



## The Next Chapter of PD/A CRSP Research in Honduras

by Matt Niles (taken in part from the PD/A CRSP work plan entitled *Institutionalizing Aquacultural Development in Honduras: A Multi-Disciplinary Approach*)

The PD/A CRSP is continuing its 15-year presence in Honduras with the introduction of a new work plan for activities and studies to be undertaken there during the two-year period that began in May of this year. Honduras has been a host country since the program's inception in 1983 (excluding a brief interruption from 1987 to 1988); Thailand is the only host country in which the CRSP has enjoyed a longer presence.

Previous CRSP research in Honduras has established a strong network of relationships with aquaculture producers in the country. The new project in Honduras will build on this experience, making use of the pool of trained individuals—many of them with previous CRSP involvement—now present there.

In doing so, the new Honduras project seeks to help Honduran tilapia farmers take better advantage of the strong potential for aquaculture in Honduras and to help ensure that small- and medium-scale aquaculture production will remain viable in Honduras when the CRSP is no longer active there. These efforts will be addressed by strengthening institutional support for aquaculture in Honduras through a multi-disciplinary approach.

There are five components of the new project, each addressing issues vital to the sustainable practice and future success of small- and medium-scale tilapia aquaculture in Honduras.

- “Decision support for policy development—planning conferences for collaborating researchers, public agencies, and nongovernmental organizations working in aquaculture” is designed to foster and improve linkages among national and regional organizations working in aquaculture; this activity will “focus



Escuela Agrícola Panamericana (Zamorano), Honduras

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## NEWEST CRSP MOU LINKS ZAMORANO AND UNIVERSITY OF GEORGIA

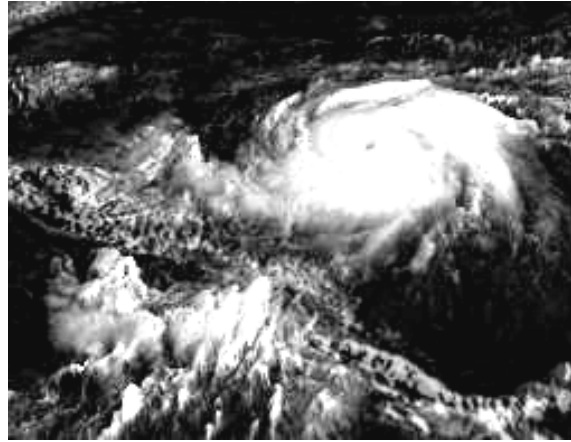
As of July 1999 the Escuela Agrícola Panamericana El Zamorano (Panamerican School of Agriculture), called El Zamorano, and the University of Georgia entered into a PD/A CRSP Memorandum of Understanding. The coupling of these two institutions will allow the implementation of research and related activities that foster regionalization of aquacultural efforts, address the production needs of small- and medium-scale fish farmers, and facilitate outreach activities that will ensure the existence of infrastructure for aquaculture in Honduras. El Zamorano, founded in 1942, is a private, non-profit, international educational organization, offering baccalaureate degrees related to agriculture, social development, and the environment. Since 1976 El Zamorano has offered coursework in aquaculture and subsequently has developed infrastructure and training programs that presently form an integral part of its academic curriculum. The university, located about 35 km southeast of the capital of Honduras, Tegucigalpa, is composed of an international student body representing approximately 20 countries. The faculty of El Zamorano, also international, resides on campus to facilitate ample and continuous interaction with the students.

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## Mitch, One Year Later

One year ago in the Fall 1998 issue of Aquanews we reported on the devastating effects of Tropical Storm Mitch.

Mitch hit at a time when the previous CRSP Honduras project was in the process of closing down activities, having decided to decline funding for CRSP research under the Ninth Work Plan. The storm forced the early termination of several research activities that were still underway. During the torrential rains of 30–31 October 1998, research underway at ponds at the Centro Nacional de Investigación Piscícola El Carao, Comayagua, was disrupted when ponds flooded, resulting in mass escape of fish. On an estuary of the Gulf of Fonseca in southern Honduras, a commercial farm that had been a participant in a CRSP water quality study was flooded



NASA satellite image of Tropical Storm Mitch's approach to Honduras

along with most of the other farms in the area, resulting in huge economic losses to farmers and extensive damage to farming facilities in the region.

In the bigger picture, Tropical Storm Mitch, a later stage of the fourth strongest Atlantic hurricane ever, and one of the deadliest in the last 200 years, was responsible for the deaths of over 7,000 Hondurans and forever changed the landscape of Honduras. An estimated 70,000 houses were destroyed and most of the highways and

bridges in Honduras were damaged or destroyed. The country is redrawing maps to reflect new courses of rivers and locations of entire villages that were forced to relocate.

We regret all the losses. 🇧🇵

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## New Honduras Project

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attention on a strategic vision for aquaculture development in Honduras, and on the problems and possibilities of small- and medium-scale tilapia aquaculture.”

- The second component of the new Honduras work plan, “Production strategies characterizing small- and medium-scale tilapia farms: Approaches, barriers, and needs” entails an analysis of Honduras tilapia producer perceptions of production processes, limitations, constraints, and possibilities. A survey instrument will be developed to assess the distribution and production problems of Honduran tilapia producers. Enhanced understanding of production barriers, distribution difficulties, and disincentives to participation in tilapia culture will step up efforts to increase tilapia production by Honduran farmers.

- “Linkages of aquaculture within watersheds and concurrent design of hillside ponds” will identify design criteria for aquaculture ponds in hillside watersheds and improve understanding of the “biophysical and socioeconomic linkages” between pond aquaculture operations and hillside watersheds. This component of the project will seek farmers’ perspectives on linkages between pond aquaculture operations and watersheds, in hopes of identifying the special needs of Honduran aquaculture operations in these areas and identifying alternate designs for pond construction. This, it is hoped, will lead to more sustainable pond aquaculture operations, as well as improved sustainable resource management practices in general in the hilly landscape of Honduras.
- “Technical assistance for fingerling production serving small- and medium-scale tilapia producers” consists of an activity to provide technical assistance to public and private tilapia fingerling production sites to improve their capacity to serve tilapia farmers in Honduras. Fingerling supply is a “central issue shaping the future of tilapia culture in Honduras,” and it is therefore important to improve farmer access to reliable supplies of fingerlings. To this end, Auburn University and Zamorano will collaborate to provide technical assistance to fingerling producers by holding workshops and developing and maintaining a national database of tilapia producers. Sex-reversed tilapia fingerling production will also be undertaken at Zamorano.

### MORE ON HONDURAS...

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## New Host Country Counterpart on the Scene in Honduras

by Deb Burke

Dan Meyer, the new host country Principal Investigator in Honduras, has a long history of involvement with aquaculture in Honduras, which grew from his work as a Peace Corps volunteer at the Escuela Agrícola Panamericana (Panamerican School of Agriculture) in Zamorano, Honduras, from 1974 to 1976. Meyer has been a faculty member at Zamorano since 1974 and came into contact with the PD/A CRSP in 1983—the first year of the program’s Honduras activities. Since then Meyer has maintained close contact with the CRSP investigators; Zamorano and the CRSP have collaborated on several experiments and on-farm trials. Most recently, Zamorano presented a paper at the Fifth Central American Symposium on Aquaculture at San Pedro Sulas, Honduras, 18–20 August 1999, related to research results of work done in collaboration with the CRSP (see “CRSP Presence at V CASA,” p. 5).

Meyer’s educational history includes a B.S. in biology and a M.Sc. in Zoology from Clemson University, South Carolina, US. In 1990 he completed his Ph.D. in aquaculture at Auburn University. In describing his desire to become involved with aquaculture, Meyer said, “My motivation to get involved in aquaculture was to utilize my knowledge and experience in biology in a useful and productive way.



*New CRSP Honduras host country Principal Investigator Dan Meyer*

I had always been interested in aquatic biology and ecology, so aquaculture was a logical and attractive option for me to pursue.” Meyer’s aquacultural research interests include the evaluation of different pond management strategies, assessment of the environmental impacts of aquaculture, and exploration of genetic resources for use in aquaculture.

Concern over the environmental impacts of aquaculture has grown in concert with the commercial production of tilapia and marine shrimp. “Both environmentalists and shrimp farmers,” Meyer asserts, “have sincere concerns regarding the environmental impacts of the many

human and natural influences on the aquatic resources in Central America.” To address these concerns research programs have been implemented to evaluate the environmental impacts of aquaculture in Central America and guide future development of the industry. Meyer points out that the PD/A CRSP was instrumental in this effort through its estuarine water quality monitoring and estuarine carrying capacity study, initiated in 1993, that provided long-term, continuous, systematic data on the health of estuaries located in shrimp producing regions of the Gulf of Fonseca.

Meyer notes that Zamorano has extensive experience with other CRSPs (Bean/Cowpea, TropSoils, Integrated Pest Management, and International Sorghum and Millet) and USAID, which will be very useful in navigating administrative processes. Meyer foresees maintaining “a fluid and continuous line of communication with other CRSP participants” as the principal challenge of the project, because the “national communications capabilities in Honduras are at best limited.” Despite the communication challenges, Meyer asserts that “we will do our best to keep in touch and keep everyone well informed of our activities.” Additionally, he hopes that his efforts with the CRSP will “contribute to implementing commercially viable and ecologically sound fish farming techniques in Honduras and the region.”

### HONDURAS PROJECT PERSONNEL

#### University of Georgia (Lead Institution) Investigators

**Brahm Verma** (Project Leader), Department of Biological and Agricultural Engineering

**E. William Tollner**, Department of Biological and Agricultural Engineering

#### Escuela Agrícola Panamericana (Zamorano) Investigators

**Dan Meyer**, Department of Biology  
**Freddy Arias**, Department of Agribusiness

#### Auburn University Investigators

**Joseph J. Molnar**, Department of Agricultural Economics and Rural Sociology

**Tom Popma**, Department of Fisheries and Allied Aquacultures

#### Collaborating Investigators

**Robert Nelson**, Department of Agricultural Economics and Rural Sociology, Auburn University

**E. Bronson Knapp**, Centro Internacional de Agricultura Tropical (CIAT), Cali, Colombia

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## CRSP Research Portfolio—What's in it for Honduras?

Studies funded by the CRSP can have both host country and global applicability; as such the program has placed a premium on developing a research portfolio that integrates research regionally as much as thematically. The following CRSP investigations presently underway (organized by research theme) have a discrete focus on aquaculture in Honduras and Central America although they are the work of researchers not principally involved in the Honduras Project:

### **Adoption and Diffusion Research**

Socioeconomic dimensions of aquaculture development: Baseline conditions, human capital impacts, and technology diffusion processes

### **Marketing and Economic Analysis Research**

Development of Central American markets for tilapia produced in the region  
Rapid economic evaluation tools

In addition, the PD/A CRSP Eighth and Ninth Work Plan research agenda contains other investigations (organized by research theme) with global applicability that also likely

have relevance for the aquaculture community in Honduras and, more broadly, in the Central American region:

### **Pond Dynamics Research**

Pond soil characteristics and dynamics of soil organic matter and nutrients

### **Marketing and Economic Analysis Research**

Economic and social returns to technology and investment  
Risk analysis of pond management strategies

### **Decision Support Systems Research**

Decision support for aquaculture systems  
Decision support systems for fish population management and scheduling in commercial pond aquaculture operations  
Enhancing the POND decision support system for economics, education, and extension

### **Reproduction Control Research**

Steroid immersion for masculinization of tilapia  
Detection of masculinizing agents in the pond environment  
Masculinization of tilapia by immersion in trenbolone acetate  
Fate of methyltestosterone in the pond environment

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## Rapid Economic Evaluation in Honduras

by Matt Niles

Another new PD/A CRSP work plan focusing specifically on Honduras is "Rapid economic evaluation tools," a Ninth Work Plan Marketing and Economic Analysis study. Utilizing fish production data collected by the CRSP in Honduras for the past ten years along with local input and fish prices, profitability and risk indicators will be determined and used to evaluate the profitability and riskiness of various aquaculture systems developed by the CRSP in Honduras. These determinations will be used to develop "user-friendly tools" that will enable a rapid determination of whether a particular tilapia production strategy is likely to be profitable, easy to implement, and associated with acceptable levels of risk.

While resulting only in a preliminary evaluation, these tools will enable CRSP investigators to focus research efforts on the production systems that have passed this initial economic "screening," thereby making the most efficient use of limited CRSP resources and ensuring that the research conducted is of greatest potential benefit to farmers. ■

### Want to Know More?

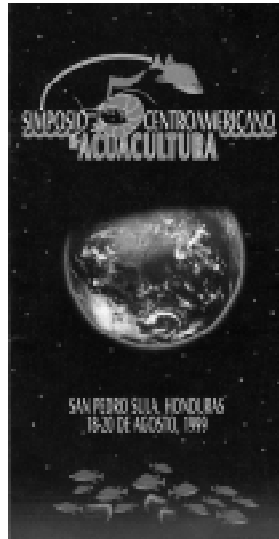
In the next issue of Aquanews, look for a profile of Upton Hatch, project leader for this study and new PD/A CRSP principal investigator. While this current project is Hatch's first as project leader, he is no stranger to the CRSP. A professor in the Department of Agricultural Economics and Rural Sociology in the College of Agriculture at Auburn University, Hatch was a co-PI on an Eighth Work Plan Adoption/Diffusion study entitled "The influence of fish culture technology, extension methodology, and socio-economics on success of fish culture on limited-resource farms." Read the full story in the Winter 2000 issue of Aquanews, on newsstands in January.

## CRSP Presence at V CASA

**M**ore than 400 individuals were in attendance at the Fifth Central American Symposium on Aquaculture, held 18-20 August 1999, in San Pedro Sula, Honduras, where concurrent sessions on shrimp and tilapia over the course of three days covered topics including water quality effluents and environmental concerns, culture systems, disease and pathology, and genetics.

The Symposium provided an opportunity for both formal and informal exchanges among researchers, students, and individuals representing the aquaculture production sector, private industry, and government and nongovernmental organizations.

The PD/A CRSP was a conference co-sponsor, along with ANDAH (Asociación Nacional de Acuicultores de Honduras) and the Latin American Chapter of the World Aquaculture Society.



CRSP program participants presented 13 papers (listed below) at the symposium. Notices of Publication for the CRSP-related papers will appear in the next issue of *Aquanews*. The papers appear in the proceedings:

B.W. Green, H.C. Clifford, M. McNamara, and G.M. Montaña (Editors), 1999. V Central American Symposium on Aquaculture, 18-20 August 1999, San Pedro Sula, Honduras. Asociación Nacional de Acuicultores de Honduras, Latin American Chapter of the World Aquaculture Society, and Pond Dynamics/Aquaculture CRSP, Choluteca, Honduras.

Contact information:

Asociación Nacional de Acuicultores de Honduras: andah@hondutel.hn  
Latin American Chapter, World Aquaculture Society: mcr@netwaybbs.com

### ...and the CRSP presenters were...

Boyd, C.E. and M.C. Haws. Good management practices (GMPs) to reduced environmental impacts and improve efficiency of shrimp aquaculture in Latin America, pp. 9-33.

Charris, F., B. Green, and D. Meyer. Efectividad de cinco métodos para la enumeración de alevines de tilapia (*Oreochromis* sp.), pp. 240-242.

Contreras-Sánchez, W.M., M.S. Fitzpatrick, G. Márquez-Couturier, and C.B. Schreck. Masculinization of Nile tilapia (*Oreochromis niloticus*) by immersion in synthetic androgens: Timing and efficacy, pp. 246-248.

Dasgupta, S. and C.R. Engle. Non-parametric estimation of returns to investment in Honduras shrimp research, pp. 201-203.

De Jesus, M. Aquaculture in the Amazon.

Fitzpatrick, M.S., W.M. Contreras-Sánchez, R.H. Milston, and C.B. Schreck. Fate of the masculinizing agent methyltestosterone in the pond environment, pp. 249-250.

Green, B.W. Sistemas de producción de tilapia en Honduras, pp. 254-257.

Green, B.W., D.R. Teichert-Coddington, C.E. Boyd, J. Wigglesworth, H. Corrales, D. Martinez, and E. Ramirez. Efecto del recambio de agua en la producción semi-intensiva de *Penaeus vannamei* (Boone, 1831) (Crustacea Penaidae) en una granja piloto, pp. 209-212.

Jensen, G.L. and K.R. Young. Implications of food safety regulations on aquaculture producers, pp. 134-145.

Lovshin, L.L. and N.B. Schwartz. Evaluation of integrated tilapia culture by resource limited farmers in Panama and Guatemala, pp. 258-261.

Meyer, D. and E. Caamaño. Frecuencia de la alimentación y consumo en tilapia (*Oreochromis niloticus*), pp. 262-265.

Valderrama, D. and C.R. Engle. Risk analysis of shrimp farming in Honduras, pp. 236-239.

Ward, G.W., B.W. Green, and D.R. Teichert-Coddington. Estimation of carrying capacity for shrimp aquaculture in the eastern estuaries of the Gulf of Fonseca, pp. 34-63.

## New Honduras Project

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- "Training and technical assistance for Honduras institutions working with small- and medium-scale tilapia producers" will undertake to build the capacity of Honduran technical assistance providers through improved understanding of aquacultural technologies. CRSP researchers will provide training and technical assistance through a series of meetings and training sessions for technicians and farmers. Held at various sites around Honduras, these activities will improve extension efforts in Honduras and result in increased

transfer of technical information to tilapia farmers in Honduras.

The new Honduras project marks the first formal CRSP collaboration with the Escuela Agrícola Panamericana (Zamorano), the new CRSP host country institution in Honduras. With over 800 students, a 7,000-hectare campus comprising cultivated farmland, pasture, forest, and modern facilities, and several earthen ponds and concrete tanks for tilapia production, Zamorano is an ideal institution for the CRSP to collaborate with in Honduras. ■

## Rosy Future for Bokay at CRSP

by Kris McElwee

Kevin Bokay joined the CRSP Management Office in late August as Administrative Program Assistant. He will wear three hats, serving as administrative assistant to the Financial Manager, the Assistant Director, and the Information Manager. Bokay recently completed a 20-year career in the US Army, 16 years of which were served in Italy. Between two stretches in the Army, he studied violin, voice, and Spanish at Missouri Western State College. When he rejoined the Army he earned a BA in history at the University of Maryland in his off-duty hours. Bokay is currently finishing a master's program in Human Relations that he started in Naples, Italy, through the University of Oklahoma.

Bokay was stationed for a few years at Oregon State University in the early 1990s and wanted to return to Corvallis to raise his family. He was drawn to the CRSP because it allowed him to work for the University in an International Programs activity. When asked how he's adapting to the job, Bokay responded, "I have always wanted to know more about the

management of the University and particularly the grants arena... I'm looking forward to learning the budget process, the proposal process, the on-going evaluations, and filing and reporting. And by July of 2001, I hope to help put it all together."

Bokay spent most of his military career in Italy, working as an administrative assistant to NATO officers. His affection for the people of Italy is clear: "I fell in love with Italy while I was there, though,

and will always be thankful to the Army (or fate) for sending me there. I spent over 16 of 20 years in the Army in Italy, mostly in Vicenza, a small town in the Veneto region. In Vicenza, I was able to integrate into the local community where I played in a community orchestra, sang in a community choir, and took part in local sporting activities, like triathlons and bicycle races. The Italians are wonderful hosts with an enormous amount of patience. I thoroughly enjoyed my stay there."

We hope that Kevin Bokay finds as satisfying a home at the PD/A CRSP and warmly welcome him on board. 📷



Kevin Bokay, new CRSP Administrative Program Assistant

KRIS MCELWEE

## A New Peach Arriving in Georgia

by Deb Burke

Ingvar Elle, PD/A CRSP Systems Administrator, has moved on. He completed his time (four years!!) with the CRSP and said his farewells mid-September. Elle is now at the University of Georgia, located in Athens, working in the School of Forest Resources. In his new job, Elle will be taking on a number of different tasks—website development, technical editing, and grant writing. He will also take part in a collaborative project involving the remote sensing of Georgia forests.

Reflecting on his time with the CRSP, Elle said, "As I'm preparing to leave, I'm realizing how much I've learned working for the CRSP."



Ingvar Elle, former CRSP Systems Administrator

DEB BURKE

He especially enjoyed his work with Decision Support Systems Project Leader John Bolte and Database Manager Doug Ernst. Elle, Bolte, and Ernst set in place the program's publications database, a project in which Elle learned a great deal about database interface design.

We wish Elle the best with his transition to the southeast and his new employment adventure. 📷

## Young—Newest Addition to CRSP Board of Directors

The CRSP wishes to extend a warm welcome to Dr. Anthony Young, Associate Dean for Research in the College of Agriculture at Southern Illinois University, Carbondale (SIUC). Dr. Young joined the PD/A CRSP Board of Directors in early September. After receiving his M.S. and Ph.D. from and completing a postdoc at University of Kentucky, Young began his academic career at University of Wisconsin-Madison. He joined the faculty at SIUC as Chairman and Professor in

the Department of Animal Industries in 1980 and has served as dean since 1987. His research has focused on ruminant nutrition, including work on forage quality and on the metabolism and digestion of cattle and sheep.

Young joins Russ Moll (The University of Michigan), Shadrach Okiror (University of Arkansas, Pine Bluff), L.J. (Kelvin) Koong (Oregon State University), CRSP Director Hillary Egna, and USAID Project Office Harry Rea on the Board of Directors.

## Graduate Student Profile: Wilfrido Contreras-Sánchez

by Kris McElwee

A faculty member in Mexico and doctoral candidate at Oregon State University, Wilfrido Contreras-Sánchez has been associated with the PD/A CRSP for three years, concentrating on reproduction control and, more recently, effluents research. After receiving his bachelor's degree in Mexico City at the Universidad Autónoma

Metropolitana-Xochimilco in 1985, Contreras-Sánchez worked as a consultant for fishermen's cooperatives in Tabasco, Mexico, from 1985 to 1986. He joined the Universidad Juárez Autónoma de Tabasco (UJAT) as a part-time teacher in 1986 and started working full-time for UJAT in 1987, when he became a faculty member assigned to the Biological Sciences Division.

Contreras-Sánchez received a Fulbright-LASPAU (Latin American Scholarship Program of American Universities) scholarship in 1993 for graduate study at Oregon State University. His master's thesis was titled "Effects of stress on the reproductive performance and physiology of rainbow trout (*Oncorhynchus mykiss*)."

After completing his master's degree, Contreras-Sánchez returned to Tabasco for one year to teach and conduct research at the university. At that time, CRSP Principal Investigator Martin Fitzpatrick received word of continued funding from the CRSP and invited Contreras-Sánchez to join him as a Ph.D. student. Contreras-Sánchez started his Ph.D. program at OSU in November 1996 and to date has conducted 30 experiments with tilapia progenies. The objectives of his research are to determine if short-term immersions in steroid results in complete masculinization of Nile tilapia (*Oreochromis niloticus*) and if unique messenger RNA is expressed during sexual differentiation in Nile tilapia. "In other words, we are trying to find out if masculinization of Nile tilapia can be done by short immersions in steroids. Our goal is to find a

safe and reliable method for sex inversion, one in which the residual hormone is contained and eliminated from the system, and which avoids contamination of water and sediments." The title of his dissertation, which he expects to complete by December 2000, will be "Mechanisms of sex differentiation and sex inversion in Nile tilapia (*Oreochromis niloticus*)."



GABRIEL MÁRQUEZ-COUTURIER

CRSP Graduate Student  
Wilfrido Contreras-Sánchez

In addition to Contreras-Sánchez's doctoral research, he and Fitzpatrick have established a collaborative agreement with the Aquaculture Laboratory at the Biological Sciences Division at UJAT. OSU and UJAT recently signed a Memorandum of Understanding, and several projects involving tilapia sex inversion have already started at UJAT. Describing the CRSP research at UJAT, Contreras-Sánchez explained, "We are evaluating the fate of MT in ponds, as well as the potential for immersions as a technique for masculinizing tilapia fry

at the farm level." Among those conducting CRSP-related research at UJAT are professor Gabriel Márquez-Couturier, one technician, and three students working on tilapia. The students are doing their bachelor's degree theses.

Asked about the status of aquaculture in Mexico, Contreras-Sánchez commented, "Aquaculture is an incipient activity in the majority of the country. Most aquacultural facilities in Mexico are located in the northern states of Sinaloa and Sonora, focusing on shrimp culture. Few farmers have started intensive or semi-intensive tilapia cultures. However, tilapia has been used by the Mexican government for promoting small-scale aquaculture; unfortunately, some programs have included the release of tilapias into lagoons and rivers. Very few systems use monosex cultures, but I think this activity is growing very fast in Mexico.

"From my perspective, in Mexico there is a need for well-trained aquaculture technicians (most of them are already working for the shrimp industry), as well as aquaculture programs at the university level. There is also a need for research in the field, as well as support for the researchers working in the field."

After completing his Ph.D., Contreras-Sánchez plans to "go back to Tabasco, improve the laboratory capabilities, bring lots of support for our research through grants and collaborative agreements, keep the research on tilapia going, and go back to the research I was conducting when I left on native species, especially the tropical gar." ■



XENA CUMMINGS

Matt Niles and Heidi Furtado host the PD/A CRSP information booth at University Days, 16 September 1999, on the Oregon State University campus. The university community uses this day to learn of the scope of research projects and services available. CRSP brochures and publications were dispensed to those who visited the CRSP display.

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# Notices of Publication

These Notices of Publication announce recently published work carried out under PD/A CRSP sponsorship. To receive a full copy of a report, please contact the author(s) directly unless it is otherwise noted.

## CRSP Research Report 99-133

### MASCULINIZATION OF NILE TILAPIA (*Oreochromis niloticus*) BY IMMERSION IN ANDROGENS

William L. Gale  
Columbia River Research Laboratory  
5501A Cook-Underwood Road  
Cook, WA 98605

Martin S. Fitzpatrick, Michael Lucero,  
Wilfrido M. Contreras-Sánchez, and Carl B. Schreck  
Oregon Cooperative Fishery Research Unit  
Department of Fisheries and Wildlife  
Oregon State University  
Corvallis, OR 97331

The use of all-male populations increases the efficiency and feasibility of tilapia aquaculture. The objective of this study was to determine the efficacy of a short-term immersion procedure for masculinizing Nile tilapia (*Oreochromis niloticus*). Two synthetic androgens were evaluated: 17 $\alpha$ -methyl-dihydrotestosterone (MDHT) and 17 $\alpha$ -methyltestosterone (MT). Exposure (3 h) on 10 and again on 13 days post-fertilization to MDHT at 500 mg/l successfully masculinized fry in all experiments, resulting in 100, 94 and 83  $\pm$  2% males in Experiments 1, 2 and 3, respectively. Immersions in MDHT or MT at 100 mg/l resulted in significantly skewed sex ratios in Experiments 1 and 3 (MT resulted in 73 and 83  $\pm$  3% males; and MDHT resulted in 72 and 91  $\pm$  1% males) but not in Experiment 2. Immersion in MT at 500 mg/l only caused masculinization in Experiment 3. Although further research and refinement is needed, immersion of Nile tilapia in MDHT may provide a practical alternative to the use of steroid-treated feed. Furthermore, when compared with current techniques for steroid-induced sex inversion of tilapia, short-term immersion reduces the period of time that workers are exposed to anabolic steroids.

This abstract was excerpted from the original paper, which was published in *Aquaculture*, 178(1999):349–357.

## CRSP Research Report 99-134

### RISKS ASSOCIATED WITH THE USE OF CHEMICALS IN POND AQUACULTURE

Claude E. Boyd and Laurence Massaut  
Department of Fisheries and Allied Aquacultures  
Auburn University  
Auburn, AL 36849

The most common substances used in pond aquaculture are fertilizers and liming materials. Fertilizers are highly soluble and release nutrients that can cause eutrophication of natural waters. Fertilizers are also corrosive and some are highly explosive, so proper handling is necessary to prevent accidents. Some liming materials are caustic and can be hazardous to workers if proper precautions are not exercised. Liming materials do not cause environmental problems, and liming and inorganic fertilizer compounds do not present food safety concerns. An array of other substances is used less frequently in aquaculture including: oxidants, disinfectants, osmoregulators, algicides, coagulants, herbicides, and probiotics. These compounds or biological products quickly degrade or precipitate. They are not bioaccumulative and do not cause environmental perturbations in natural waters receiving pond effluents. Accidental spills of some substances could cause environmental damage. Most substances used in pond aquaculture to improve soil or water quality present little or no risk to food safety. The use of human wastes in aquaculture or the contamination of aquaculture systems with agricultural or industrial pollution could result in product contamination and food safety concerns. Some substances pose safety risks to workers, explosion or fire hazards, or cause mild pollution.

This abstract was excerpted from the original paper, which was published in *Aquacultural Engineering*, 20(1999):113–132.



# Notices of Publication

## CRSP Research Report 99-135

### GENERATION OF DAILY AND HOURLY SOLAR RADIATION VALUES FOR MODELING WATER QUALITY IN AQUACULTURE PONDS

Z. Lu and R.H. Piedrahita  
Department of Biological and Agriculture Engineering  
University of California  
Davis, CA 95616-5294 USA

C. dos Santos Neto  
Department of Ecology and Evolutionary Biology  
Universidade Federal de São Carlos  
São Carlos, Brazil

A stochastic model has been developed for generation of daily and hourly solar radiation values that can be used as

inputs in a water quality model for aquaculture ponds. The daily solar radiation values are generated based on the monthly probability distribution of the daily clearness index. The monthly probability distributions are obtained from an incomplete historical daily solar radiation data set collected from fish pond sites. The hourly solar radiation values are estimated by breaking down the generated daily value using an empirical equation from the literature. The model has been applied to locations in Thailand, Honduras, and Rwanda. The length of historical data for the different locations ranged between six and eight years. The generated values show good agreement with the measured data. This model can be used to generate solar radiation values for locations having scant historical information.

This abstract was excerpted from the original paper, which was published in *Transactions of the ASAE*, 41(6):1853–1859.

## IIFET 2000: Call for Abstracts

The tenth biennial conference of the International Institute of Fisheries Economics & Trade (IIFET 2000) will take place 10–13 July 2000 at Oregon State University in Corvallis, Oregon, USA. The conference will include presentations by historians, legal scholars, industry spokespeople, policy-makers, biologists, nutritionists, and social and behavioral scientists. As at past conferences, there will be both formal and informal opportunities for interaction among the participants. A tentative list of conference topics includes: fishery biology and the social sciences; aquaculture: past, present, and future; fisheries in economic development; issues in international trade; consumer demand for seafood; seafood market behavior; and seafood consumption and human health.

The PD/A CRSP is a co-sponsor of this event, providing an opportunity for scholars from host countries in which the CRSP is presently active (Mexico, Honduras, Peru, Kenya, Thailand, and the Philippines) to attend and present. Preference will be given to papers with a focus on the social and economic aspects of aquaculture in determining eligibility for full or partial CRSP sponsorship. IIFET conference organizers will be coordinating the review and selection process.

In addition to the funds available specifically for CRSP host country presenters on social and/or economic aspects of aquaculture, a very limited amount of financial aid may be available on a competitive basis for those from

developing countries generally. Inquiries regarding financial assistance should be included with abstract submissions, or, if submitting via the Web, by checking the appropriate box on the submission form.

The final deadline for abstracts is 15 January 2000 and for final papers 14 July 2000. Those requesting aid must submit abstracts by 15 December 1999. Abstracts of prospective presentations will be reviewed by a panel as they are received, and submitters will be notified shortly thereafter whether their abstracts are accepted.


To present at the conference, submit a brief (250 words max.) abstract to:

Debi Mandigo  
Department of Agricultural and  
Resource Economics  
Oregon State University  
Corvallis, OR 97331-3601 USA  
Fax: 541-737-2563  
Email: Debi.Mandigo@orst.edu



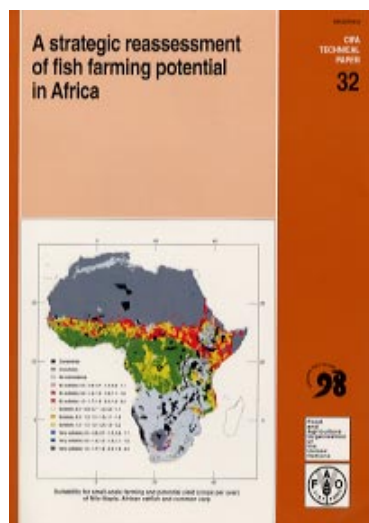
Abstracts can also be submitted directly from the website at: <osu.orst.edu/Dept/IIFET/html/2000>.

A \$500 prize will be presented for the best student paper. For details, please visit the website or contact Ann.L.Shriver@orst.edu, or write to the address above.

More detailed information will be provided in upcoming mailings. If you are not an IIFET member and wish to receive future mailings by email or regular mail, please contact the address above with your postal and email addresses. 

## Upcoming Conferences and Expositions

Date	Topic/Title	Event Location	Contact Information
October 26–29, 1999	Aquaculture Canada '99	Victoria, BC, Canada	Linda Townsend, Malaspina University, 900 5th Street, Nanaimo, BC, Canada, V9R 5S5; Phone: 250-741-8708; Fax: 250-755-8749; Email: townsdl@mala.bc.ca
October 28–30, 1999	V Ecuadorian Aquaculture Conference	Guayaquil, Ecuador	CENAIM-ESPOL Foundation, PO Box 09-01-4519, Guayaquil, Ecuador; Phone: 593-426-9495/494; Fax: 593-426-9492/456; Email: lschwarz@espol.edu.ec
November 3–5, 1999	Feed Ingredients and Grain Processing Asia '99	Bangkok, Thailand	Victam International, BV, PO Box 197, 3860 AD Nijkerk, Netherlands; Phone: 31-033-246-4404; Email: expo@victam.com
November 17–20, 1999	Aquaculture Venezuela '99	Puerto La Cruz, Venezuela	WAS Conference Manager, World Aquaculture Society, 21710 7th Place West, Bothell, WA 98021; Phone: 425-485-6682; Fax: 425-483-6319; Email: worldaqua@aol.com
February 2–5, 2000	Aquaculture America 2000	New Orleans, Louisiana, USA	WAS Conference Manager, World Aquaculture Society, 21710 7th Place West, Bothell, WA 98021; Phone: 425-485-6682; Fax: 425-483-6319; Email: worldaqua@aol.com
February 21–26, 2000	Conference on Aquaculture in the Third Millennium	Bangkok, Thailand	Aquamillennium Conference, PO Box 1040, Kasetsart Post Office, Bangkok, Thailand 10903; Phone: 662-561-1728; Fax: 662-561-1727; Email: naca@fisheries.go.th
May 2–6, 2000	World Aquaculture 2000	Nice, France	WAS Conference Manager, World Aquaculture Society, 21710 7th Place West, Bothell, WA 98021; Phone: 425-485-6682; Fax: 425-483-6319; Email: worldaqua@aol.com
July 10–13, 2000	IIFET 2000	Corvallis, Oregon, USA	Debi Mandigo, Dept. of Ag. & Resource Economics, Oregon State University, Corvallis, OR 97331-3601; Phone: 541-737-1414; Fax: 541-737-2563; Email: Debi.Mandigo@orst.edu; Website: osu.orst.edu/Dept/IIFET/html/2000
July 20–23, 2000	Third International Conference on Recirculating Aquaculture	Roanoke, Virginia, USA	Dr. George Libey, Recirculating Aquaculture Conference 2000, Virginia Tech, Blacksburg, VA 24061; Phone: 540-231-6805; Fax: 540-231-9293; Email: CFAST@vt.edu
January 21–25, 2001	Aquaculture 2001	Orlando, Florida, USA	WAS Conference Manager, World Aquaculture Society, 21710 7th Place West, Bothell, WA 98021; Phone: 425-485-6682; Fax: 425-483-6319; Email: worldaqua@aol.com



### **Strategic Reassessment on the Web**

A publication co-authored by former CRSP researcher Shree Nath is now available on the World Wide Web at <[www.fao.org/docrep/W8522e/W8522E00.htm](http://www.fao.org/docrep/W8522e/W8522E00.htm)>. The 170-page book *A Strategic Reassessment of Fish Farming Potential in Africa* by José Aguilar-Manjarrez and Shree S. Nath was published in 1998 by the Food and Agriculture Organization of the United Nations as CIFA Technical Paper No. 32. A summary of the book appeared in the Fall 1998 issue of *Aquaneews* as CRSP Research Report 98-127. The project used a geographic information system (GIS) to assess locations in Africa with the potential for warmwater and temperate-water fish farming. A bioenergetics model was combined with the GIS to predict yields of Nile tilapia, African catfish, and common carp across Africa. The results suggest that about 37% of Africa's land surface contains areas suitable for small-scale fish farming, and 43% for commercial farming. CRSP fish growth data were used in the bioenergetics model.

## 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; Phone: 66-2-524-5445; Fax: 66-2-524-5484; Email: tcuaasp@ait.ac.th
Year-round	Training and Research in Fisheries and Stock Management/Wageningen Agricultural University, the Netherlands	G. van Eck, Dept of Fish Culture & Fisheries, PO Box 338, 6700 AH Wageningen, The Netherlands; Phone: 31-8370-8330; Fax: 31-8370-83937; Email: gerrie.van.eck@alg.venv.wau.nl
Year-round	Tropical Aquaculture Advanced Training in a Third World 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; Phone: ++49-8157-38-0; Fax: ++49-81-57-38-227
December 1-3, 1999	Opportunities in Aquaculture Short Course/Aquaculture Center for Training, Education, and Demonstration (ACTED), Harbor Branch Oceanographic Institution, Fort Pierce, Florida	ACTED; Phone: 800-333-4264 or 561-465-2400 ext. 416; Fax: 561-466-6590; Email: acted@hboi.edu; Internet: <www.hboi.edu/aquaculture/acted.html>
October 31-November 12, 1999	HDNR Smithsonian Conservation Short Course: "Smithsonian Environmental Leadership & Communication Course"/Washington, D.C.	Christopher Ros c/o SI/MAB Program, Smithsonian Institution, S. Dillon Ripley Center, 1100 Jefferson Drive SW, Suite 3123, Washington, D.C. 20560-0705; Phone: 202-357-4793; Fax: 202-786-2557; Email: cjr@ic.si.edu; Internet: <www.si.edu/organiza/museums/ripley/simab/start.htm>
November 8-12, 1999	Recirculating Systems Short Course/Aquaculture Center for Training, Education, and Demonstration (ACTED), Harbor Branch Oceanographic Institution, Fort Pierce, Florida	ACTED; Phone: 800-333-4264 or 561-465-2400 ext. 416; Fax: 561-466-6590; Email: acted@hboi.edu; Internet: <www.hboi.edu/aquaculture/acted.html>
December 6-10, 1999	Culture of Penaeid Shrimp Short Course/Aquaculture Center for Training, Education, and Demonstration (ACTED), Harbor Branch Oceanographic Institution, Fort Pierce, Florida	ACTED; Phone: 800-333-4264 or 561-465-2400 ext. 416; Fax: 561-466-6590; Email: acted@hboi.edu; Internet: <www.hboi.edu/aquaculture/acted.html>

### CRSP Impacts-At-A-Glance

#### INSTITUTIONAL LINKAGES

Number of domestic and international institutions with which the PD/A CRSP has formal linkages: 32  
 Number of informal linkages with institutions worldwide: 81

#### TRAINING

Number of farmers, scientists, and agency personnel worldwide who have received CRSP training in fish production, sampling techniques, computer use, economics, and marketing: > 2,400  
 Number of countries that these farmers, scientists, and agency personnel represent: 42

#### CRSP-DEVELOPED TECHNOLOGIES

Since its development, the number of requests worldwide to download POND® software: 2,244  
 Number of US-based requests for POND® software: 1,137  
 Number of production studies from the Philippines, Thailand, Indonesia, Egypt, Kenya, Rwanda, Honduras, Panama, and Peru housed in the CRSP Central Database, the world's largest standardized database: 100+  
 Number of observations of pond variables obtained from CRSP production studies: 1,000,000+

Pond Dynamics/ Aquaculture CRSP  
Oregon State University  
400 Snell Hall  
Corvallis OR 97331-1641



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## CRSP Contact Information

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Oregon State University  
400 Snell Hall  
Corvallis, OR 97331-1641

You can also access CRSP publications electronically at  
[www.orst.edu/dept/crsp/publications/pubs.html](http://www.orst.edu/dept/crsp/publications/pubs.html).

Or email us:

Director: Hillary Egna	<a href="mailto:egnah@ucs.orst.edu">egnah@ucs.orst.edu</a>
Assistant Director: Cormac Craven	<a href="mailto:cravenc@ucs.orst.edu">cravenc@ucs.orst.edu</a>
Information Manager: Danielle Clair	<a href="mailto:claird@ucs.orst.edu">claird@ucs.orst.edu</a>
Asst. Info. Mgr.: Kris McElwee	<a href="mailto:mcelweek@ucs.orst.edu">mcelweek@ucs.orst.edu</a>
Research Assistant: Deb Burke	<a href="mailto:burked@ucs.orst.edu">burked@ucs.orst.edu</a>
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Director: Hillary S. Egna  
*Aquanews* Editor: Danielle Z. Clair  
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