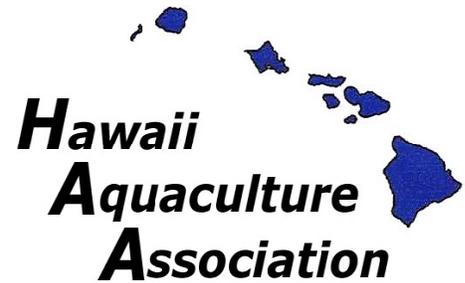
## ***Aquaculture Jobs Site***

Are you looking for employees or employment beyond Hawaii? Some of our community recently received an email that said:

**Check out** some of the recently posted jobs on [www.AquacultureConnection.com](http://www.AquacultureConnection.com). **Job Seekers** - If you can't find what you are looking for, Submit your resume and one of our professional recruiters will help you find your next great opportunity! **Recruiters and HR Managers** - If you have a job opening that requires Aquaculture experience, post your positions on our Job Board. \$150 for 90 days. Attract qualified talent by posting a Preferred Employer Profile. \$500/annually.

Start your search at: [www.aquacultureconnection.com/JobBoard/JobList.aspx](http://www.aquacultureconnection.com/JobBoard/JobList.aspx)

The **Hawaii Aquaculture Association** is the statewide producers' organization. Its mission is to foster the development of commercial aquaculture production in Hawaii. HAA provides a unified industry voice for legislative issues, opportunities for networking and fellowship with other aquaculturists, and numerous other benefits to members.



## President's Message

Dear HAA members,

A song from my youth conveyed 'the times, they are a-changing', and such lyrics would certainly apply to our situation in the Hawaii aquaculture industry today. With rising costs on virtually every front, with the concerns of economic recession and the tightening of consumer spending, and with decreasing government coffers and programmatic spending, we may be in for an interesting ride ahead. At the same time, decreasing wild seafood supplies and increasing consumer demand for seafood offer potential opportunities for Hawaii's aquaculture seafood producers, and increasing air freight rates for distant ornamental producers offer increased opportunities for Hawaii's ornamental producers by virtue of being closer to major ornamental markets. The challenge for us all will therefore be to contain our production costs, maintain or find viable niche markets, adjust pricing as necessary to remain profitable, and maintain essential government support programs.

As the HAA Board of Directors considered potential themes for this year's HAA Conference, we were drawn to topics addressing aquaculture production costs, particularly energy costs. As we further refine this theme, we once again encourage HAA members to provide us input on topics you would like to have addressed at our conference and for which you can suggest appropriate conference speakers. This should be a joint effort of all members, so please get involved and help us with planning for this year's conference.

The 2008 legislature ended with limited success for HAA and the Hawaii aquaculture industry. We did succeed in having a resolution passed calling for a financial and management audit of NELHA's operations, and we supported three HAA-initiated bills requesting funds to support aquaculture extension, shellfish certification, and aquatic quarantine. These bills passed the various subject matter committees and the House Finance Committee, but failed to be scheduled for hearing by the Senate Ways and Means Committee and therefore died in committee...a fate shared by most bills requesting funds this session. We also joined with the Hawaii Farm Bureau Federation in supporting legislation to amend the State Enterprise Zone law to be more supportive of agriculture and to pass new legislation to protect important agriculture lands, and these bills are currently awaiting the Governor's signature to become law. In order for us to be more successful with our legislative efforts in the future, we may need to increase a positive perception of our industry with the legislature. This will need to be an effort that we are all involved in if we are to succeed.

As I so often say, please remember that we are all in this together and need to show the community and our elected officials that we are a unified and active industry and association. Also, as all of HAA's activities are entirely volunteer, we need broad membership support of our efforts in order to be fully effective. Again, please offer topic and/or speaker suggestions for this year's HAA Conference and join us in our various positive promotional efforts of our industry.

## Board Member's Message

At a recent HAA Board meeting it was suggested to have a letter from one of our board members in each newsletter and since I was the one who made this suggestion, I was volunteered to do the first one. The Aquaculture Industry has a vast amount of issues that we all need to be informed on. Some will have a direct effect on our business and others will not, but if we are to have a vibrant industry, we must all strive to be educated on such issues.

Over the years in dealing with offshore aquaculture I have seen first hand the challenges that affect our industry. In the future I hope to share some of my views on such subjects as marketing, permitting, community relations, federal legislation, and the relationship between industry and research. Today I will share my experience on the changing times of the seafood industry.

*(Continued on page 6)*

**Ready to start up or renew HAA membership? Use the form on page 8.**

# Hawaii Aquaculture Extension Program




**The Hawaii Aquaculture Extension Program** is your statewide extension service. We support the development and sustainability of aquaculture business in Hawaii by providing information, education, and technical assistance to existing businesses, potential entrepreneurs and the general public. The Program is sponsored by the UH Sea Grant College Program, the Aquaculture Development Program of the Hawaii Dept. of Agriculture, and the UH College of Tropical Agriculture and Human Resources.
 

## Aquaculture Extension in American Samoa

Your “statewide” extension program actually extends a little further, as noted in an earlier issue of this newsletter. UH Sea Grant, with funding initiated by American Samoa’s congressman, supports extension agent Ephraim Temple in residence there, based at American Samoa Community College. Your Hawaii program specialists and numerous other academic and technical folks have visited to learn and contribute.

Awareness of aquaculture in American Samoa is increasing, but knowledge of species options and technical skills for successful aquaculture is still not widespread. Ephraim taught two courses at ASCC during fall 2007: Introduction to Aquaculture and Marine Science Senior Projects. As part of their term project, aquaculture students renovated a brick and cement tank in Leone Village in preparation for tilapia culture. They are procuring the necessary permits to begin fish culture in the next quarter.

The demand for tilapia in American Samoa results in roughly 170,000 lbs per year in local consumption, generally satisfied with imported frozen fish. Resources on Tutuila Island are ideal for tilapia aquaculture, however, and it is generally desired and agreed that production can be increased locally to decrease dependency on foreign imports. Ephraim served as technical advisor to two farmers who received Sustainable Agriculture Research and Education grants (USDA SARE program) last year. One farm is evolving into a tilapia hatchery demonstration farm while the other is demon-

strating aquaponics. Workshops at each of these farms will increase public knowledge of hatchery and aquaponics methods. Both will lead to increased yields of food fish per cubic foot of water over pond culture with less management.

The competition between cultured fresh fish and frozen fillets is made difficult by the low costs of the imported fish and the high costs of farming, particularly that of feeds. Ephraim and Darren Okimoto, the Hawaii Sea Grant Extension Leader, hosted Dr. Chhorn Lim, a nutrition specialist with the U.S.D.A., on Tutuila in December 2007 to assess the suitability of local agriculture products for the production of tilapia feeds. Highlights of his visit include site visits to local tilapia farmers, meetings with officials at both tuna canneries on the island, and his presentation of two public workshops on tilapia nutritional needs and feeds

formulation. Dr. Lim suggested a recipe for creating a complete tilapia diet using fishmeal, breadfruit, banana, flour, oil, vitamins, and minerals and demonstrated how to mix, pelletize, and dry diets. Sixteen people were educated on the nutrition of tilapia during Dr. Lim’s first workshop, which addressed feeding practices, feed formulation and manufacture, and nutrient requirements. The second workshop taught feeds production to nine attendees using a hands-on demonstration at the ASCC feeds production lab.

The issue of local production of fish feed from available low cost ingredients has been pursued on and off for some years. Recent progress has taken it further than ever toward practical results for farmers. Funding in the amount of \$5,000 was received from the American Samoa Community College Land Grant Program to purchase equipment to further develop the feeds lab on campus. Both of the large tuna canneries on Tutuila are willing to sell fish meal to local farmers, including the Samoan Family Sunfish Cooperative, Inc., to use as the major protein component of locally made fish feeds. Protein is typically the most costly feed component and both canneries have offered to sell the fish meal at a very low cost. One tilapia farmer has used the feeds production lab established by Hawaii Sea Grant at the American Samoa Community College to produce over 50 lbs of pelletized feed.



*Top Left: C. Lim (center), D. Okimoto (right).  
 Bottom Right: E. Temple, C. Lim, J. Fuamatu.*



PACIFIC AQUACULTURE  
& COASTAL RESOURCES CENTER

200 West Kawili Street, Hilo, Hawaii 96720  
(808) 933-0706

## *Ocean Day 2008 a Splash at the Pacific Aquaculture and Coastal Resources Center*

Over 1000 people attended the second annual event themed "Year of the Reef" held on Saturday, April 26<sup>th</sup> at the Pacific Aquaculture and Coastal Resources Center (PACRC) in Hilo. The free event was designed to increase ocean conservation awareness through interactive education. The opening ceremony included a welcome by UHH Chancellor Rose Tseng and Keaukaha Community Association President Patrick Kahawaiola`a, followed by a hula performance by the children of Ka'umeke Ka'eo Public Charter School. This year's event featured more than 30 activity booths designed by local agencies, organizations and University groups such as UHH Partnership for Reform through Investigative Science and Math (PRISM), state DLNR and DOH, Marine Mammals Response Network, Dolphin Quest, The Nature Conservancy, UH Sea Grant and the Mokupapapa Discovery Center.

The splashes from PACRC's large tanks attracted a steady crowd of people that eagerly waited to participate in the ROV challenge with underwater Remotely Operated Vehicles (ROV) designed by Hilo Intermediate School Robotics Team. The University of Hawaii at Hilo Marine Science SCUBA divers put a thrilling twist on the old pole and line fishing game by diving in the tanks and swimming away with the hook before sending "fish" up to be caught and identified.

Each booth offered a fun hands-on experience for kids of all ages that got them engaged and excited about science. They learned a variety of science techniques as they learned about genetics and made their own DNA necklaces from cheek cells,



identified plankton under a microscope, and practiced proper handling of sea creatures in the touch tanks. Adults and kids enjoyed the coconut frond weaving, Native Hawaiian art by Papa Mu Gallery and poi making workshops that were a great new addition to the event, as well as entertainment and food provided by the Na Waha Hanakahi canoe halau. There was also plenty of helpful information on careers, internship opportunities and marine science curriculum for teachers and students.

The day was also an opportunity for people to explore facilities and activities at the Center. The educational outreach program at PACRC highlighted the collaboration with Na Pua No'EAU Center for Talented and Gifted Native Hawaiian Children over the last year, as students presented a poster and display of their final data on their project monitoring the growth of mullet at PACRC. The site tours given through out the day by PACRC staff showcased our current research on pearl oysters, limu, sturgeon, aholehole, and mullet, which brought in positive feedback, great interest from the community and a dramatic increase in school field trip requests after the event! For more information on touring the PACRC Keaukaha site or to get more information on Ocean Day please contact the main PACRC office 933-0706.

Mahalo nui to all those that participated and attended Ocean Day 2008 and for the generous support received from the Hilo Jaycees and UH Sea Grant for this year's event, as well as our partnership with Na Pua Noeau in making the day come off so well! See you next year!



**AQUACULTURE IN  
HAWAII**



**AQUACULTURE DEVELOPMENT PROGRAM  
DEPARTMENT OF AGRICULTURE  
STATE OF HAWAII**



*The Aquaculture Development Program (ADP) provides a wide range of support for Hawaii's aquaculture industry. ADP is a planning, development and problem-solving organization, whose goals are to get production and service businesses started, and once started - to help ensure their success through active assistance.*

## ***New Staff Members at ADP***

**Daniel Pierce** has recently joined ADP as its new Information/Marketing Specialist. He comes to us with many years of Peace Corps, building industry and publication experience and is replacing Dean Toda who left to join the private sector last August. Dean tirelessly promoted the aquaculture industry and its products for over 18 years.

Dan is currently learning about the industry and will be visiting our local producers to help develop brochures for product promotion and health management. He is producing the ADP electronic bulletin *Aqua Flashes* with a new improved look. Look for him at future promotional events that ADP participates in, or stop by for a visit. He may be reached at [daniel@hawaiiaquaculture.org](mailto:daniel@hawaiiaquaculture.org).

**Amanda Lowrey** recently joined the ADP staff as a microbiologist. She grew up outside of Washington D.C. and received her B.S. from the University of Miami majoring in biology and German. She is completing her Ph.D. from Northwestern University in cellular and molecular biology, focusing on membrane fusion of Herpes viruses. Her work has included research in breast cancer, cochlear development, and experimental feed crops, as well as stints at a German-owned travel agency and as a volunteer English teacher in Laos.

Amanda's grandfather was an ophthalmologist and surgeon at Tripler Hospital, and her father received both his bachelor's and master's in physics from the University of Hawaii, so she is pleased to continue a family tradition of both academics and public service in Hawaii. For many years she also has been actively involved with Korean adoptee organizations around the world and is currently on the board of Korean Adoptees of Hawaii.

At ADP, she will be helping to develop molecular diagnostic tests for finfish and shellfish diseases, and also conducting research in disease prevention. She can be reached at [amanda@hawaiiaquaculture.org](mailto:amanda@hawaiiaquaculture.org).

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**Web: [www.hawaii-aquaculture.org](http://www.hawaii-aquaculture.org)**



## ***Fish Updates***

**Nile Tilapia** It is well known to some of our readers that the Nile tilapia *Oreochromis niloticus* has not been legally permitted for commercial (nor any) use in Hawaii,

though several other tilapia species are permitted, and it is commonly said that the species is actually in the state. In order to bring our state and industry into the modern day on this issue, your extension program and the HAA, ADP, and other stakeholders have been working to get a permit to bring a new stock of juvenile Nile tilapia into Hawaii on legal terms. On May 27, the state Board of Agriculture approved our application to import, with the species now listed as "conditionally approved for research and exhibition" (i.e., still not for commercial production), for examination and adaptive research at the UH Hilo farm. Thanks to all who contributed information and support, and to CTSA for patient support of this lengthy but important process.

**Bluefin Tuna** Quite lot of large tuna are aquacultured worldwide, almost entirely by captive growout of wild-caught juveniles. The high sushi-market price of the product also makes it worthwhile to continue work on the difficult captive reproduction and larval rearing of the several related (and some demonstrably overfished) species. Thanks to Clyde Tamaru for sharing this information from a slide show on a Japanese group's rearing of Pacific bluefin, *Thunnus orientalis*. Adaptations to open sea life make larval rearing difficult: hatchlings are very *small* (~ 1mm, *hard to see*), fry *grow so fast* (*bypassing small predators' attention*) that their food size preference changes (to larger) every other day, and all sizes *spook readily* (*alert*) and damage themselves on container sides, even soft ones. The group has become able to produce batches exceeding 5000. For juveniles, the larger container the better: they did best in a tank of 30 m diameter, 16 m deep. Their growth (i.e. profit-generating) potential makes it worth the trouble, getting them to 20 kg (44 lb in two years), more than twice that in another year. This far exceeds the growth rates of Japanese yellowtail (Kona kampachi relative) and mahimahi, two of the fastest outside the tuna world.

(Board Member's Message, from page 2)

Recently I attended the Boston Seafood Show. During the show I met several high level distributors who are interested in our product. One issue that illustrated how the seafood industry is changing is the subject of frozen products. While I have always felt that one advantage of aquaculture is the ability to harvest to order and have fresh product vs. frozen, our customers are changing their opinions on this as well as how we package aquaculture products. Consumers want the ability to increase shelf life by freezing the product, have a product that will thaw in minutes, and have a product already cleaned. This is not necessarily new; however, a major driving factor for frozen food is the cost of shipping. The cost of air freight due to high fuel prices has become such an issue in society it is impacting the seafood industry.

Just as some from within our own industry tout to be "green and clean" in their operational practices, many distributors are also marketing frozen seafood as "green and clean" since shipping frozen products takes less fuel to get it to market. This coupled with the fact that labor has increased substantially for the restaurant and shopping markets, businesses do not want to deal with paying labor to prep products.

Technology is also another key factor driving the frozen seafood rush. The number one question asked of our product

was if there is vacuum to liquid freezing capability. Right now, the answer is no, however, distributors are willing to make this investment for us, demonstrating a high level of interest. Consumers are better educated regarding our products as well, and there is no question that certain seafood products should freeze due to quality.

There are many other new technologies to increase or enhance the value of seafood products, some are good and others are not, but one thing is clear - the practice of freezing products for shipment is going to become the future for our industry unless the oil prices are reduced.

Even if products are marketed only within Hawaii, the cost of shipping inter-island has increased dramatically. Once the consumer accepts frozen products, it will be forever changed. Ten years ago who would have predicted that nearly 90% of all poke, (a raw fish specialty) would come from a frozen product? It is very difficult to find fresh poke, now it is marketed as "freshly made," not fresh!

Finally, it is important that players in the industry have an open mind to changing trends, otherwise problems will arise while trying to remain competitive in today's changing economic world.

**Randy Cates - Hukilau Foods**

(AQUA 106, from page 1)

Mahealani brought fresh approaches to the course, including teaching collaboration with our extension specialist Clyde Tamaru and HIMB researcher Teresa Lewis, and guest speakers including Kathy McGovern-Hopkins, Dave Krupp, Jeff Koch, Allen Riggs, and Inge White. The fresh approaches and a high level of student appreciation for the course were reflected in their comments:

"Aquaculture 106 at WCC was the best class I ever had in college. .. We had hands on experience with Lyre Tail artificial insemination. We learned how to test water quality and all the intricate detail that goes into the building of an aquaculture system and we also had the pleasure of building one at HIMB. ... This is the first class that I actually got to know everyone in the class .."

"I believe this is a particularly important class for students who are not enrolled in agricultural or biology courses because it can provide a window through which we can begin to understand food production. .. Despite being concerned about my personal nutrition and diet, and feeling pretty savvy about knowing how food is produced, I was astonished at how much I didn't know!"

"Aquaculture 106 has been an excellent resource for me to learn more about the industry. .. what I got was even greater than I had anticipated. ..this class is definitely promoting the development of aquaculture in Hawaii and I hope it continues."

"The course exceeded all expectations and I am happy to have been a part of it's rebirth at WCC. "

Congratulations to Mahealani for an obviously successful session and thanks to her and her students for the update.



### ***Federal Cooperation Toward Alternative Feeds***

This past April, NOAA and USDA held a jointly sponsored session to discuss their Alternative Feeds Initiative. Background and details of this ongoing effort can be found at [aquaculture.noaa.gov/news/feeds.html](http://aquaculture.noaa.gov/news/feeds.html). To quote from the first page:

The purpose of the NOAA-USDA Alternative Feeds Initiative is to identify alternative dietary ingredients that will reduce the amount of fishmeal and fish oil contained in aquaculture feeds while maintaining the important human health benefits of farmed seafood. Ultimately, the initiative will lead to the commercialization of alternatives for some species which will result in reduced dependence on marine fish resources by feed manufacturers and seafood farmers worldwide.

## *Historical Notes on Red Tilapia in Hawaii*

by **Tom Iwai, Biologist, Anuenue Fisheries Research Center (AFRC)**

(in consultation with Mike Fujimoto and Wayne Okamura, and [editor's notes in brackets])

With the successful development of freshwater prawn (*M. rosenbergii*) aquaculture in Hawaii, Fuji wanted the AFRC staff to develop alternative species for aquaculture development. [The late Takuji Fujimura developed prawn reproduction technology at AFRC; Tom conducted much of the extension work that started the industry.] Tilapia genetic manipulation, especially changing the color from black to red/pink was critical to his plan given the stigma tilapia had at the time in Hawaii. On a visit to AFRC, Dr. Ichiu-Liao gave a slide presentation in which he showed a slide of red tilapia. I remember the fish had the distinctive *T. mossambica* plate-like lips but was pink-red in color. Dr. Liao confirmed that it was a tilapia hybrid. Fuji asked Dr. Liao to send us some of this red tilapia. The year Dr. Liao sent Fuji these fish from Taiwan is in question but was definitely 1978 or earlier.

Fuji had a lot of experience culturing tilapia fry in the mid-60s as a substitute bait to "replace" nehu for the aku fishery. According to Mike, Fuji had some doubts about the aquaculture potential of tilapia because of the inherent disease problems and constant treatment they required when mass cultured. However, in my conversations with him, Fuji convinced me that tilapia grown in clean seawater and fed a commercial fish food diet was an excellent foodfish. In my hana bata days growing up in Kalihi, we used to go down to Kalihi Stream and catch tilapia. We used to sell them to an elderly Filipino taxi driver who kept them in concrete ponds in his backyard. He claimed the tilapia was a good eating fish. We considered it a "trash" fish but decided to cook it and see for ourselves how it tasted. My friend fried it and we all sat down to a nightmare of "soft fleshy earthy tasting fish" and swore we would "never eat tilapia again!" Fuji laughed after hearing my story, but insisted I needed to see for myself how good cultured tilapia was. The next day I took home and cooked up some of our AFRC cultured tilapia. I immediately became a cultured tilapia convert. I forgot to mention that our taxi driver friend did tell us that he fed the tilapia commercial fish pellets and purged the fish in clean fresh water several weeks before harvesting them to eat. Being young, ignorant, impatient, and hungry teens, we didn't realize the importance of the proper preparation of the fish before eating it. This was in reality my first introduction to aquaculture and I didn't even know it. Anyway, this was why I became a firm believer that Fuji was right. If we could fool the public into thinking that what they were purchasing and eating was not tilapia, then tilapia might have a chance of becoming an important aquaculture foodfish in Hawaii. Fuji taught me an important lesson; "Sometimes perception can become reality if you are unwilling to think out of the box!"

Wayne Okamura recalls conducting his hybridization experiments in '78 utilizing AFRC's Taiwanese red that he got from David Onizuka with other "red" [refers to a range of shades with some red component] tilapia he acquired through the ornamental trade (pet shop?). We were successful in doing the necessary changes to the lips and shape of the fish, but Wayne's knowledge and hybridization efforts were instrumental in retaining the rose/red color as a dominant trait in AFRC's red tilapia stocks. According to Wayne, Terry Astro imported the Florida reds (Cherry Snappers?) into Kauai in '79 and Aquatic Farms began importing the Taiwan reds in the '80s. Around 1989, Richard Fowler brought in some red tilapia from Guam and along with the Waianae Opele Project, which promoted the culture of red tilapia in recirculating systems, popularized the current name of Hawaiian Sunfish.

Both Mike Fujimoto and Wayne don't recall anything about the test marketing of the AFRC's red tilapia to Tamashiro Fish Market. I recall being told this was done but can't verify it. If I remember correctly, some of the names Tamashiro tried were Egyptian Perch, Rose Snapper, etc. I remember being told that Tamashiro's was excited because they were able to sell the fish for ~ \$1.25/lb.; a price unheard of for tilapia. But aside from the price, what was most important and impressive was that the public's response was all positive. They wanted to know when more fish (red tilapia) would be available. From that day on, the tilapia industry in Hawaii was "born."

[Thanks to Tom and Mike and Wayne. Many readers know that red tilapia are an important component of our industry today, though lots of natural-colored ones are produced and sold also. Comments and original contributions are invited with aloha.]

### *Feed, Feed, and More Feed*

No apologies here for this newsletter's third item on feeds (see pp. 3 and 6). The price of gasoline, as folks are quickly realizing, is the tip of an iceberg, with a large percentage of its consequences below the surface. The need for creative thought and action on feeds is part of this emerging picture.

West Virginia University's *Fish Tales* newsletter ([www.wvu.edu/~agexten/aquaculture/newsletter.htm](http://www.wvu.edu/~agexten/aquaculture/newsletter.htm), thanks to Dan Miller, WVU, who sent it through Gary Jensen, USDA) has an article on page 3 about recovery of valuable protein and highly unsaturated lipids from fish waste, specifically the parts left over after fillets are taken. A few words about chemistry may be of interest to those who may be tired of words about gasoline, and the amount of meat left in the waste parts may be surprising.



# HAWAII AQUACULTURE ASSOCIATION

# INVOICE

NAME:  
COMPANY:  
ADDRESS:

## 2008 MEMBERSHIP RENEWAL:

Commercial Aquaculturist Member. Any person or company whose income derives primarily from aquaculture production or services and who possess a State of Hawaii General Excise Tax License for the purpose of paying taxes on that income. Commercial Aquaculturist members have all rights and privileges of membership in the HAA, and shall have the right to vote. **Only one person per company can have this membership; additional persons may join as an Associate Member.**

Associate Member. Any person who has an interest in aquaculture, but is not a commercial aquaculturist (as defined above) or student. This membership includes employees of commercial aquaculture companies and other aquaculture related businesses or agencies. Associate members have all rights and privileges of membership in the HAA, but shall not have the right to vote.

Student Member. Any student currently enrolled in a Hawaii educational institution. Student members may attend all meetings of the HAA and receive all mailings, notices, and publications of the HAA, but shall not have the right to vote.

.....

(Fill out below only if there are any changes to existing information)

Date: \_\_\_\_\_

Name: \_\_\_\_\_

Company: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ Zip: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

E-mail: \_\_\_\_\_

Select one:	<u>Dues</u>
<b>COMMERCIAL AQUACULTURIST MEMBERSHIP</b>	<b>\$30.00</b>
<b>ASSOCIATE MEMBERSHIP</b>	<b>\$15.00</b>
<b>STUDENT MEMBERSHIP</b>	<b>\$ 5.00</b>

School: \_\_\_\_\_

Amount Enclosed: \_\_\_\_\_  
Make check payable to: Hawaii Aquaculture Association

Return with payment to:  
**Hawaii Aquaculture Association, c/o 1177 Alakea Street, Room 400, Honolulu, HI 96813**