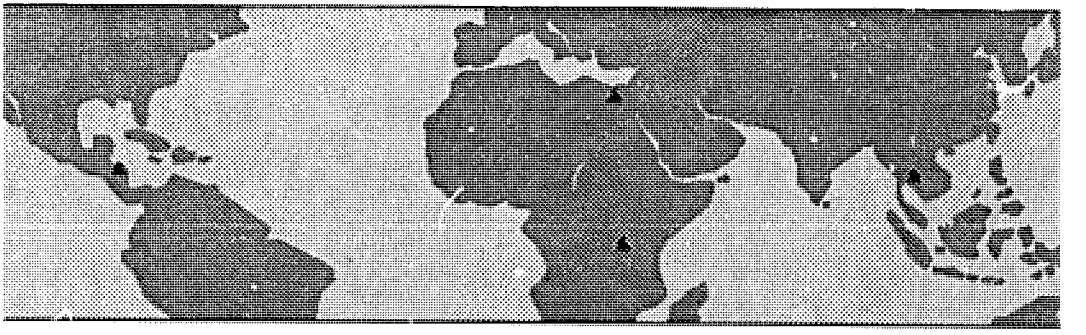
Quarterly Report



January-March 1994

Pond Dynamics/Aquaculture

Collaborative
Research
Support
Program

Pond Dynamics/Aquaculture

Collaborative Research Support Program

Quarterly Report
January-March 1994

The status of CRSP activities for the January through March 1994 quarter is reported according to project. The CRSP Sixth and Seventh Work Plans provide detailed descriptions of these experiments. This summary highlights technical progress as reported by each university, and includes explanations of difficulties encountered in reaching stated goals. Financial information is sent to AID in a separate report.

Honduras

Status of the Experiments

Seventh Work Plan, Study 1: Estuarine water quality

This study seeks to establish a baseline of information on selected chemical, biological, and physical characteristics of water at points along major estuaries that supply water and receive effluents from shrimp farms. The study is in progress and is expected to continue through May 1994.

Seventh Work Plan, Study 2: Farm nutrient budgets

This study seeks to quantify nutrient flow into and out of four farms located on two different estuarine types. Sampling is done every two weeks. Included in the nutrient flow are the feeds and fertilizers applied to ponds and the shrimp that are harvested; water in the supply and drainage canals is also sampled. The study is in progress, and will continue through the summer of 1994.

Seventh Work Plan, Study 3A: Substitution of inorganic fertilizer for feed in semi-intensive production of Penaeus vannamei *in Honduras*

This study compared yields of *Penaeus vannamei*, primary productivity and water quality in ponds receiving feed or combinations of feed and inorganic fertilizers. In previous studies, the substitution of organic fertilizers for feed during the first eight weeks of growth improved profitability, but farmers remain reluctant to use organic fertilizers such as chicken litter in shrimp grown for export, fearing that the crop might be considered "contaminated." This study attempts to determine if substituting inorganic fertilizers for feed during the first eight weeks of growth will have the same positive effect on profitability without the perceived risk of contamination from organic fertilizers. The dry and rainy season repetitions of this study have been completed, and data analysis is in progress.

Seventh Work Plan, Study 4B: Stocking rate of Colossoma macropomum *in polyculture with tilapia*

This study seeks to determine the relative growth potential of tambaquí *(Colossoma macropomum)* in polyculture with tilapia, and the optimum stocking rate for tambaquí in this polyculture. Tambaquí appear to be capable of faster weight gain than tilapia, especially at mean weights over 400 grams, but the tambaquí require feed to grow well, while tilapia can grow well on natural pond food alone. A polyculture of the two fish under fed conditions may be more efficient than a monoculture of either, and could increase production efficiency. The study is in progress, and is expected to be completed by May 1994. Preliminary data indicate that tambaquí stocked at $3/m^2$ are growing much slower than predicted.

Other Staff Activities

David Teichert-Coddington was invited to present a talk on water quality in shrimp ponds at the Camaron '94 conference in Mazatlán, Mexico, 9-13 February 1994. Approximately 350 attended the conference, organized by Ralston Purina Feed Company for shrimp farmers and business people in Mexico and Central America.

A one-day conference on sustainable shrimp farming in Honduras was organized by the Honduran National Association of Aquaculturists on 10 January 1994. The conference was designed to educate the farming community on sustainable shrimp culture, and to elicit support for CRSP research relating to estuarine monitoring and water quality. The La Lujosa Water Quality Laboratory played a major part in organizing the conference, and Teichert-Coddington summarized the results to date of estuarine monitoring and the implications of this work for shrimp farmers.

Teichert-Coddington gave a short course on water quality as part of a longer course on shrimp diseases. The program, organized by the Ministry of Natural Resources, was held 1-4 February 1994.

Marco Polo Micheletti, Technical Advisor to the Honduras Ministry of Natural Resources, and Teichert-Coddington attended the PD/A CRSP Annual Meeting in Hilo, Hawaii, 28-31 March 1994.

Mission Interaction

Margarit Harrit, USAID Environmental Officer, and John Warren, USAID Project Officer, visited the laboratory at La Lujosa and toured a local farm in March 1994.

Rwanda

Status of the Experiments

Sixth Work Plan, Study 3: Tilapia production in fertilized and fed rural ponds as a function of elevation

An on-farm study of supplemental feeding in private ponds at five elevations was completed in May 1993. Farmers participating in the experiment were trained in the feeding procedures and in proper water sampling practices. Data analysis is in progress.

Seventh Work Plan, Study 2: Fish production relationships derived from existing farmer-generated data

This study is designed to tabulate and analyze production data available from private fish farmers in Rwanda. Pierre-Clacer Miyibizi has been hired at the Rwasave Station to enter the data for this study. The computer needed for this study cleared customs during this reporting period, and Miyibizi was trained in his duties transcribing farmer-generated data into the newly developed data base.

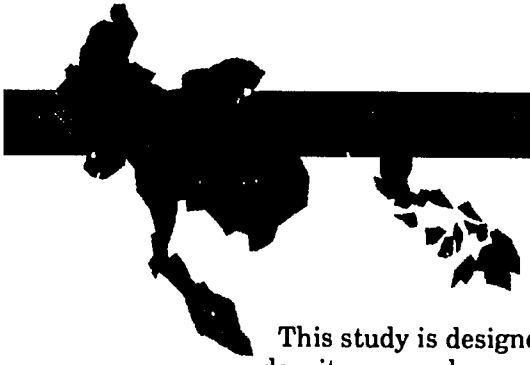
Other Activities

The renovation of the fry production pond was completed. The addition of a catch basin will add to the new fry production system, improving the capacity of the station to generate the large numbers of fry needed for on-farm studies. Bridges were constructed over two sex-reversal ponds to facilitate the use of hapas in the sex-reversal process. 145,000 fry were sex-reversed.

Other

The current situation in Rwanda is beyond the period of this report, but is nevertheless germane. As of 10 April 1994, Joyce Newman and

her husband have both returned to the U.S. to avoid hostilities within Rwanda that are resulting in the loss of many lives. Lieven Verheust and his family have returned to Belgium.



Thailand

Status of the Experiments

Sixth Work Plan, Study 6: Stocking density and supplemental feeding

This study is designed to determine the effects of stocking density on pond carrying capacity, including fish size and total net yield, in fertilized ponds with supplemental feeding. The study began in August at the Asian Institute of Technology (AIT) and continued through this reporting period.

Seventh Work Plan, Study 6: Management of carbon dioxide balance for stability of total alkalinity and phytoplankton stocks in fertilized fish ponds

This study addresses the question, "How can decreasing total alkalinity best be managed in fertile ponds during a growth cycle?" Relationships among the nature of fertilizer, net CO_2 balance, and total alkalinity concentrations in pond water during typical CRSP pond fertilization experiments are examined. In one of the Global Experiment treatments, manure and feed supplements are used; in the other Global Experiment treatment, PONDCLASS is used to manage the ponds.

Seventh Work Plan, Study 8: Carbon dioxide exchange between pond water and the atmosphere

This study is designed to quantify the rates of exchange of carbon dioxide between pond water and the atmosphere. Researchers will compare estimated exchange rates with rates of photosynthetic carbon uptake by pond phytoplankton and with rates of carbon release during community respiration. The study began at AIT during this reporting period. Researchers are using an automated system to monitor the diel cycles of CO_2 concentrations in pond water.

Seventh Work Plan, Study 9: Yield trials with genetically selected tilapia

This study is designed to determine the growth and yield of genetically improved tilapia. There are five treatments in this study; all use CRSP standard on-farm protocols for sampling and water management and the most current CRSP fertilization guidelines in 500 m^2 ponds for five months. Fish are stocked at the rate of 2/m^2. Four treatments use different strains of *Oreochromis niloticus*: treatment 1 uses the Philippine strain of *O. niloticus*; treatment 2 uses the Thailand strain of *O. niloticus*; treatment 3 uses *O. niloticus* from ICLARMs Genetic Improvement of Farmed Tilapias (GIFT) project; treatment 4 uses YY-male *O. niloticus* from the FAC/ University of Wales Swansea Research Project on Genetically Manipulated Improvement of Tilapia (GMIT). The fifth treatment uses a communal culture with tagged fish from the four groups described above. The study began at the Freshwater Aquaculture Center (FAC) in the Philippines in January.

Staff activities

James Szyper oversaw the experimental and analytical activity at the Asian Institute of Technology (AIT) in Thailand. He traveled to the Philippines to update and assist with project activities and facilitated the initiation of the CRSP socioeconomic study. Jim Diana, Kevin Hopkins, C. Kwei Lin, Eduardo Lopez, and Szyper attended the PD/A CRSP Annual Meeting in Hilo, Hawaii, 28-31 March 1994.

Status of the Experiments

Seventh Work Plan, Study 1: Respiration dynamics in aquaculture ponds

After extensive laboratory testing at the University of California at Davis (UCD), the apparatus for pond respiration measurements was field tested in Thailand. Testing revealed problems with the probes and with some components of the data acquisition system. Solutions to these problems were investigated through continued testing in the laboratory at UCD. Data collected in the field and in the laboratory are being analyzed for inclusion in future models.

Seventh Work Plan, Study 2: A water quality/fish yield model with stochastic inputs

Review and testing of techniques suitable for developing probability distributions for the CRSP solar radiation and wind data continue. In addition to simple statistical procedures, generalized weather generation programs such as WGEN and CLIGEN are being studied. Modifications of models previously developed by the UC Davis DAST continue. The modifications are necessary for the long-term simulations that will be carried out using stochastic data inputs. Means for simulating secchi disk depth changes over time are being investigated.

The OSU/DAST continued refining and testing models in the decision support system POND. One version was demonstrated to CRSP participants at the Annual Meeting in March. The models are organized hierarchically into three levels, which provide a mechanism for performing different kinds of analyses and for addressing the extent of user-entered data available to run simulations.

Seventh Work Plan, Study 3: Refinement of CRSP pond fertilization guidelines

Level 1 models are fairly simple, require minimal data inputs, and are intended for applied management and rapid analysis of pond facilities. At this level, the variables simulated are fish growth and

water temperature. Consumption of natural food by fish is assumed to be a function of fish biomass and appetite. Fertilizer application rates are user specified, but the model optionally generates supplementary feeding schedules.

Seventh Work Plan, Study 4: Alternate pond management strategies

Level 2 models predict phytoplankton and zooplankton dynamics in addition to fish growth and temperature (steady state conditions are assumed for nitrogen, phosphorus and carbon), and are intended for detailed pond analysis, management of optimization and numerical experimentation. Consumption of natural food (phytoplankton and zooplankton pools) by fish is predicted on the basis of a resource competition model, and also depends on fish appetite. At this level, both fertilization and feeding schedules are generated by the models.

Validation of Level 1 and 2 models and documentation of POND are in progress. The software and documentation will be distributed to CRSP participants for internal review.

Staff activities

Philip Giovannini, UCD DAST traveled to Thailand for field-testing of the respirometer as part of Study 1. John Bolte, Shree Nath, Raul Piedrahita and Christiano dos Santos Neto attended the PD/A CRSP Annual Meeting in Hilo, Hawaii, 28-31 March 1994.

of the respirometer as part of Study 1. John Bolte, Shree Nath, Raul Piedrahita and Christiano dos Santos Neto attended the PD/A CRSP Annual Meeting in Hilo, Hawaii, 28-31 March 1994.

Status of the Experiments

Seventh Work Plan, Study 1A: Validation of PD/A CRSP pond management strategies

Data analysis of the Global Experiment is underway at the Central Laboratory for Aquaculture Research (CLAR) in Abbassa.

Seventh Work Plan, Bioconversion Studies 2A, 2B, 2C1, and 2D

These studies test the efficacy of grass and black carp as control agents of unwanted organisms at CLAR. Pond harvest was completed in January. Initial data analysis indicates that grass carp might be able to control some of the nuisance plants. However, grass carp were not effective control agents in ponds which were dominated by *Azolla*, a plant that floats on the water surface, or by *Ceratophyllum*, a submerged living plant. Snail populations appeared to be low during the 1993 growing season. However, the effect of black carp predation remains unclear as a satisfactory method to estimate snail populations is still missing. Analysis of the data is further complicated, because ponds were significantly contaminated by unwanted fish species. Efforts to ensure a sufficient supply of black carp for the 1994 Polyculture Studies are underway. Low survival of the 1993 spawning may constrain black carp supply for 1994. Work at CLAR will focus on overcoming this problem in 1994.

Seventh Work Plan, Biotechnology Study A1

Progeny testing to identify 'YY' male tilapia continues at Auburn University. Possible 'YY' individuals have been isolated and attempts have been made to spawn them under controlled conditions. However, the candidates display highly aggressive behavior which has led to the death of the females, so spawning has not yet been successful.

Seventh Work Plan, Biotechnology Study A2

A second recirculating tank system was installed in a greenhouse in Abbassa. Renovation of ten round (100-m^2) earthen ponds to be used for tilapia reproduction research was completed. Renovations included installation of concrete harvest basins, new inlet and drain structures, and grading of pond bottoms. Mean water temperatures at the CLAR were about 18 to 19°C in late March; water temperature is anticipated to reach 20°C by early April, at which time ponds will be stocked to produce tilapia fingerlings needed for this year's research.

Seventh Work Plan, Biotechnology Study B1

Preliminary results from this study, conducted at the Hawaii Institute of Marine Biology, indicate that treatment with 17α-methyltestosterone (MT) seemed to have no influence on the growth performance of *O. aureus*. The results for the second species, *O. mossambicus*, were different. The group of *O. mossambicus* which received a dose of 25 mg MT/kg feed grew faster than untreated *O. mossambicus*. However, even the treated *O. mossambicus* grew more slowly than the untreated *O. aureus*.

Seventh Work Plan, Biotechnology Study C2

17α-methyltestosterone (MT) immersion experiments to determine the efficacy of an alternate method for tilapia sex reversal were started at Oregon State University. Preliminary results indicated that MT was non-detectable by High Performance Liquid Chromatography (HPLC) within 48 hours. Initial treatment level was 1000 mg MT/liter; the HPLC detection limit is about 10 ng.

Other Staff Activities

Ali Abdelghany and Bartholomew Green organized a PD/A CRSP workshop at the CLAR in Abbassa for 5, 6, and 9 January 1994. The workshop was developed as in-service training for Government of Egypt aquaculture/fisheries personnel. Shmuel Rothbard from the Gan Shmuel Fish Breeding Center, Israel, CRSP visiting scientists Kevin Hopkins and William Shelton, and on-site CRSP researchers participated in the workshop. Rothbard traveled to CLAR at his own expense to confer with Shelton and other CLAR researchers. The workshop was attended by approximately 50 participants including CLAR staff, as well as representatives from the General

Authority for Fish Resource Development (Cairo), Cairo University, and Zagazig University.

Abdelghany, Green, Hussein El Ghobashy, Fatma Hafez, Ibrahim Shaker and Yasir Awad attended the World Aquaculture Society Conference and Expo '94 in New Orleans from 12 to 18 January 1994. They met with Abdel R. El Gamal who traveled from the USFWS Marion laboratory where he was pursuing his post-doctoral program. Green presented two papers at the Water Quality/Fertilization session: *Water Budgets for Fish Ponds in the Dry Tropics* and *Chemical Budgets for Fish Ponds in the Dry Tropics.*

El Gamal returned to CLAR in late February from his post-doctoral assignment, and in early March resumed his activities as CLAR Director and CRSP Principal Investigator.

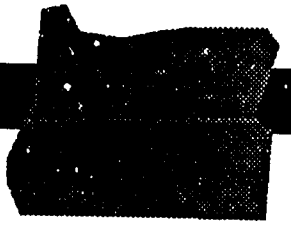
Abdelghany, Green, and Zeinab Elnagdy traveled from Egypt to Hilo, Hawaii to attend the CRSP Annual Meeting from 28 to 31 March 1994. Elnagdy presented a technical paper which examined preliminary production data and economic results, *Validation of PD/A CRSP Pond Management Strategies* by Green, Elnagdy and Hebicha. Martin Fitzpatrick from Oregon State University presented *Optimization of Gender Control Techniques for Tilapia* by Fitzpatrick, Carl Schreck and William Gale. Other Egypt Project researchers who attended the Annual Meeting were Claude Boyd, Jim Diana, Bryan Duncan, Gordon Grau, Kevin Hopkins, Kwei Lin and Hal Richmond.

Esam Hosney has joined CLAR as Gamal El Naggar's replacement; he will be responsible for the hatchery/physiology department.

Two staff members of CLAR participated in the Scholarly Exchange Program. Hani Ebrahim traveled to the University of Hawaii where he collaborated with Grau on CRSP research. Ashraf Soliman collaborated with CRSP researcher Shelton at the University of Oklahoma.

Abdelghany and Hebicha participated in the Scholarly Exchange Program in January/February 1994. Abdelghany traveled to the Northwest Fisheries Science Center in Seattle to collaborate with Ron Hardy on aspects of fish nutrition. Hebicha collaborated with Upton Hatch, Auburn University, on a project regarding the economic aspects of aquaculture.

A. S. Gomaa, Head, Agricultural Research Centers, Ministry of Agriculture and Land Reclamation, visited CLAR on 7 March and learned about CRSP activities and accomplishments.



Program Management Office

Highlights of activities

During this reporting period, members of the Management Office participated in the activities outlined below.

- Planned, coordinated and participated in the CRSP Annual Meeting in Hilo Hawaii. The Management Office prepared extensive briefing and background materials for the development of the continuation plan, coordinated the distribution of preproposals to meeting attendees, and chaired the meeting.
- Coordinated a buy-in from USAIDs Office of Women in Development for a workshop at the CRSP Annual Meeting. The workshop focused on integrating social sciences into the CRSP research agenda. All logistics for the workshop were coordinated through the Management Office.
- Helped to organize a structure for the Continuation Proposal.
- Hillary Egna, Claude Boyd, and researchers in the CRSP as well as other aquaculture scientists, are making progress on the book *Dynamics of Pond Aquaculture.*
- Assisted the Thailand team in reviewing their project status in light of the announced closure of the USAID Mission in Thailand.
- Distributed the Final Report of the External Evaluation Panel and submitted the final paperwork for closing out this project activity.
- Oregon State University sponsored Brigitte Goetze's travel to Eritrea to respond to the invitation of the Ministry of Marine Resources and Asmara University to propose future collaboration.
- Goetze and Marion McNamara wrote articles about CRSP projects in Honduras and Egypt for the newsletter of the Office of International Education at Oregon State University.
- A draft of Volume 2 (Program Activities) of the Eleventh Annual Report, was sent to USAID for review. Layout and design for Volume 1 (Technical Reports) is in progress. Both volumes will be distributed during the next reporting period.
- Revised the Instructions for Authors for CRSP Publications.
- Updated the staff directory.

- Egna participated in the CRSP Council conference call on 3 February 1994. Goetze and Egna participated in the CRSP Council conference call on 16 March 1994.
- Egna and Goetze obtained USAID approval for and facilitated the transfer of funds from the Egyptian portion of the Egypt Project to the U.S. portion in order to simplify equipment purchases.
- Egna and Goetze coordinated with USDA the upcoming technical evaluation of the Egypt Project, including preparation of information packets for evaluators and briefing of researchers.
- Goetze researched suppliers and purchase cost, placed purchase bids, and requested USAID approval for proposed equipment purchase.
- Coordinated routine travel and purchasing arrangements, including the travel of the nine Egyptian scientists who participated in the Scholarly Exchange Program.

Publications

- Aquanews, Winter 1993, Volume 9, Number 1. McNamara, M., ed. PD/A CRSP Program Management Office, Office of International Research & Development, Snell Hall 400, Oregon State University, Corvallis, Oregon 97331-1641, USA.
- Quarterly Report October-December 1993. PD/A CRSP Program Management Office, Office of International Research & Development, Snell Hall 400, Oregon State University, Corvallis, Oregon 97331-1641, USA.

The following Notices of Publication were also issued:

Springborn, R.R., A.L. Jensen, W.Y.B. Chang, and C. Engle. Optimum harvest time in aquaculture: An application of economic principles to a Nile tilapia, *Oreochromis niloticus* (L.), growth model. CRSP Research Report 94-61. PD/A CRSP Program Management Office, Office of International Research & Development, Snell Hall 400, Oregon State University, Corvallis, Oregon 97331-1641, USA. [Originally published in *Aquaculture and Fisheries Management* 23:639-647, 1992.]

Hopkins, K., and D. Pauly. Instantaneous mortalities and multivariate models: Applications to tilapia culture in saline water. CRSP Research Report 94-62. PD/A CRSP Program Management Office, Office of International Research & Development, Snell Hall 400, Oregon State University, Corvallis, Oregon 97331-1641, USA. [Originally published in *Multivariate methods in aquaculture research: Case studies of tilapias in experimental and commercial systems*, M. Prein, G. Hulata, and D. Pauly (eds.). ICLARM Stud. Rev. 20, 1993]

Green, B.W., and D.R. Teichert-Coddington. Production of *Oreochromis niloticus* fry for hormonal sex reversal in relation to water temperature. CRSP Research Report 94-63. PD/A CRSP Program Management Office, Office of International Research & Development, Snell Hall 400, Oregon State University, Corvallis, Oregon 97331-1641, USA. [Originally published in *J. Appl. Ichthyol.* 9:230-236, 1993.]