

II. Research Program Accomplishments

Major accomplishments during the current reporting period include the completion of a number of the activities scheduled under the Sixth and Seventh Work Plans. These include further refinements to several CRSP aquaculture pond models, improvements to the *POND*[®] decision support system, continued environmental monitoring, and

resumption at other CRSP sites of studies which were originally scheduled for Rwanda. Activities described in the Interim Work Plan were begun during this reporting period. As always, efforts to disseminate research results continued through a variety of channels.

Global Studies and Activities

The centerpiece of PD/A CRSP research is the Global Experiment. The Interim Work Plan's Global Experiment attempts to quantify the effect of a particular pond management strategy on water quality and sediment quality by developing nitrogen and phosphorus budgets. Little information is available on the effect of semi-intensive pond management strategies on the quality of pond effluents. Discharge of nutrient-rich pond water may cause deteriorated quality of receiving waters. Development of nutrient budgets will permit researchers to quantify the potential pollution impact of a specific pond management strategy. This experiment is presently being conducted at the Honduras and Thailand sites and results are not yet available.

The following studies also exemplify the global significance of PD/A CRSP research efforts: the investigations of fertilizer effects on growth and production in Thailand and Honduras, the investigations of lime requirement estimators, and the CRSP global socioeconomic research. The CRSP Central Data Base-the world's largest standardized aquaculture database-continues to grow.

Researchers evaluated fertilization strategies for rain-fed ponds in Thailand based on strategies developed for ponds that receive regular water inputs. Regular pond fertilization resulted in the highest fish growth rates. Irregular fertilization yielded lower growth, and fertilizing only at time of

stocking yielded the lowest growth. Results of this study will impact farmers in northeast Thailand, whose ponds are typically rain-fed, and who have lacked research-based information on appropriate fertilization regimes.

Researchers in Honduras studied the effects of nitrogen fertilization on water quality and tilapia yield in ponds supplied with adequate phosphorus. They found that fish yields were not significantly correlated with nitrogen input, despite higher phytoplankton biomass. Cool water temperatures apparently inhibited fish growth, rendering the fish unable to take advantage of higher available nutrient supply.

Researchers on the Global Social Sciences Project investigated how and to what extent CRSP research is reaching the institutions that serve farmers, and whether these institutions influence the practices of fish farmers. The study portrayed the institutional context and connections of the CRSP based on information obtained from U.S. scientists, Host Country counterparts, and others knowledgeable about the program. Researchers interviewed over 125 farmers in Rwanda, Honduras, Thailand, and the Philippines, and collected data from cooperating institutions in each Host Country. An economic analysis examined the financial viability of different feeding and pond fertilization approaches associated with several years of parallel experimentation. This

study will facilitate the conduct of research that meets farm-level needs in an environmentally and socially sustainable way.

Results from the Global Social Sciences study indicate that tilapia growers in each of the countries face vastly different institutional systems supporting tilapia production. Therefore, the CRSP researchers suggested that CRSP efforts should emphasize infrastructure development and improved functioning of the private sector when the CRSP has the opportunity to do so. Currently, poorly organized markets and distribution systems hinder aquaculture development. As markets for tilapia expand, so will demand for production and support services. The development of private sector marketing services are crucial for sustained aquacultural development. Efforts to enhance the transfer and utilization of CRSP research results will require greater attention to actual and potential pathways of influence and information flow to the farm and village. Although the provision of information directly to end-users is not a mandate of the CRSP, a better understanding of the actual and potential pathways of influence and information flow will help researchers focus their efforts to include appropriate influential institutions as research partners.

DAST researchers continued work on model refinement in the decision support system *POND*[®] (Version 2.5). These models provide users with the capability of simulating pond aquaculture facilities at three levels of complexity. At Level 1, models are geared toward applied management and rapid analysis of pond facilities. Simulation results agree reasonably well with observed data under a wide range of culture conditions, suggesting that the models used at this level are relatively robust and will likely be useful for a diverse audience, including pond managers, planners, and educators. The water temperature model in *POND*[®] has been validated by the use of CRSP data from Honduras, Rwanda, and Thailand. The fish bioenergetics model has also been calibrated for *Ictalurus punctatus* (channel catfish), *Colossoma macropomum* (tambaquí), and *Piaractus mitrei* (pacu).

Level 2 models allow for more detailed pond analysis, management optimization, and numerical experimentation. Plankton and nutrient dynamics in ponds are part of this model. Level 3 models explore in greater detail fundamental aspects of pond dynamics such as detailed nutrient transformations in pond water and sediments, as well as atmospheric diffusion processes.

A methodology to enable users to customize *POND*[®] for alternate culture species and locations has been incorporated directly into the software. Because of the high level of complexity of interactions among variables in the model, manually changing the parameters proved to be extremely time consuming, limiting the use of the software for examining production potential for different pond culture species. An iterative, non-linear, adaptive search method (genetic algorithm or GA) for automatically generating new parameters for the fish growth model has been developed. Adequate convergence to acceptable parameter values was obtained for the three species (channel catfish, tambaquí and pacu) chosen to evaluate GAs as an effective parameter estimation technique.

Another example of the global activities of the CRSP includes the Central Data Base which is used for global analyses and model building. The Data Base is the central repository for data from the CRSP Global Experiments. The Central Data Base has been housed at the University of Hawaii at Hilo since mid-1993. During this reporting period, all incoming data were processed, all data requests were filled, a new data entry manual was drafted, Data Base structure was modified to handle textual data, and the Data Base manager, worked with the Program Management Office on establishing a link to the Data Base on the PD/A CRSP's World Wide Web (www.orst.edu/dept/crsp/homepage.html). During the 1996 Annual Meeting in Thailand the Technical Committee reviewed two proposals to relocate the Central Data Base. The Technical Committee recommended that John Bolte of the OSU DAST team manage the Central Data Base. Beginning April 1996, the Central Data Base will be housed at the Department of Bioresource Engineering at OSU.