

# AQUANEWS



*Sustainable Aquaculture  
for a Secure Future*

POND DYNAMICS/AQUACULTURE COLLABORATIVE RESEARCH SUPPORT PROGRAM NEWSLETTER

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## **Fresh and Brackish Water Aquaculture in Honduras**

*by Bartholomew W. Green*

**A**quaculture is an important agricultural activity in Honduras. Tilapia farms, while concentrated in northern Honduras, also are found in the other regions of

research program on tilapia culture is being implemented. Priority research areas include the Global Experiment and production system intensification. Planned research on production system intensification will be applicable not only to tilapia culture in Latin America, but also in the US.

Research activities are centered at DIGEPESCA's El Carao National Fish Culture Research Center located in Comayagua, where biologists Carolina Cardona and Nelson Claros, and technician Rene



South central Honduras

quality laboratory was renovated, project ponds were repaired, a blower system is being installed in the wet lab, and electricity and security lighting were installed at the ponds.

Honduran shrimp culture relies on extensive to semi-intensive production technologies. Farms often are located along riverine estuaries, which serve not only as water sources, but also as destinations for pond effluents.

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BRIGITTE GOETZE

*Ponds at El Carao National Fish Culture Research Center*

the country. Shrimp farming is located exclusively along Honduras' Gulf of Fonseca coastline. The overwhelming majority of shrimp farms have been constructed on un-vegetated salt flats located in the eastern part of the Gulf near Nicaragua. Because of these two important aquacultural activities in Honduras and their associated research needs, the Honduras CRSP project has developed research programs for tilapia culture and for shrimp culture.

Tilapia culture in Honduras has entered a phase of rapid development, yet the production systems currently in use have been derived empirically by farmers. Thus, it is through the Honduras project that a systematic

Palacios are involved in the daily implementation of pond studies and water quality analyses. The El Carao station, constructed in the late 1970s as part of a USAID/Honduras aquacultural development program, has been the Honduras project's

tilapia research site since 1983. Beginning last year the Honduras project initiated a series of needed renovations at the station using PD/A CRSP funds: the water

### **Need Help with the Acronyms? (NHWA!)**

Host-country collaborators include the General Directorate of Fisheries and Aquaculture (DIGEPESCA), the Ministry of Agriculture and Livestock, the Honduran National Association of Aquaculturists (ANDAH), and the Panamerican Agriculture School (EAP). Auburn University, the University of Texas at Austin, and the University of Arkansas at Pine Bluff are the US institutions currently involved in Honduras project research.



## New Publication From PD/A CRSP

### THE COLLECTED ABSTRACTS FROM THE PD/A CRSP RESEARCH REPORT SERIES IN ENGLISH, FRENCH, & SPANISH, 1987-1995

Translations by Félicien Rwangano and Gabriela Montaña.

The Research Report Series of the PD/A CRSP was launched in 1987 as a means of disseminating CRSP-sponsored research results. Each report consists of an abstract, of research work that has been published either in the peer-reviewed literature or by the CRSP. To increase accessibility the series of reports through 1995 has now been compiled in this single publication, together with previously unavailable French and Spanish translations.

This is a 187-page collection of 88 abstracts. Each abstract is presented in English, French, and Spanish. In the case of reports published in peer-reviewed journals, reference information is provided. Copies of reports published by the CRSP can be obtained from CRSP Publications. Copies of the Collected Abstracts can also be requested from the CRSP:

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## CRSP Graduate Student Profile: Malkia Lockhart

by Matt Niles

Although her first official encounter with the CRSP was at the CRSPs 16th Annual Meeting in Las Vegas in February, Malkia Lockhart has been affiliated with the CRSP since she began her Master's program in rural sociology at Auburn University last year. As Joseph Molnar's graduate student, Malkia has been working on the CRSPs Kenya project ever since. The data she is collecting on the Kenya project will form the basis of her thesis, which she hopes to finish by August 1999.

Malkia's interest in aquaculture and community development grew fairly recently out of several sociology courses she completed while an undergraduate at Tuskegee University, Alabama, where she received her BS in biology in 1997. In 1995, she completed her Associate of Arts degree in biology with a minor in

chemistry in her home country of the Bahamas at the College of the Bahamas, Nassau.

Among her accomplishments at Tuskegee was a research paper she wrote entitled "Females and their Tolerance of Verbal Abuse," which she presented at meetings of the Southern Sociological Association in Memphis, Tennessee.

Malkia enjoyed this opportunity, explaining that "It was a wonderful experience to be able to converse with so many intellectuals I met and to have

them critique what I did. It was an honor."



Malkia Lockhart, graduate student in rural sociology at Auburn University, Alabama

While at Tuskegee University, Malkia was encouraged to look into graduate work at Auburn University by her mentor, Cathy Winkler, to whom Malkia first expressed an interest in sociology. Malkia chose Auburn because of the many projects underway there that involved aquaculture and community development in some way, and she felt that Auburn's program fit her needs quite well.

## Finding a Natural Niche for Aquaculture in Southern Mexico

by Matt Niles

In May Gabriel Marquez-Couturier presented a seminar at Oregon State University entitled “A Multidisciplinary Project for Sustainable Management of Native Flora and Fauna of the Wetlands in Tabasco, Mexico.” He was in Corvallis on a scientific exchange with the PD/A CRSP from the Universidad Juarez Autonoma de Tabasco, where, in addition to conducting research on the larval development of fish in the rivers of Southern Mexico, he has been involved with several aquaculture projects.



GABRIEL MARQUEZ-COUTURIER

The wetlands of Tabasco support a wide variety of native species that are threatened by development

Gabriel described his efforts to date towards developing a project to sustainably manage the extensive wetland areas of Tabasco. This project is intended to be developed in an area populated by the “Chontales,” an indigenous group linked with the ancient Olmec civilization. It is an ambitious project, spanning many

disciplines and currently involving nine professors and their combined resources, including labs, students, and library materials.

The native people in Tabasco and surrounding regions have a very strong connection to the environment; in the past, development projects have

Malkia feels that the CRSP Kenya project can be a “win-win” situation for everyone involved. “The US government and organizations, Kenyan organizations, and the Kenyans themselves all gain because they can all benefit from the data collected in the study,” Malkia explains, adding, “There is so much that is not known about practices in Africa, so I see how beneficial the CRSP work is.”

“How can other countries assist Africa in moving toward self-sufficiency if they know nothing about the socio-economics and cultural views of the country?” Malkia asks.

Additionally, she explains, “Other countries are at an advantage because they have these studies to compare and maybe perhaps implement a similar plan or perhaps to use the theories in the adoption of another

innovation. For example, maybe not tilapia but shrimp instead.”

Although the work at Auburn is Malkia’s first exposure to aquaculture-related research, Malkia hopes to assist with at least two publications before she completes her degree, and at 21 years old, Malkia has already compiled an impressive list of accomplishments. She is a member of Zeta Phi Beta Sorority Inc., which is a social and community service organization. Her chapter holds blood drives, visits with delinquent young men to encourage and mentor them, and conducts health awareness programs on AIDS, breast cancer, and other diseases.

“I really enjoy giving back to the community because I think of all the people who have given me a chance to improve myself, and I would like to pass along this kindness and joy to others.” ◀



GABRIEL MARQUEZ-COUTURIER

Aquaculture research pond at the University of Tabasco

overlooked this. The fundamental goal of Gabriel’s project is to establish a management plan for natural resources and wetlands that will strike a balance between the environment and the existing political and socioeconomic dynamics of the region. Earlier management plans implemented in this area have ignored these factors.

The University of Tabasco is also working to complete an assessment of the environmental impact of development in the area and determine possibilities for the environmental improvement of the region. The biodiversity of the native wetland flora and fauna of the region has been particularly affected by development, and the University hopes to reverse this trend by recovering traditional uses of native species in the region. One way the University hopes to accomplish this is to use native species, such as the tropical gar, in several of its aquaculture projects.

Tropical gar are among the most important food fish in the region, and gar culture has been tried successfully in the lab at the University of Tabasco. Several studies have been performed on gar fry, which can be raised in the lab, brought to aquaculture sites, and released when they reach about 5 cm in length. Projects such as these can be easily transferred from the University to the community.

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## Interview with an Alumnus—Félicien Rwangano

by John Baker

The CRSP is delighted to report that one of its long-term associates, Félicien Rwangano, successfully defended his doctoral thesis “Growth and reproduction of *Oreochromis niloticus* (L.) in tropical aquatic microcosms at fluctuating temperature regimes” at Oregon State University on 15 April 1998.

Félicien Rwangano joined the CRSP in Rwanda as a host country Research Associate in 1985. He held a Baccalaureate degree in Mathematics and Natural Science with a minor in Science Teaching Methods, and an Ingénieur Agronome (Agricultural Engineering) degree with emphasis on animal production and its economics. He also held a research post as a faculty member of the College of Agronomy at the National University of Rwanda. He worked with the CRSP at the Rwasave station on Cycle I to III experiments, encompassing work on site characterization during wet and dry seasons and organic inputs including composted grass, rice brans, and chicken manure.

From 1988 to 1990 Rwangano worked towards his masters degree in Fisheries Science at Oregon State University. He conducted growth trials at Rwasave where he tested the effects of various organic inputs on the productivity of ponds stocked with Nile tilapia. His investigation demonstrated the efficacy of mixed green grass for the fertilization of tilapia ponds. Rwangano completed his Masters in 1990 and returned to visit the National University of Rwanda and the Rwanda National Fish Culture Project to investigate tilapia farming at high elevations.

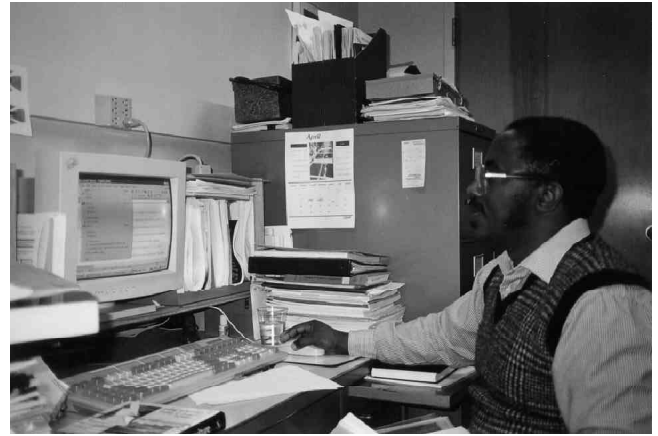
Much of Rwanda is a mountainous region, presenting a particular challenge to aquaculture. With consideration of the low water temperatures recorded above 1500 m and during the dry season in these regions, the PD/A CRSP research in Rwanda focused on revising the knowledge of high-altitude constraints to aquaculture. Aquacultural efforts in Rwanda demonstrated that tilapia

could be grown at elevations up to 2300 m (the CRSP prime site at Rwasave was at an altitude of 1700 m). Integrated systems using poultry produced 250- to 400-g tilapia, and experiments with chicken manure (optimum application of 500 kg dry weight hectare<sup>-1</sup> week<sup>-1</sup>) and additional nitrogen or phosphate, if these were limiting, provided yields of up to 2,000 kg ha<sup>-1</sup> yr<sup>-1</sup>.

The outbreak of violence in Rwanda in October 1990, which climaxed in 1994, led to the loss of life of several members of CRSP personnel, including Dr. Valens Ndoreyaho, then CRSP PI and Rwangano’s supervisor. The crisis prevented Rwangano from conducting his doctoral research in Rwanda. However, Rwangano continued his interest in the growth and reproduction of tilapia under various temperature regimes. He designed and successfully conducted

laboratory experiments simulating tropical conditions at Oregon State University’s Department of Fisheries and Wildlife. Now that his doctoral program is completed, he wants to continue research on tilapia aquaculture, especially integrated systems, which he values for their particularly efficient use of resources. He is also interested in developing temperature-related models in combination with other factors such as feeding and stocking rates.

The 1994 crisis in Rwanda interrupted CRSP work at the



Rwangano at his office in Nash Hall, Oregon State University

### GROWTH AND REPRODUCTION OF *Oreochromis niloticus* (L.) IN TROPICAL

For his doctoral research Rwangano investigated the growth and reproduction of tilapia under various temperature regimes, with particular emphasis on the generally overlooked aspect of temperature fluctuation. He carried out two experiments using 0.7-m<sup>3</sup> (1.4-m<sup>2</sup>) experimental tanks, mimicking the conditions of aquaculture ponds found at differing altitudes in Central Africa. In the first experiment, he grew tilapia at 19 and 25°C, with daily temperature fluctuations of ± 1, 3, or 6°C. Tilapia grew more rapidly at 25°C (yields ranging from 26 to 33 kg are<sup>-1</sup> yr<sup>-1</sup>) than at 19°C (yields ranging from 20 to 30 kg are<sup>-1</sup> yr<sup>-1</sup>). However, at both temperatures, the highest yields were obtained under the greatest temperature fluctuations.

The second experiment investigated the effects of temperature and temperature fluctuation on both growth and reproduction. In this experiment tilapia were reared at 22 and 28°C, again with daily temperature fluctuations of ± 1, 3 or 6°C. The results confirmed those of the first experiment, that growth was more rapid at the higher temperature and at greater temperature fluctuations in addition, they showed that reproductive output was also greater under these conditions.

These results have practical management and economic implications. Under cool temperature conditions tilapia can be grown with little

Rwasave station and its research activities at different elevations. However, prior to this time, CRSP researchers at Rwasave were involved in aquacultural research and extension work in liaison with the National Fish Culture Project, funded by a USAID grant to Auburn University, Alabama. One of the impacts of the CRSP in Rwanda was the spread of fish culture technology further afield, as Rwasave became the regional center of focus for tilapia culture in Central and Eastern Africa. Rwangano points out that results from CRSP research carried out in Rwanda are applicable to other locations and believes that collaborators from Zaire, Burundi, Tanzania, and Kenya who visited Rwasave will have benefited from the work carried out there.

Rwangano believes that of the many achievements of the CRSP in Rwanda, particularly valuable outcomes were the establishment of baseline aquacultural data, furthering the understanding of pond dynamics for high-elevation sites where resources are limited, and the demonstration that at such sites aquaculture proved to be not only a source of protein for human nutrition, but also yielded greater financial income than any subsistence crop. ◀

## CRSP Booth at OSUs Earth Week

by John Baker

The work of the PD/A CRSP was presented to Oregon State University staff and students and to the Corvallis community during OSUs celebration of Earth Week (April 20-24). During Earth Week, OSUs Student Affairs Committee organized a series of environmental events. The CRSP staffed a booth at the Information Fair showcasing aquaculture and the work of CRSP in aquacultural development. At a time when the general public is questioning the environmental impacts of aquaculture and the media are tending to focus on its environmentally damaging aspects, it is important that the sustainable development of warmwater aquaculture and its potential benefits are presented as widely as possible.

Earth Week's Information Fair provided the opportunity to present warmwater aquaculture in the context of environmentally benign



DANIELLE CLAIR

Kris McElwee (left) and Sayea Jenabzadeh model T-shirts and a tilapia hat at CRSPs Earth Week booth at Oregon State University

developments. The booth generated interest and questions from Earth Week participants and was received in a positive manner.

In keeping with the informal atmosphere of the Fair, the CRSP organized an aquaculture poetry competition. The winning entry "Untitled # 5," below, was written by Kris McElwee and Sayea Jenabzadeh, who were awarded a CRSP T-shirt and mug. The following two poems go some way towards capturing the depth of talent of this newly discovered literary duo:

### Untitled # 5

From Kenya to far-off Peru  
 You want boys? Here's what you do;  
 MDHT in a pail  
 Your fish come out all male.  
 Ten months later just see how they grew.

### Untitled # 6

Goats poop in my pond.  
 Look how quickly my fish grow.  
 Yum, tilapia.

## AQUATIC MICROCOSMS AT FLUCTUATING TEMPERATURE REGIMES

likelihood of the occurrence of reproduction although the production cycle is longer due to slow growth, and the fish production in these regions is lower than that from warmer areas. Tilapia culture projects undertaken in cool temperature areas need to investigate sources of fingerling supply, since it will not be possible to produce these locally. Methods for controlling tilapia reproduction must be considered in warmer regions. The linear relationship between cumulative degree-days and growth and production in these experiments is of predictive value to researchers, extension agents, and prospective farmers. Expected fish yields in a particular climatic zone can be calculated, allowing farmers to assess whether expenditure on planned aquacultural ventures will pay off financially.

Rwangano recommends the adoption of pond management/construction strategies to maximize both pond temperatures and the capacity of the pond water as a heat sink. Ponds should be located in warm locations and not incorporate water flow-through, which can reduce pond temperatures, as the inlet water is several degrees cooler (average 5°C difference in Rwanda) than the pond water. Shallow ponds (minimum and maximum depths of 0.4-0.5 and 1.0 m, respectively) with 1-2% slopes are recommended since they tend to maintain warmer temperatures.



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## Fishellaneous Items

### Biggest Fish Farm in the World

*Azerbaijan—May 25, 1998*

According to the newspaper *Azadlyg*, Azerbaijan plans to build the biggest fish farm in the world by the first quarter of the year 2000.

Reportedly, the US\$5 million farm, to be sited on the Kura river, will produce some 15 million sturgeon per year. If approved, an international tender will be held. It is thought that the Azerbaijani government has already held talks with the World Bank.

Source: *Fish Info Service*, [www.sea-world.com](http://www.sea-world.com). Reprinted with permission.

### Cosmetics Based on Fish

*Chile—May 23, 1998*

Salmon, among with other animal and vegetable products, can be used in the cosmetics industry, according to an article published in the Chilean newspaper *El Mercurio*.

The article said that an extract obtained from the salmon's flakes could be used in creams, cosmetics and even in nail enamel. From 100kg of flakes, about 2kg of extract could be produced, which was enough to prepare 8kg of final product.

This industry might be very important for Chile, as the country is the world's second biggest salmon exporter.

Source: *Fish Info Service*, [www.sea-world.com](http://www.sea-world.com). Reprinted with permission.

## Thai Government Making Efforts to Limit Shrimp Farm Pollution

The Thai government is taking new steps to discourage farmers in rice-producing areas from switching to more profitable shrimp farming, which is highly damaging to the environment, officials said in May.

The Agriculture Ministry is nonetheless concerned that Thailand maintain its position as the world's number-one shrimp exporter, said Dhammarong Prakobboon, director of the Fisheries Department.

Pongpol Adireksarn, the agriculture minister, has ordered the department to stop allowing shrimp farms in rice zones, where high salinity and effluent in the waste water from shrimp farming damage the water table and agricultural soil. Pongpol said farmers should be encouraged to move to saltier areas in coastal regions.

"We want to solve problems of environmental protection and of course we want shrimp farming to be sustainable," Dhammarong said.

Shrimp farming has badly damaged mangrove forests in coastal areas where it became popular about a decade ago. Officials want to move shrimp farming away from the mangroves as well as rice land to areas where it will have minimal impact.

Thailand is the world's number-one shrimp exporter, producing some 300,000 tons of the world annual demand of 800,000 tons. About 90 percent of shrimps exported from Thailand come from farms.

Source: *The Aquaculture News* Vol. 6, No. 7, May 1998.

## Farmed Shrimp Production Increases

*Colombia—June 9, 1998*

Production of farmed shrimp on Colombia's Atlantic coast increased from 5,500 to 6,217 tonnes in 1997, despite the reduction in the farming surface, which decreased from 2,251 to 1,919 hectares. Export revenues also rose, from US\$26.64 million to US\$35.35 million.

According to a study, Colombia has a big potential for shrimp farming, since there are 24,000 hectares suitable for aquaculture activities.

Source: *Fish Info Service*, [www.sea-world.com](http://www.sea-world.com). Reprinted with permission.

## British Investment in Costa Rican Tilapia

The Commonwealth Development Corporation (CDC) has strengthened its position in the aquaculture sector by taking a controlling (85 per cent) interest in AquaCorporacion International SA (ACI) and ownership of the brand Rain Forest™ from the US owners who were responsible for the successful development of the company.

Based in Costa Rica, ACI was founded in 1986. Its principal activities are the growing, processing and exporting of fresh tilapia fillets to the North American markets under the Rain Forest™ brand name. Under CDC ownership ACI is expected to expand from 4,000 to 8,000 tonnes per annum.

US sales are controlled through a Maine based sales and marketing subsidiary of ACI, Rain Forest Aquaculture which sells and distributes most of the fish produced by ACI.

Customers are primarily speciality seafood distributors, food retailers and broadline distributors. In 1997 the company's sales exceeded US\$12 million.

The acquisition of ACI complements existing CDC aquaculture activities, in particular, Lake Harvest Aquaculture (PVT) Ltd., a Zimbabwean tilapia operation based on Lake Kariba. This project will benefit from the technical and marketing capabilities which ACI has developed.

CDC is the British overseas development finance institution with headquarters in London and 27 overseas offices. At the end of 1997 its investments totalled US\$2.6 billion in over 400 businesses.

Source: *Fish Farmer International* 12, no. 2, March/April 1998.

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## It's High Time for a New Feed

United States—June 6, 1998

Kentucky State University researchers are feeding 150 blue catfish a fish meal diet mixed with hemp - with positive results so far.

Using hemp meal provided by Craig Lee, of the Kentucky Industrial Hemp Association, the researchers will start another study on channel catfish in June using formulations closer to commercial feed; they will try substituting hemp meal for soybean meal, a main ingredient in fish feed.

At the moment, US-produced soybean meal, about 50-60% of the fish food market, costs about US\$170 a ton, plus delivery. Hemp meal, with its higher shipping cost, is about US\$1,200 a ton. Most hemp seed now comes from China, because growing hemp is illegal in the US.

However, hemp meal could replace fish meal (another fish feed ingredient) in the future; because of El Nino's changes in ocean temperature, fish meal has skyrocketed to US\$600 a ton.

Source: *Fish Info Service*, [www.sea-world.com](http://www.sea-world.com). Reprinted with permission.

## African Catfish Spread in Asia

*Dr. Hans A.J. Middelorp reports promising progress with intensive culture in Bangladesh*

African catfish today seems triumphant all over southeast Asia, and has now spread across the breadth of southern Asia as well. The story goes that only a few fish were originally introduced to Indo-China from Africa by the French in the 1950s where it hardly survived the Indo-China wars.

From Vietnam, it reached Thailand in the early 1980s, where hybrids of African catfish, *Clarias gariepinus*, and the local 'Pla duk oui,' *Clarias macrocephalus*, have since successfully transformed catfish rearing into a big business. . . .

African catfish, or magur, as it is called on the Indian subcontinent,

## V Central American Symposium on Aquaculture

The V Central American Symposium on Aquaculture, "Aquaculture & The Environment: Together Into The New Millennium," sponsored by the Asociacion Nacional de Acuicultores de Honduras (ANDAH), the Latin American Chapter of WAS, and the PD/A CRSP, will be held 3-5 March 1999 at the Centro Social Hondureño Arabe in San Pedro Sula, Honduras. The V Symposium will have a full program on Tilapia and Shrimp and will draw a large attendance from international aquaculture professionals.

The IV Central American Symposium on Aquaculture, held 22-24 April 1997 in Tegucigalpa, Honduras, was a tremendous success with double the number of attendees from the III Symposium. The IV Symposium included a full program on tilapia as well as shrimp. ANDAH and the Latin American Chapter of WAS worked together to produce the IV Symposium.

Because the conference and exposition have grown so much, the V Symposium has been moved to San Pedro Sula in the northern part of Honduras. San Pedro Sula is the

industrial center of Honduras with one of the largest and most modern ports in the Central American region. San Pedro provides better meeting facilities and hotels. It is situated close to the Caribbean beaches, the beautiful Bay Islands and the Copan ruins, as well as other sites of interest. San Pedro makes an ideal starting point for your pre- or post-conference vacation. It is easy to fly into San Pedro Sula from just about anywhere.

There will be three full days of conferences, exhibits, receptions and time to meet with others in the shrimp and tilapia industry. The Program will include a full range of presentations on shrimp and tilapia production by leading experts from around the world. All aspects of shrimp and tilapia production will be addressed. There will be industry tours for shrimp and tilapia on the day after the Symposium ends (6 March).

For further information:  
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reached Bangladesh in 1991. African magur fingerlings were introduced from Thailand by officials from the Ministry of Fisheries and Livestock and were successfully bred in Jessore in 1992. Since then, an important catfish fry export business has been in operation from Jessore, with many thousands of catfish fingerlings being sold every year to West Bengal and Assam. Surprisingly few magur are actually reared to market size within Bangladesh, as it fetches relatively low market prices compared to the Indian major carps.

African catfish fingerlings were brought to Andrah Pradesh from Jessore soon after introduction to Bangladesh. The area around Kolleru lake in Andrah Pradesh has become an important aquaculture producer of Indian major carps (rohu, catla and mrigal) and farmed carps from Andrah Pradesh are routinely

exported to Dhaka, at an estimated daily contribution of between 20 and 30 per cent of the Dhaka fish wholesale market. African magur fingerlings may have reached Kolleru on the return trade.

From Andrah Pradesh, catfish fingerlings reached Kerala in 1993 or early 1994. It can be safely assumed that African catfish also found its way to Tamil Nadu in the same period. It was certainly bred in Kerala in 1995, where it seemed to be welcomed by the market. As one aquaculture entrepreneur in Kerala stated at the end of 1996: "Any fish which will fetch more than 70 rupees (US\$2) per kg is interesting for culture".

There is a clear interest in rearing African Magur in south India, although nobody yet seems quite clear on the appropriate rearing techniques. Catfish rearing is certainly different from a

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## Finding a Natural Niche for Aquaculture in Southern Mexico

... from p. 3

Despite the appeal of working with native species, the University feels that it cannot ignore proven aquaculture species such as tilapia, and other projects include efforts at the farm level to masculinize tilapia with immersion treatments. This work relies heavily on students, who work as volunteers. Last year there were ten students involved in the project, and this year Gabriel has 15

students working for him. Gabriel is currently selecting broodstock to find the best masculinizing technique to produce large quantities of tilapia and bring this technology to the farm level.

Gabriel also expressed an interest in forging connections to the project with interested OSU faculty. Such a connection would offer both OSU and the University of Tabasco an invaluable exchange of knowledge and resources. ◀

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## Fresh and Brackish Water Aquaculture in Honduras

... from p. 1

Estuarine water quality significantly affects shrimp culture, which in turn affects estuarine water quality. The potential for development of shrimp farms along an estuary will be dictated ultimately by estuarine water quality, which itself is controlled by nutrient inputs from river discharge, shrimp farms, terrestrial agriculture, rainfall runoff, municipal discharge, and exchange with the Gulf of Fonseca.

Honduras project research on environmental impacts of shrimp culture focuses on monitoring water quality in shrimp farming estuaries and on estimating the assimilative capacity of these estuaries. On a weekly basis, estuarine water samples are collected and transported by participating farmers to the DIGEPESCA-ANDAH-PD/A CRSP

**Assimilative capacity** is the nutrient load that can be sustained without degrading receiving water quality below acceptable levels. Determination of estuarine assimilative capacity is a long-term effort because of seasonal and annual variations in water quality, and because assimilative capacity is a function of position in the estuary.



Water quality laboratory at La Lujosa, Choluteca

water quality laboratory, La Lujosa, Choluteca, where chemists Delia Martínez and Eneida Ramírez and technician Jaime López are responsible

to initiate shrimp research and estuarine monitoring in Nicaragua based upon the Honduras project model. And in Costa Rica, the CRSP hopes to work with Escuela Agrícola de la Región Tropical Húmeda (EARTH) on research related to pond management strategies. With the implementation of these activities, the Honduras PD/A CRSP will achieve a truly regional impact. ◀

for water quality analyses. During the past year ANDAH has provided funds to enlarge the lab and to drill a new well, and the PD/A CRSP has purchased additional lab and computer equipment, and lab supplies.

Another component of the Honduras project shrimp research effort addresses production system optimization. Because DIGEPESCA does not have a brackish water research station, pond research is conducted on ANDAH members' farms in a truly collaborative partnership between farmers and CRSP researchers. Pond trials are designed jointly by Honduras project researchers and farmers. Farmers provide ponds, all pond inputs, and daily pond management, while the CRSP conducts water quality analyses at the La Lujosa lab and analyzes and reports research results. Results of research conducted on feeding rates and water exchange rates have shown that both can be decreased without affecting shrimp production.

In the coming year, Honduras project researchers hope to regionalize project activities to Nicaragua and Costa Rica. Project personnel have submitted proposals

Honduras project staff include: Claude Boyd, Carolina Cardona, Federico Charres, Nelson Claros, Bartholomew Green, Jaime Lopez, Delia Martinez, Marco Polo Micheletti, Rene Palacios, Eneida Ramirez, and David Teichert-Coddington.



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## African Catfish Spread in Asia

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polyculture of rohu, catla, mrigal and sometimes common carp and silver carp and grass carp as well, as is customary on the subcontinent. In Kerala, a fish feed industry is starting to develop, mixing imported fish meal from Chile with local ingredients. Although the feed industry presently mainly targets shrimp culture (*Penaeus monodon*), it could easily produce good quality catfish feed. . . .

In Bangladesh, however, culture of catfish to marketable size has not really become established yet. For one thing, quality pelleted fish feed is not easily available, and it is suspected that some Bangladeshi feed companies produce so-called fish meal from locally-dried trash fish treated with pesticides, rather than using high quality fish meal. Also, policymakers seem to insist on the superior taste of the indigenous small catfish and snakehead species.

It is true that the market price of African catfish is presently well below the market value of the traditionally high-valued rohu and catla, but this does not necessarily mean that culture of catfish is therefore not economic.

Others seem convinced that the African catfish is a voracious predator, capable of decimating the local fish fauna like the Nile perch in Lake Victoria. The truth is that an

African catfish is an extremely opportunistic, omnivorous feeder. It depends largely on its barbels for scavenging the bottom, as its eyes are very small. Admittedly, it will eat other small fish when they happen to be in front of its mouth, but it is not the dedicated piscivorous eradicator some people think. . . .

The recently-introduced Thai catfish, *Pangasius sutchi*, certainly is more acceptable in Bangladesh, through its similarity to the indigenous *Pangasius pangas* (simply called 'pangas' in Bangladesh). Very large pangas, of up to 20 kg or more, are occasionally caught from the big rivers, fetching very high prices. However, it is a mistake to think that farmed pangas will fetch similarly high prices once they become available in larger quantities and at much smaller sizes than their wild cousins are caught. For example, pangas reared in cages near Jessore fetched only about US\$ 2.5 per kg (400 g average size) in 1997, while pangas fingerlings were sold at 7 BDT per piece (US\$ 0.17) in Jessore in 1996, three times the price of carp fingerlings.

African magur is well-suited to the social conditions in Bangladesh. It has a low mortality rate and grows very fast when fed well. It is best reared in small ponds or ditches, or even in cement tanks. The numerous borrow-pits for house construction, which are usually deep and steep and

... continued on p. 10

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## Notices of Publication

### CRSP Research Report 98-124

#### SMALL-SCALE FISH FARMING IN RWANDA: ECONOMIC CHARACTERISTICS\*

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A survey was conducted of 156 cooperative and 111 individual Rwandan fish farmers to estimate the costs and returns of aquacultural and agricultural crops. Enterprise budgets were developed for both individually and cooperatively produced fish, sweet potatoes, Irish potatoes, cassava, taro, sorghum, maize, peas, beans, soybeans, peanuts, rice, and cabbage. With the exception of Irish potatoes, all enterprises showed positive income above variable costs and positive net returns to land, labor, and management. Fish production yielded the highest income above variable costs and the highest net returns if fingerlings could be sold. If only food fish could be sold, cabbage was the most profitable crop. Sweet potatoes produced the highest yield of carbohydrates and soybeans were the least expensive source of protein. This study demonstrated that the cash income per unit of land generated by fish production is superior to other crops raised in the *marais* in Rwanda. While aquaculture is often considered a source of animal protein for household consumption, a high potential also exists for cash income generation.

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# Notices of Publication (cont.)

## CRSP Research Report 98-124a

### SMALL-SCALE FISH FARMING IN RWANDA: DATA REPORT\*

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This data report presents information collected in a survey of 267 fish farmers in Rwanda in September 1991. The findings are discussed in CRSP Research Report 98-124 entitled, "Small-Scale Fish Farming in Rwanda: Economic Characteristics" (Hishamunda et al., 1998). The Research

Report contains enterprise budgets for individual and cooperative enterprises that raised fish and alternative crops. These enterprise budgets demonstrate that fish production yielded the highest net returns to land, labor, and management. Additionally, the Research Report compares the carbohydrate yield and protein costs of fish with those of alternative crops, and concludes that sweet potatoes produced the highest yield of carbohydrates and that soybeans were the least expensive protein source. The results of the study demonstrate that fish culture is a superior production system in terms of cash income per unit of land when compared with other crops raised in the marais, or valley lowlands, in Rwanda.

This data report presents information collected in the survey that, while supplemental to the original research objectives, may be of interest. Section 1 contains 15 tables and 3 figures, which summarize the supplemental data collected by the survey instrument. The questionnaire itself comprises Section 2. Section 3 contains the criteria which were used to classify survey responses as unreliable, factors for converting various measures of crops and inputs into kilograms, and secondary data from the literature which were used to compare the nutritional values of various crops in the Research Report. Sources of secondary data used in the study are listed in the Literature Cited section.

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## African Catfish Spread in Asia

... from p. 9

not at all appropriate for carp culture, should be excellent for rearing magur. It likes a muddy bottom, and poor water quality or even oxygen depletion is not a serious problem. Given the scarcity of land, African magur rearing is one of the few aquaculture options open to poor people who only have the land around their one-room hut.

However, one drawback is that magur production depends on regular feeding rather than natural production of phytoplankton, which is the basis for carp polyculture. When good fish feed is available in adequate quantities, African catfish may reach a marketable size of 400 g within two months of stocking, or reach one kg in four or five months (estimated price at the fish pond: about US\$1.5/kg). . . .

The Department of Fisheries and NGO s active in aquaculture development should realise that it is far too late to stop the introduction of African catfish in Bangladesh, or in South Asia for that matter, while it has the potential of boosting animal protein production in this

densely-populated country.

Inland aquaculture and inland open water fisheries in Bangladesh already depend largely on exotic fish species, notably common carp and silver carp, Nile tilapia and Thai silver carp. And the reared stocks of rohu, catla and mrigal have become so inbred, that the Fingerling Producers' Association in Jessore is crying for government intervention. "Wild type" Indian major carps have become extinct, at least in southern Bangladesh.

Proper extension support is needed, in order to teach pond operators the rearing methods for African magur. Backyard magur hatcheries already exist; now backyard production units should be encouraged. Most importantly, good pelleted fish feed should be available locally, in order to support the development of this branch of the aquaculture industry.

Excerpted from: *Fish Farmer International* 12, no. 2, March/April 1998.

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## Upcoming Conferences and Expositions

Date	Topic/Title	Event Location	Contact Information
Aug 23-26	Seafood Africa '98	Johannesburg, South Africa	Tel (27 3)-3354-1890; Fax (27 3)-3354-1962
Aug 26-28	IFA '98	Sao Paulo, Brazil	Royal Dutch Jaarbeurs, PO Box 8500, 3503 RM Utrecht, The Netherlands; Tel +31-30-295-5662; Fax +31-30-295-5709; email ifa.brasil@jaabeursutrecht.nl
Aug 30-Sept 3	3rd International Symposium on Aquatic Animal Health	Baltimore, MD, USA	Division of Comparative Medicine, Johns Hopkins University School of Medicine, 720 Rutland Ave, Baltimore, MD 21205, USA; Tel 1-410-955-3273; Fax 1-410-550-5068; email wellfish@welchlink.welch.Jhu.edu
Sept 2-4	FishEco '98, International Symposium on Fisheries and Ecology	Trabzon, Turkey	Dr. A C Dincer, Faculty of Marine Science, Karadeniz Technical University, 61530 Camburnu, Trabzon, Turkey; Fax +90-462-752-2158; email fisheco@risc01.bim.ktu.edu.tr
Sept	16th Lowell Wakefield Fisheries Symposium & 1998 Joint Meeting of AFS Western Division, Alaska Chapter & N. Pacific Intl. Chapter	Fairbanks, AK, USA	Brenda Baxter, Coordinator, Alaska Sea Grant College Program, University of Alaska Fairbanks, PO Box 755040, Fairbanks, AK 99775-5040 USA; Tel 1-907-474-6702; Fax 1-907-474-6285.
Sept 22-24	Feria Internacional Aqua Expo '98	Guayaquil, Ecuador	Tel (593-4)690739/40; Fax (593-4)281741-298357
Oct 1-3	II Simposio Internacional de Acuicultura	Mazatlan, Sinaloa, Mexico	Tel 52-(67)-17-27-20/21; Fax (67)-14-08-85
Oct 6-10	1st Latin American Shrimp Culture Congress and Exhibition	Panama City, Republic of Panama	Grupo de Ferias, Congresos Y Eventos, S.A. P.O. Box 7277, Panama 5, Rep. de Panama; Tel (507) 269-3995/264-7227; Fax (507) 264-6983; email gfce@sinfo.net. www.expoferia.com/camaron.
Oct 7-10	Aquaculture Europe 98	Bordeaux, France	Aquaculture Europe 98 Secretariat, EAS, Slijkensesteenweg4, B-8400 Oosetende, Belgium; Fax 32 59 32 10 05; email eas@unicall.be
Oct 7-10	Bordeaux Aquaculture 5th Biennial Conference, Workshop & Exhibition	Bordeaux, France	BCS, Palais de Congrès, 33300 Bordeaux Lac, France; Fax +33-5-56-43-17-76
Oct 8-11	Agritech '98 & Fisheries '98	Surabaya, Indonesia	Tel (852)-2851-8603; Fax (852)-2851-8637
Oct 15-17	Fish Expo Boston	Boston, MA, USA	Diversified Expositions; Tel 207-842-5508
Nov 2-7	I Congreso Sud Americano de Acuicultura; X Simpósio Brasileiro de Acuicultura; V Simpósio Brasileiro Sobre Cultivo de Camarão; Feria Internacional de Acuicultura.	Pernambuco, Recife, Brasil	Tel (55-81)-445-2200
Nov 11-14	5th Asian Fisheries Forum	Chiangmai, Thailand	Dr. Padermsak Jarayabhand, Aquatic Resources Research Institute, Chulalongkorn University, Bangkok 10330, Thailand; Tel 66-2-2188160-62; Fax 66-2-2544259; email ardic@chulkn.car.chula.ac.th
Nov 13	Asian Fisheries Society, Symposium on Women in Asian Fisheries	Chiangmai, Thailand	Asian Fisheries Society, MC PO Box 2631, 0718 Makati, Metro Manila, Philippines; Tel 63-2-818-9283; Fax 63-2-816-3183; email e.tech@cgnet.com
Nov 16-18	IV Simposium Internacional de Nutrición Acuicola	La Paz, Baja California, México	Tel (8)-352-63-80; Fax (69)-88-01-57/58
Nov 19-21	Fish Expo Seattle	Seattle, WA, USA	Diversified Expositions; Tel 207-842-5508
Dec 2-5	ExpoPESCA '98, Latin America's Total Fish Show	Santiago, Chile	Sue Hill, Emap Heighway, Meed House, 21 John St., London WC1N 2BP, England; Tel 44-171-470-6340/6302; email sueh@meed.emap.co.uk

## Workshops and Short Courses

Date	Title/Topic/Site	Contacts
Year-round	Work Experience in Hatcheries Techniques/ Asian Institute of Technology, Thailand	Training and Consultancy Unit, Aquaculture and Aquatic Resources Management Program, School of Environment, Resources and Development, Asian Institute of Technology, PO Box 4, Klong Luang, Pathumthani 12120, Thailand; Tel (66 2) 524-5445; Fax (66 2) 524-5484; email tcuaasp@ait.ac.th
Year-round	Training & Research in Fisheries & Stock Mgmt/Wageningen Agricultural University, the Netherlands	G. van Eck, Dept of Fish Culture & Fisheries, PO Box 338, 6700 AH Wageningen, The Netherlands; Tel 31-8370-8330; Fax 31-8370-83937; email gerrie.van.eck@alg.wenv.wau.nl
Year-round	Tropical Aquaculture Advanced Training in a Third Country/Escuela Agricola Panamericana (EAP), Honduras, and Asian Institute for Technology, Thailand	Zentralstelle fuer Ernährung und Landwirtschaft (ZEL) Feldafing/Zschortau, Deutsche Stiftung fuer Internationale Entwicklung (DSE), D-82336 Feldafing, Germany; Tel ++49/8157/38-0; Fax ++49/81 57/38-227

# AQUANEWS

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