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From Basic Science to Food Production: A Success Story of USAID-funded Aquaculture Research in Mexico

By Grant Feist, Guillermo Giannico, and Carl Schreck, Oregon State University

In developing countries, aquaculture has been increasingly used to provide a source of protein for continually growing populations. This has led to technical, cultural and environmental challenges for these countries, which can be addressed through scientific research. These problems include the difficulty of importing exotic species, obtaining a reliable source of robust

GUILLERMO GIANNICO



Tilapia broodstock at Mariano Matamoros State Hatchery ("Jose Narciso Roviroso") in Teapa, Tabasco. Broodstock are from a line selection project at UJAT (ACRSP funded) to produce more robust fish.

broodstock, finding technologies to produce single-sex populations of fish, and impacts of aquaculture effluents on the environment and humans.

Many exotic species of fish that are used elsewhere in the world for aquaculture purposes (i.e. tilapia) have been imported for use in other developing nations. These fish frequently escape, causing environmental perturbations and displacement of indigenous species. This is not only a problem from an environmental point of view, but also culturally, as people must be convinced to change traditions in the types of food they eat. Many of these traditions have been practiced for generations. In addition, many farmers who want to raise

fish often do not because appropriate broodstock is unavailable or current technologies do not permit efficient protein production.

Some species of fish must be grown as either all-male or all-female populations because reproduction in ponds severely reduces meat output and also because one sex may grow much faster than the other. The production of single-sex populations usually requires the use of hormones (steroids). Although they are quickly eliminated from the fish, these compounds can directly affect fish culturists that come in contact with them. They also persist in the environment, potentially affecting both animals and humans.

...continued on p. 4

SUCCESS Program off to a Strong Start

By Maria Haws, University of Hawaii, Hilo

The USAID/EGAT Water Team has launched a new Leader with Associates Award Cooperative Agreement to advance the practice of integrated management of coastal ecosystems worldwide. The SUCCESS Program (Sustainable Coastal Communities and Ecosystems) emphasizes coastal resources, aquaculture, and fisheries management under the leadership of the University of Rhode Island's Coastal Resources Center. The Pacific Aquaculture and Coastal Resources Center of the University of Hawaii-Hilo (a current CRSP partner institution) is providing expertise in aquaculture and fisheries as a main sub-recipient. Other partners include the Sea Grant Network, The Nature Conservancy, World Wildlife Fund, Conservation International, Western Indian Ocean Marine Science Association (WIOMAS), Eco-Costas/Ecuador, the University of Central America (UCA), and other local institutions throughout Latin America and East Africa. The goal of the SUCCESS Program is to improve the quality of life for people in coastal communities.

Initial activities of this global effort will focus on three demonstration programs for sustainable livelihoods in Tanzania, Nicaragua, and Ecuador, continuing and strengthening on-going partnership efforts at these sites. The demonstration efforts will feature training and support for com-

...continued on p. 3

CRSP Researchers Attend the 7th Asian Fisheries Forum

By Yuan Derun,
Asian Institute of Technology



The 7th Asian Fisheries Forum was held in Penang, Malaysia, from 30 November to 4 December 2004. Six Aquaculture CRSP researchers, namely C. Kwei Lin, Amrit Bart and Yang Yi from Thailand, Md. Abdul Wahab from Bangladesh, Madhav K. Shrestha from Nepal, Le Thanh Hung from Vietnam, and Ph.D. students Yuan Derun, Dao Huy Giap, and Vu Cam Luong, who were partially or fully involved in the CRSP project from Asian Institute of Technology, attended this event.

Amrit Bart, Yang Yi, Md. Abdul Wahab, and Madhav K. Shrestha were invited as session chairs, reflecting the influence of CRSP research on aquaculture in the region.

CRSP participants took this conference as an opportunity to showcase the latest research and achievements of CRSP in the area of environmentally friendly aquaculture technology. They brought six oral presentations to the conference including:

Culture of Freshwater Prawn *Macrobrachium rosenbergii* with Closed and Recycle systems. Derun Yuan, Yang Yi, James S. Diana, and C. Kwei Lin;

Mitigating Environmental Impact of Cage Culture Through Integrated Cage-Cum-Cove Culture System in Tri An Reservoir of Vietnam. Le Thanh Hung, Yang Yi, James S. Diana, C. Kwei Lin and Dinh The Nhan;

Cove Culture of Marble Goby *Oxyeleotris marmorata* Bleeker and Carps in Tri An Reservoir of Vietnam. V.C. Luong, Yang Yi, and C. Kwei Lin;


Integrated Cage-Cum-Pond Culture Systems with High-Valued Stinging Catfish *Heteropneustes fossilis* in Open Ponds. Md. Abdul Wahab, Yang Yi, James S. Diana, C. Kwei Lin, and Obaidullah-Al- Masud;

Integrated Cage-Cum-Pond Culture Systems with High-Valued Sahar

Tor putitora in Cages and Low-Valued Carps in Open Ponds. Madhav K. Shrestha*, Yang Yi, James S. Diana, C. Kwei Lin, and Narayan P. Pandit;

Towards sustainable development of Shrimp farming in Vietnam. Dao Huy Giap, Yang Yi, and Amarartne Yakupitiyage.


Yang Yi organized an informal gathering of all attending CRSP participants, where while expressing the importance and necessity of the CRSP to aquaculture development in the region, participants also shared their optimistic views for the future of the CRSP project and confirmed their willingness to continue collaboration.

Yang Yi was re-elected as one of the Asian Fisheries Society Governing Council members in the conference. We would like to extend our sincere congratulations to him. 

Shrinfo Shrimp Research Information

SHRINFO – Shrimp Research Information Database

SHRINFO is a project funded by The National Center for Genetic Engineering and Biotechnology (BIOTEC) of Thailand and partially sponsored by the South/Southeast Component Project of Aquaculture CRSP through the sharing of equipment and researchers' time. This project has been conducted by Aquaculture CRSP researchers Yang Yi and Sahdev Singh, starting from January to December 2003 (Phase I) and from January to December 2004 (Phase II). Vinij Tansakul, one of the earliest Aquaculture CRSP staff members in Thailand, is the database manager.

SHRINFO is a web-enabled database dedicated to information on shrimp research conducted at various agencies and universities in Thailand. This dual language (Thai-English) information resource is accessible through a website (<http://www.aqua-information.ait.ac.th/shrinfo/>). User-friendly interfaces are provided for those who would like to update the database and search for information. The database website also provides general information about the shrimp industry in Thailand, government and private agencies working on shrimp, and other useful shrimp related links. SHRINFO has more than 2,000 records, covering almost all literature of Thai shrimp research. 

Rural Women's Groups Conduct Integrated Shellfish and Seaweed Culture in Zanzibar

By Narriman Jiddawe and Aviti Mmochi, Institute of Marine Science, Zanzibar, Tanzania

The SUCCESS (Sustainable Coastal Communities and Ecosystems) project is a global initiative of USAID/Coastal Resources Center-University of Rhode Island in partnership with the Pacific Aquaculture and Coastal Resources Center/University of Hawaii Hilo and the Institute for Marine Science at Zanzibar, Tanzania. One component of the coastal management efforts in Tanzania is directed at small-scale mariculture as an alternative livelihood for coastal communities. This article describes an on-going project testing shellfish culture in Zanzibar. It is hoped that not only will production be improved at the current shellfish farms, but that these efforts will serve as models so that similar shellfish culture projects can be established in other coastal areas of East Africa. The SUCCESS project has targeted improvement of bivalve and seaweed production in East Africa as a likely means of fostering culture of native species that have low technology requirements, contribute to water quality, and are appropriate to local lifestyles.

The Institute for Marine Sciences (IMS), part of the University of Dar es Salaam (UDSM), has provided assistance to community groups for over 10 years to make seaweed culture one of Tanzania's leading coastal economic development success stories. Innovative

research conducted by IMS and UDSM researchers continually produces results that guide researchers and extension agents in their quest to work with producers to improve seaweed production. Along with their colleagues from the Fisheries Department, IMS and UDSM scientists provide much of the extension assistance for the coastal villages in aquaculture.

The typical seaweed producer in East Africa is a woman living in a rural coastal village. Most women engage in a variety of household and income producing activities. In the case of Zanzibar, seaweed is third after tourism and cloves in economic contribution. Although seaweed production



HAUKE KITE-POWELL

Women seaweed farmers culture a variety of bivalves in plots averaging 6 m².

is one of the few income generating alternatives available to rural, coastal women, their average income of \$40-\$90 falls below the average GDP for Zanzibar of \$170. Recently seaweed prices have dropped by 30%. Since women in this project were already engaged in collecting and selling mollusk of various species, IMS scientists and community leaders sought additional and complementary alternatives in the form of shellfish culture with a low requirement for technology. Additional assistance was provided by Hauke Kite-Powell (Woods Hole Oceanographic Institution) with funding from the McKnight Foundation.

With the help of the IMS and

...continued on p. 9

SUCCESS

...from p. 1

community-based efforts for culture of milkfish, seaweed, tropical bivalve species, shrimp, and tilapia. Over its five-year span, the project will explore possibilities for new forms of coastal aquaculture. Regional training courses in aquaculture extension methodology will also be held to build institutional capacity and support the demonstration efforts. Additionally, two regional learning and exchange networks in Latin America and East Africa are growing under USAID auspices. CRSP Stakeholders are open to participation in the regional trainings and network.

One of the SUCCESS program's key goals is to build extension

capacity, and the program hopes to establish strong ties and collaborative efforts with the CRSP's network of researchers and extension agents. A first step in this direction will be the upcoming inclusion of SUCCESS news, updates, and articles as a separate section in future issues of Aquanews. These pieces will be linked to longer works posted on the SUCCESS website that readers can access for further information. Our hope is that this information exchange between the SUCCESS and CRSP networks will bear fruitful new collaboration and learning opportunities.

For further information contact:

Brian Crawford, Program Director,
SUCCESS
Coastal Resources Center, University of Rhode Island
Phone: 401-874-6225
Email: brtian@crc.uri.edu
Or
Maria Haws
Deputy Director for Mariculture and Fisheries, SUCCESS
Pacific Aquaculture and Coastal Resources Center, University of Hawaii-Hilo
Phone: 808-933-0707
Email: haws@aol.com



Aquaculture in Mexico

...from p. 1

The goal of our collaborative research has been to develop aquaculture systems that are sustainable, employ clean technologies, use indigenous species, enhance biodiversity, produce protein and involve local people.

Our specific objectives have been to: 1) develop alternate methods for sex control in desirable species; 2) track the fate of hormones used for

sex reversal in the environment; 3) develop clean and safe methods for sex reversal; 4) incorporate indigenous species into aquaculture practices; and 5) implement information transfer and personnel training.

Our work conducted at OSU and Universidad Juárez Autónoma de Tabasco (UJAT) in Mexico has resulted in new techniques that can induce masculinization, which drastically shortens treatment time and uses contained water, reducing human health

risks. We have also developed an economical and easily constructed water effluent treatment system that eliminates hormones, thereby reducing or eliminating the environmental impact and health risk to people and native

animals. Results from our research have allowed us to provide training and technical information to growers in developing nations to enable them to become self-sufficient at

producing fry and market-sized fish on site using these clean technologies.

In 1999 a Memorandum of Understanding was signed between OSU and the Laboratory of Aquaculture at UJAT. In the five years since, the results from basic research completed earlier at OSU, and subsequently at UJAT, have been dramatically transformed into practical applications in Tabasco, Mexico and elsewhere. Some of the people at UJAT who have provided the driving force for these positive results

are Wilfrido M. Contreras Sanchez, Gabriel Marquez Couturier, Mario Fernandez Perez, and Ulises Hernandez Vidal. Contreras received his Ph.D. from OSU with the help of ACRSP funding. In 2001 he became the leader of the Laboratorio de Acuicultura, División Académica de Ciencias Biológicas, and last year he was promoted to Director of the Division itself. In his three-year tenure, the size of the aquaculture laboratory and capacity for fish production has tripled.

Since 1999, USAID funded research at OSU and UJAT has resulted in the training and education of over 45 students who have generated more than 20 academic theses. OSU and UJAT have produced 6 leaflets, 2 technical manuals, 2 videos, and conducted 13 workshops at a variety of locations including Mexico City, Mazatlan, Villahermosa, Ejido Rio Playa, State Hatchery (Jose Narciso Roviroso), and Ejido Tucta in Tabasco. These workshops have resulted in the training of over 225 people in tilapia production, sex reversal, line selection, culture of indigenous species, and clean technologies for aquaculture. UJAT has also trained and provided technical information to over 250 growers and supplied more than 2,000,000 masculinized tilapia fry to over 500 people.

Due to UJAT's involvement with



GUILLERMO GIANNICO

Morning seminar at a three day workshop conducted jointly by OSU and UJAT presented by Wilfrido M. Contreras Sánchez.

...continued on p. 7

Asian Researchers of Aquaculture CRSP Well Represented at ISTA6

By Dhirendra Prasad Thakur, Asian Institute of Technology

The Sixth International Symposium on Tilapia in Aquaculture, better known as ISTA6, was held on 12–16 September 2004 at the Philippines International Convention Center in Manila, Philippines. It brought together experts in tilapia growing to review the latest discoveries in tilapia biology, ecology, improvements in production systems, and other fields related to tilapia in aquaculture. The forum was an opportunity to display the Aquaculture CRSP's long involvement in tilapia research and it was duly done as Aquaculture CRSP Asian researchers showed their striking presence. It was evident from the number of presentations made by the group in ISTA6 covering different aspects of tilapia research. A total fifteen scientific presentations were made by the group for the joint research conducted by the

Aquaculture/CRSP and the Asian Institute of Technology (AIT).

Yang Yi delivered a talk on tilapia culture in China jointly with Lai Quiming of Hainan University, China, during the plenary. They presented an extensive review on the history and current status of tilapia culture in mainland China and a critical analysis of different components of tilapia aquaculture in China, particularly in light of the outstanding Chinese success in registering 25% annual growth in tilapia production between 1987 (18,100 metric tons) and 2002 (706,585 metric tons). They observed that though China is the largest producer of tilapia in the world, the production is quite localized, as the five top tilapia producing provinces accounted for 87.5% of the total tilapia production in China in 2002.

...continued on p. 6

AKTEA Conference on Women in Aquaculture

By Jeff Burright

Suyapa Triminio Meyer of the CRSP project in Honduras represented the Aquaculture CRSP at the AKTEA International Conference titled "Women in fisheries and aquaculture: Lessons from the past, current actions and ambitions for the future" in Santiago de Compostela, Spain, from 10–13 November 2004. As many as 200 women and 10 men from around the world attended the event to hear presentations and participate in forums dedicated to the roles, challenges, and opportunities that women share in fisheries and aquaculture despite their different social cultures and to highlight the importance of women's contributions to the fisheries sector.

Meyer presented two posters at the conference. The first, entitled "www.acuacultura.org" explained the power and function of a new Spanish-language website that offers information related to tilapia culture and also presents an opportunity to connect farmers, students, NGO agents, experts, and others interested in aquaculture via the Internet. The site was developed and supported in a collaboration between the Aquaculture CRSP, Zamorano University, the University of Georgia, and Auburn University.

The second poster, "Effecting Organizational Culture Change: A Brief History of the Aquaculture CRSP" was the product of members of the Aquaculture CRSP Management Entity. This poster presented information on the increasing participation of women in the research and activities of the project from 1982 to 2004.

This information was a good fit for the theme of the conference, and both



Graduate Student Profile: Vu Cam Luong

By Yang Yi, Asian Institute of Technology


Dr. Vu Cam Luong became a lecturer at the Fisheries Department of the University of Agriculture and Forestry in Ho Chi Minh City of Vietnam in May 1997 after he received his Bachelor degree from the same university that April. He joined the Asian Institute of Technology (AIT) as a Master student in January 1999 with a DANIDA Master Research Abroad Fellowship, and received his M.Sc. degree in December 2000. He conducted the research entitled "Trophic model and technical-economic aspects of cove aquaculture in Tri An Reservoir of Vietnam" under the supervision of CRSP PI Professor C. Kwei Lin.

He was selected as an exchange student to be trained for Ecopath modeling and research methodology during January–April 2000 at center,




Aarhus and Copenhagen University in Denmark, and in September 2001

he started his doctoral study at AIT with support from the Vietnamese Government Ph.D. Research Abroad Fellowship. The Aquaculture CRSP sponsored his dissertation research entitled "Management strategies of natural food webs for marble goby-carp polyculture in coves based on natural food webs in Tri An Reservoir, Vietnam" and it linked with

Aquaculture CRSP project in Vietnam under Dr. Yang Yi's supervision. He successfully obtained his doctoral degree in December 2004, and returned to his home institution where his research interests are limnology, aquaculture, food web interaction and trophic modeling. 

during their two-hour presentation and later throughout the event, the posters drew a great deal of interest from the participants.

The conference also gave women in aquaculture an important forum through which to make new contacts, discuss the CRSP project's success in


the promotion of tilapia culture and the positive impact this has had on the lives of rural people in Central America, and to find new partners for future collaboration. Meyer met several women from Latin America, Asia, and Africa who were interested in working with her, and the women from Latin America were especially interested in the idea of having a regional meeting on women in aquaculture to further the progress gained at the conference. 

ISTA 6

...from p. 4

Amrit Bart, Coordinator of AARM at AIT, presented on AARM contributions to tilapia research. In his presentation he acknowledged the strong cooperation between the Aquaculture CRSP and AIT in conducting joint research on tilapia, which resulted in several valued publications in peer reviewed journals. He noted that joint research conducted by Aquaculture CRSP and AIT to optimize tilapia production by improving primary production and husbandry practice during 1980s became a theme that continues today at AARM, AIT. C. Kwei Lin presented two papers related to red tilapia culture in brackishwater. He observed that red tilapia grew better in brackishwater than in the freshwater, and the best growth performance was achieved at 10 ppt salinity. He also found that under fertilization system 50% satiation feeding was the most efficient feeding rate to grow red tilapia. M. K. Shrestha presented two papers, one on control of Nile tilapia recruitment by predatory snakehead and second on grass carp Nile tilapia polyculture. His research findings showed that snakehead were able to control Nile tilapia recruitment completely and thus, may provide an alternative technique for Nile tilapia culture. D. P. Thakur presented research on fertilization and feeding strategy for Nile tilapia grow-out ponds, and concluded that combination of fertilization and feeding should be a preferred strategy over fertilization followed by feeding for culturing Nile tilapia.

Yang Yi was the leading presenter in the group with four oral and four poster presentation in ISTA6. Details for all the presentations made by the group can be found in the ISTA6 proceeding as manuscript for all the presentations was published in the Symposium proceeding; ISTA6 published two volumes of proceedings edited by Remedios Bolivar of Central Luzon State University, Kevin Fitzsimmons of the University of Arizona, and Graham Mair of Finders University. The list of all the presentations made by the group in ISTA6 is shown below.

Overall, the Aquaculture CRSP demonstrated strong involvement in tilapia research and continued commitment for tilapia aquaculture development in the region. 

Presentations:

- Amrit Bart, Contribution of Aquaculture and Aquatic Resources Management (AARM) Program of the Asian Institute of Technology (AIT) to Tilapia Research.
- Yang Yi, Stocking densities of Nile tilapia in shrimp ponds under different feeding strategies.
- C. Kwei Lin, Effects of fertilization rates on growth performance of red tilapia at different salinities.
- C. Kwei Lin, Supplemental feeding for red tilapia culture in brackishwater.
- Yang Yi, Stocking densities and fertilization regimes for Nile tilapia (*Oreochromis niloticus*) production in ponds with supplemental feeding.
- Yang Yi, Stocking ratios of hybrid catfish (*Clarias macrocephalus* x *C. gariepinus*) and Nile tilapia (*Oreochromis niloticus*) in an intensive polyculture.
- D. P. Thakur, Effects of fertilization and feeding strategy on water quality, growth performance, nutrient utilization and economic return in Nile tilapia (*Oreochromis niloticus*) ponds.
- M. K. Shrestha, Culture of mixed-sex Nile tilapia with predatory snakehead.
- M. K. Shrestha, Polyculture of grass carp and Nile tilapia with napier grass as the sole nutrient input in the subtropical climate of Nepal.
- Yang Yi, Recycling wastewater of intensive hybrid *Clarias* catfish culture for semi-intensive Nile tilapia culture.
- Yang Yi, Management of organic matter and nutrient regeneration in pond bottoms through polyculture.
- Yang Yi, Tilapia-shrimp polyculture in Thailand.
- Yang Yi, Effects of adding shrimp (*Penaeus monodon*) into intensive culture ponds of Nile tilapia (*Oreochromis niloticus*) at different densities.
- Yang Yi, Tilapia culture in China.
- N.T. Phuong, Integrated cage-cum-pond culture: stocking densities of caged climbing perch in Nile tilapia ponds.

IIFET 2006 Conference

11-14 July 2006

Portsmouth, United Kingdom

The Aquaculture CRSP is proud to announce that it will be co-sponsoring the next upcoming International Institute of Fisheries Economics and Trade (IIFET) biennial conference, IIFET 2006 Portsmouth.

Current theme ideas include: Fish for the future: recovering fisheries from collapse; and Biodiversity: fisheries and the ecosystem (including modeling fisheries' interactions with the environment). The organizers welcome ideas to strengthen the seafood markets portion of the program, a post-tsunami assessment session(s), and other topics.

IIFET will post news about the upcoming conference, including a first call for abstracts by late July 2005 and a detailed second call/announcement by early December 2005.

For questions or topic ideas, contact:
Nicola Waterman, Conference Coordinator
Email: nicola.waterman@port.ac.uk

For more information on IIFET or the Portsmouth conference, or to join, please visit
<<http://oregonstate.edu/Dept/IIFET>>.



Aquaculture in Mexico

...from p. 4

the local community, 3 commercial farms (employing over 50 people) are now producing more than 100 tons per month of market-size fish per year. In addition, mid-sized and smaller growers (involving over 200 people) are successfully cultivating and masculinizing tilapia (220,000 to 280,000/year). This has resulted in the distribution of fry to over 150 people. Not only have these growers become self sufficient for tilapia production, they have also started to incorporate the culture of indigenous species into their systems, including tropical gar and three species of cichlids. These growers and other state facilities are now using a biofilter (developed at UJAT as part of the ACRSP), which is used in intensive masculinizing systems to produce efficient masculinization and clean effluents.

Some of the "side projects" resulting from USAID funding are not as large scale as the above examples, but have similar impacts. Mario Fernandez has developed a very economical way of obtaining scholarships for indigenous students from the poverty-stricken mountainous region of Tabasco. He currently has four students who reside at the lab. A polyculture system has been established with ponds, tilapia, goats, ducks, chickens, and a vegetable garden, and the students are responsible for maintaining the system. They are able to live off of the polyculture system, and any surplus fish, eggs, goat milk, or vegetables are sold so they can have a very small stipend. The whole system is self-sufficient and the students can simultaneously earn a degree in aquaculture engineering.

A prime example of the success



Aquaculture Europe 2005

The Aquaculture Europe 2005 conference "Lessons from the past to optimize the future" is set to take place in Trondheim, Norway, 5-9 August 2005. A lively agenda will focus on further development of sustainable aquaculture and will include forums on innovation in aquaculture and framework programmes of the European Union. The conference will also host workshops on wild and farmed salmon and aquaculture technology. For more information visit <http://www.easonline.org/agenda/en/AquaEuro2005/default.asp>, or email EAS secretariat: ae2005@aquaculture.cc.



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Three day workshop (Masculinization Techniques and Safe Handling of Steroids in Aquaculture) at UJAT (ACRSP funded) conducted jointly by OSU and UJAT. Afternoon practicum, grading tilapia fry.

of UJAT in increasing fish production is at the Jose Narciso Roviroso State Hatchery. Three years ago the hatchery was producing 1.8 million fry per year. With the help

of UJAT's expertise, this year

the hatchery produced 6 million fry. So far, 4.8 million fry have been given to small family units. This equates to over 4,000 families or somewhere between 20 and 40 thousand people receiving fish. Mario Fernandez has been the key researcher behind this project.

The success of new aquaculture practices in Tabasco has generated interest from a state agency (Secretaria de Desarrollo Agropecuario, Forestal y Pesca), which is now providing funds for both research and

facilities at local and state hatcheries including Ejido Tucta, Ejido Rio Playa, and Jose Narciso Roviroso. Word of local success stories has spread quickly, and a large number of people are now actively seeking information on techniques for raising fish. In Tabasco alone there are now over 5,000 producers of tilapia and other species. The aquaculture laboratory at UJAT receives approximately 2 visitors per day from these farms seeking fry or technical assistance. This equates to over 500 visitors per year or roughly 10% of all the growers in Tabasco.

From small projects involving four students from the highlands to ventures that supply fry to tens of thousands of people, the many success stories of the burgeoning aquaculture practices in Mexico are truly remarkable, and we are very encouraged by these results.

Our future plans are to begin to train growers in other Central American countries, including Costa Rica, Honduras, and Guatemala, with the

hopes that the successes generated in Mexico can be realized in other developing countries as well.



GUILLERMO GIANNICO

Harvesting tilapia at Mariano Matamoros State Hatchery. Offspring are from broodstock produced from a line selection project at UJAT (funded by ACRSP).

Notices of Publication

Notices of Publication announce recently published work carried out under Aquaculture CRSP sponsorship. To receive a full copy of a report, please contact the author(s) directly.

CRSP RESEARCH REPORT 04-203

DYNAMICS OF POND AQUACULTURE

Hillary S Egna
Oregon State University
Corvallis Oregon

Claude E Boyd
Department of Fisheries and Allied Aquacultures
Auburn University Alabama

The culmination of over a decade's worth of research by the Pond Dynamics/Aquaculture Collaborative Research Support Program (CRSP), Dynamics of Pond Aquaculture not only explains the physical, chemical, and biological processes that interact in pond culture systems, but also presents real-world research findings and considers the people who depend on these systems. This book uses data from CRSP field research sites in East Africa, Southeast Asia, Central America, and North America to present a complete picture of the pond system and the environment in which it exists.

A thorough study of the principles and practices of aquaculture, the book reflects the state of the art in pond aquaculture and incorporates recent advances that have changed the science in the last decade or so. It provides a thorough review of the many methods, techniques, and ideas that comprise this complex and fascinating area of study.

- Includes chapters on fish diseases, fish reproduction, extension, social and economic considerations, and environmental effects
- Describes improvements in pond management techniques including seed fish production, pond preparation, fertilization, feed composition and manufacturing, aerator design, and harvesting
- Addresses the need for greater quantification and standardization in research
- Provides a synopsis of the methods, techniques, and ideas explored by aquaculture practitioners and researchers Audience Researchers, students, field workers, technicians, and engineers involved in:
 - Aquaculture research
 - Agricultural engineering
 - Bioresource engineering
 - Fisheries and wildlife programs
 - Environmental studies

Published in 1997 by CRC Press, this 480-page book can be obtained by contacting CRC Press at <http://www.crcpress.com/shopping_cart/products/product_detail.asp?sku=L1274&parent_id=&pc=>>.

CRSP RESEARCH REPORT 04-204

SPREADSHEET TOOLS FOR DEVELOPING SURFACE WATER SUPPLIES FOR FRESHWATER FISH PRODUCTION IN DEVELOPING COUNTRIES

E. William Tollner and Brahm Verma
University of Georgia Driftmier Engineering Center
Athens, Georgia

Dan Meyer, Suyapa Triminio de Meyer, and George Pilz
Escuela Agricola Panamericana Zamorano
Tegucigalpa FM, Honduras

Joseph Molnar
Auburn University, Auburn, Alabama

Variable rainfall distribution and terrain make surface water harvesting and storage a challenge in many developing countries. The overall goal of this study is to collect and develop information required to equip extension, non-governmental organization (NGO) agents, contractors and engineers for surface water development and aquaculture enterprise development in Honduras and Latin America. A pond water balance for the levee production pond enabling determination of water flow required to balance seepage, evaporation and direct rainfall was developed in English and Spanish on the Microsoft Excel® platform. The pump-in flow rate can also be determined for reaching a volume change per month target. A second model was formulated for evaluating surface water capture by watershed and/or hillside ponds for meeting the levee pond demand. Using hillside ponds that fill by impounding a fraction of total runoff (e.g., diverting water upstream) from streams appears to have promise for meeting water needs. A systematic approach using both models to reach a sustainable water supply target emerged from this work. Both the levee pond model and the water harvest model are based on balancing inputs and outputs given monthly rainfall patterns. A simple approach to mechanical spillways preliminary design was developed. The models are adaptable to any location if key input data is available, particularly average monthly rainfall and storm frequency-duration data. The models do not address water quality issues. The software is intended for watershed sizes not larger than 500ha and storage ponds of less than 5ha surface area—4m depth due to relationship limitations and safety concerns. Coupling with other cooperative development concerns such as marketing association provides a platform for helping groups of people in a watershed to realize further the potential of enlightened self-interest in developing common solutions to water problems.

Women in Tanzania

...from p. 3

Woods Hole scientists, 142 stakeholder (mostly women ranging in age from 18 to 54) in villages near Menai Bay in southern Zanzibar (Figure 1) constructed and cared for 142 shellfish culture plots that averaged 6 m² in size (Figure 2). These plots are delineated by borders of wood stakes or stones and are located on the tidal flat so that they are only exposed during spring tides when the tides are at the maximum low. The stones and stakes serve to signal ownership of the plot, but also provide substrate for settlement of juvenile bivalves (spat). As women collect shellfish for sale from the tidal flats, any mollusk ranging in size from 1 cm to just under market size is placed in the plot for grow-out. Labor requirements are low, so the cultured shellfish survive well with minimal attention. During neap tides when the plots are inaccessible, the women work in other activities. The activity is highly compatible with seaweed farming as it occurs in the same areas and the plots can be tended as the same times women go to the shore to cultivate their seaweed farms.

The trials were run for one year to determine growth and survival rates, and to collect basic economic data. Women generally gather juvenile bivalves of several types for sale or to culture in their enclosures: Black-lip pearl oysters (*Pinctada margaritifera*); Mangrove oysters (*Isognomon isognomon*); mussels (*Modiolus auriculatus*); pen shells (*Atrina vexillum*); and cockles (*Anadara antiquata*). The year long monitoring indicated that most species reached market size in seven to eight months. Some mortality occurred, particularly in the larger animals, which may have been due to water temperatures, crowding, or pre-

dation by birds or crabs. It is also postulated that the shellfish aggregations may contribute to improved spawning conditions as most of these species are gregarious spawners, and the entire structure provides additional substrate for spat settlement.

Most shellfish collectors work only during the 10 days or so per month that the intertidal flats are accessible during low tide periods. Most can collect 100-200 shellfish per day during this period. The meats from all species are generally pooled and sold in batches of 150 g. (Figure 3). A kilo of mixed shellfish meats costs Tshs 1,000 in the village to TS2,000 per kg in Zanzibar town. 1 USD is about 1,100 Tshs. The culture trials have been a financial success for women, adding another revenue stream to their incomes. Women who cultivate shellfish and grow seaweed made about \$35/month as compared to \$10/month for women who only gather and sell shellfish.

The current effort will continue in a two-pronged approach to improving production and revenues for the women. First, previous research has indicated that stocking densities could be increased well above the current 100/m² average density. Stocking and harvesting need to be scheduled more rigorously and adhered to. Increasing plot size or replicating the number of plots may also be possible. In general, there is still a great deal to do in terms of improving the production technology and transferring basic bivalve

technology to coastal communities.

The SUCCESS project aims to complement the on-going shellfish research by working to improve income generation through providing assistance

that will enable the women to sell more shellfish at higher prices, targeting tourist hotels and establishment of low-tech seafood kiosks to be run by the women at popular tourist sites, many of which are quite close to the culture sites.

Marketing studies and trials will be conducted

at the major tourist hotels and restaurants in Zanzibar town. Training in handling and sanitation will also be provided to assure product quality and safety leading to improved consumer acceptability.

Other initiatives are underway to complement the biological and market studies. One is to derive more productive use from the pearl oysters which are simply being consumed at a small size rather than being used to produce pearls. Menai Bay exhibits a relatively high rate of pearl oyster spat settlement which is a real asset as many pearl farms have to rely on hatchery production in areas where spat settlement is sporadic. The spat settling naturally on the plot stakes will be collected, grown to grafting size, then used to cultivate *mabe* pearls. *Mabe* pearls are half-spherical pearls formed when a plastic half-dome is glued to the inside of the shells and subsequently covered with nacre. These pearls can be sold to the local tourist market and the remaining shell used to produce handicrafts.

Updates will appear in Aquanews as the work progresses.

Acknowledgments

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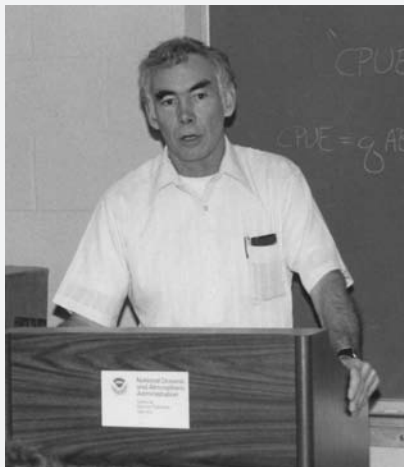
Cooked and frozen shellfish meat being sold near Zanzibar town. Effort are needed to improve sanitation and market prices/volumes to increase women's incomes.

HAUKE KITE-POWELL



Villages in Zanzibar with shellfish culture trials to supplement.

In Memory of Dr. James Lannan, May 17, 1935 - Dec. 9, 2004



Dr. Jim Lannan, one of the Aquaculture CRSP's founding members, passed away on Thursday, Dec. 9, at his Little Sky Ranch in Blodgett, Oregon.

A scientist, sportsman, rancher, and dedicated family man, Jim devoted over 30 years of scholarly and professional

service to fisheries science, salmon hatchery management, and international aquaculture development. Known for his ability to take theoretical science and translate it into the applied and practical, he made numerous contributions in educating fishery scientists and managers, advising national and state agencies, and assisting underdeveloped countries.

Jim earned a BA in zoology and an MA in molecular biology and genetics at the University of California at Santa Barbara, and a Ph.D. in fisheries from Oregon State University. He joined the faculty of the OSU Department

of Fisheries and Wildlife in 1972 and was based at the OSU Hatfield Marine Science Center in Newport. He taught genetics, fisheries, and aquaculture, and he conducted research and provided extension services in these areas. More than 30 of his graduate students now work as scientists and managers in warm and coldwater aquaculture and marine and freshwater fisheries. He was instrumental in the establishment of the Aquaculture CRSP (originally Pond Dynamics/ Aquaculture CRSP), and served as its first Program Manager from 1980 to 1987.

Jim retired from OSU as Professor Emeritus of Fisheries in 1992 and devoted his considerable energy to building his farm, to his herd of registered Angus cattle, to his passion for OSU football, and to extensive community service work. He was a dedicated volunteer fireman and spent many hours helping in elementary school classrooms in Corvallis and Toledo, Oregon. He will be remembered for these activities and for the scholarship that enhanced our understanding of aquatic systems and our use and conservation of aquatic resources. One of his special talents was his ability to translate that scholarship into practical applications for resource managers, policymakers, and the public. It was this special talent that suited him so well to his role as the ACRSP's first Program Manager and for which he will be remembered among CRSP program participants. He will be missed.

Aquaculture CRSP Technical Committee

The Aquaculture CRSP elected new members to the 2005–2006 Technical Committee earlier this year. We extend a warm welcome to new members and express our appreciation to the continuing and past members for their time in service to the Aquaculture CRSP. TC co-chairs and members serve 2- and 3-year terms, respectively. Offices are held through the conclusion of the following year's Annual Meeting.

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Wilfrido Contreras-Sanchez	Universidad Juárez Autónoma de Tabasco	Environmental Effects
Remedios Bolivar	Central Luzon State University	Production Optimization

Student Poster Awards for Aquaculture America, New Orleans

The Aquaculture CRSP sponsored three student poster awards at the Aquaculture America 2005 meeting in New Orleans. One first place and two runner-up awards were given to those posters judged as the best representatives of the broad research and development theme “to advance sustainable aquaculture.” All posters submitted by students were considered and judging was conducted using accepted Aquaculture CRSP guidelines. Specific judging criteria focused on value of the contribution to sustainable aquaculture development, technical quality of the study and level of involvement required, presentation and use of graphics, and overall applicability and benefits of the results.

Aquaculture CRSP awards were presented to the winning students during the USAS Student Reception. In addition, Dr. James Avault kindly donated a copy of his book “Fundamentals of Aquaculture: A Step-by-Step Guide to Commercial Aquaculture” to each of the winning students. The highest judged student posters at Aquaculture America 2005 were as follows:

First Place

Peng Li, Department of Wildlife and Fisheries Sciences, Texas A&M University, “Evaluation of the prebiotic Grobiotic-A and brewers yeast as dietary supplements for sub-adult hybrid striped bass *Morone chrysops* X *M. saxatilis* challenged in situ with *Mycobacterium marinum*.”

Second Place

Joseph Sawdy, Department of Animal Sciences, The Ohio State University, “Whole muscle 1-D protein fingerprints of yellow perch *Perca flavescens* correlate with total body weight and length.”

Roberto Quintana, Aquaculture Research Station, Louisiana State University “Rapid estimation of gonad-to-body ratio in oysters.”

The Aquaculture CRSP is grateful for the services of all individuals agreeing to be a member of the Honors & Awards Committee.



Peng Li



Joseph Sawdy



Robert Quintana

Goings On

The Aquaculture CRSP is facilitating a host country principal investigator project entitled “Training and Information Exchange on Cichlids.” This innovative south-south project harnesses two decades of CRSP-generated technologies for aquaculture development that uses low-cost and locally available inputs. This project’s goal is to provide an opportunity for host country partners to compare their respective CRSP successes and share lessons learned with one another. This project forms a 5-way information exchange among CRSP investigators from Universidad Juárez Autónoma de Tabasco, Mexico; Escuela Agrícola Panamericana Zamorano, Honduras; Kenya Department of Fisheries, Kenya; Central Luzon State University, Philippines; and the Asian Institute of Technology, Thailand.

The Aquaculture CRSP has garnered support from the National Oceanographic and Atmospheric Administration (NOAA) Sea Grant for an innovative program that fosters linkages between Sea Grant and the CRSP, explores the adaptability of the Sea Grant model to other countries, and provides Sea Grant with a model for future work in the international arena. This project will bring New York Sea Grant (Cornell University) extension methods and successes to Universidad Juárez Autónoma de Tabasco, Mexico—a current CRSP host country institution—and this initiative also features special Sea Grant technical assistance expertise for all existing CRSP host country partners. Rhode Island Sea Grant and Texas Sea Grant are also partners in this initiative.



Aquaculture CRSP
Oregon State University
418 Snell Hall
Corvallis OR 97331-1643



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Aquaculture CRSP
Oregon State University
418 Snell Hall
Corvallis, OR 97331-1643

Contact information for other inquiries:

Danielle Clair claird@ucs.orst.edu
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