



INTRODUCTION

The Pond Dynamics/Aquaculture Collaborative Research Support Program (PD/A CRSP) conducts research that contributes significantly to the removal of major constraints to aquacultural development, thereby promoting economic growth and enhancing food security. This report describes the activities and accomplishments of the PD/A CRSP during the period 1 August 1997 to 31 July 1998.

The PD/A CRSP is funded by the United States Agency for International Development (USAID), under authority of the International Development and Food Assistance Act of 1975 (PL 94-161), and by the universities and institutions that participate in the CRSP. This cohesive program of research is carried out in selected developing countries and the United States by teams of US and host country scientists. Now operating under its fourth USAID grant since 1982, the CRSP is guided by the concepts and direction set down in the *Continuation Plan 1996-2001*, which was awarded funding under USAID Grant No. LAG-00-96-90015-00. This grant authorizes program activities from 1 August 1996 to 31 July 2001. An overview of CRSP history and how the program has evolved since its inception is provided in Appendix 1.

The activities of this multi-national, multi-institutional, and multidisciplinary program are administered by Oregon State University (OSU), which functions as Management Entity (ME) and has technical, programmatic, and fiscal responsibility for the performance of grant provisions. ME activities at OSU are carried out through a Program Management Office (PMO), which is supported in the task of program administration by three advisory bodies: the Board of Directors (BOD), the Technical Committee (TC), and the External Evaluation Panel (EEP). PMO staff as well as advisory group membership during the reporting period appears in Appendix 2.

ANNUAL HIGHLIGHTS

The most significant decisions and accomplishments by the Program Management Office, Board of Directors, External Evaluation Panel, and Technical Committee in the reporting period are noted below.

- In October 1997, program Director Hillary Egna was presented with the first "Women in Leadership" award by the Pacific Northwest Chapter of UNIFEM (The United Nations Development Fund for Women). UNIFEM supports the development initiatives of women worldwide. The Pacific Northwest Chapter of UNIFEM instituted this award to recognize and honor women and organizations who have made outstanding contributions to the advancement of the status of women, families, and communities.
- The PD/A CRSP co-sponsored the Fourth International Symposium on Tilapia in Aquaculture held in Orlando, Florida, 9-12 November 1997. Director Hillary Egna was among the speakers at the opening address, where she had the opportunity to introduce the PD/A CRSP to the attendees. In addition, the PD/A CRSP presented its research work at the conference both through a display booth and through the presentations of CRSP-funded research.
- The Ninth Work Plan Restricted Request for Proposals (RFP) for CRSP research to be carried out in the period 1 July 1998 to 30 June 2000 was developed with input from the CRSP's three advisory groups and solicited proposals for regional work plans, cross-cutting research work plans, and work plans for specific research support activities. The deadline for submissions was 1 October 1997. The PMO coordinated a peer review of proposals received and a review by advisory committees (BOD and EEP).

The peer review was conducted in two phases—a review inclusive of all proposals (involving more than 100 scientists external to the TC) and subsequently a TC review for revised proposals. (Authors of proposals which received a

"Fund after Major Revision" recommendation in the external review were given the opportunity for revision.)

- The EEP submitted its final 1996 report to the PMO in December 1997. The report was distributed to program participants for comment, and these comments were incorporated into the ME's response. The *Annual External Evaluation Panel Review Report of the PD/A CRSP for the Period January 1996 - January 1997*, containing the EEP's report and the responses of the ME, was published in January 1998. The PMO has subsequently followed up on the report and begun implementing many of the EEP's recommendations.
- The PMO organized and coordinated attendance at the program's Annual Meeting, which was held in conjunction with the World Aquaculture Society meeting in Las Vegas, Nevada, in February 1998.
- The PMO designed and distributed Project Profiles to the EEP and the BOD at the Annual Meeting, and to program participants thereafter. These Profiles were developed at the request of EEP members, who expressed an interest in receiving information related to projects in a summarized format. The Profiles are intended to serve as management and fiscal tracking tools and to provide background information to assist the ME in decision-making and the BOD and EEP in their advisory roles.
- The TC revised its bylaws during the program's Annual Meeting. Also at the Annual Meeting, Doug Ernst, Kevin Fitzsimmons, and Marion McNamara were elected, and Shree Nath and Bill Shelton were re-elected to the TC. John Bolte and Jim Szyper stepped down after completion of their terms of office on the *Work Plan and Budgets* and the *Materials and Methods Subcommittees*, respectively. (Since the Annual Meeting, Peter Edwards has resigned from his seat on the *Technical Progress Subcommittee* due to conflicting time commitments; researcher Yang Yi was appointed by the Co-chairs to fill the vacant seat.) A complete listing of Technical Committee and Subcommittee members appears in Appendix 2.

- The PMO initiated a new subcontract with Auburn University scientists for research in adoption and diffusion of technologies to be carried out in conjunction with collaborators in Guatemala and Panama, and from the University of Delaware.
- The PMO produced the *Addendum to the Eighth Work Plan*. Researchers may in the course of their work find that a change in experimental design or schedule is needed to their approved work plan. Any such change request is made to the Co-chairs of the TC for their review and approval on technical considerations. If approved, the change request is forwarded to the PMO for final approval by the Director on programmatic considerations. Change requests that received the approval of the TC and the Director were collected and published in the first *Addendum*. Changes that have occurred since the *Addendum* was compiled will appear in a forthcoming *Second Addendum to the Eighth Work Plan*.
- The PMO commissioned a review of project impact indicators to determine whether they adequately reflect and record project impact. Having worked personally with almost every CRSP researcher, Dr. Candace Buzzard, a specialist in project monitoring and performance measures, addressed attendees of the program's Annual Meeting. In addition, *A Review of Impact Assessment and Performance Indicators for the PD/A CRSP*, which summarizes the process, was disseminated to program participants in May 1998. The review found that "the PD/A CRSP has taken steps to institute an effective system for monitoring of progress toward achieving its objectives and documenting the apparent impact of individual project activities on an on-going basis."
- The CRSP welcomed Dr. Edna McBreen, Associate Vice Chancellor of the Institute of Agriculture and Natural Resources at the University of Nebraska, Lincoln, as a new member of the EEP. (A listing of panel members appears in Appendix 2.)
- Under previous grants, the Philippines served as a companion site to the prime Southeast Asia site in Thailand. The *Continuation Plan 1996-2001* identified the Philippines as a potential prime site. The Management Entity issued a restricted Request for Proposals (RFP) for a lead institution for a Philippines prime site with a deadline of 5 May 1997. Two proposals were received, but the RFP was reopened until 1 October 1997 owing to an inconclusive external peer review and evaluations by the BOD and EEP. In response to the re-issued RFP, three proposals were received. The ME, in concert with the BOD and EEP, recommended that the University of Hawaii receive the award for Lead Institution of the PD/A CRSP Philippines Project. A new subcontract with the University of Hawaii was initiated and is in place as of July 1998.
- The Director participated in CRSP Council meetings (both by teleconference and in person) throughout the reporting period and contributed to the Council's input on revised guidelines for CRSPs that are being developed by the Board for International Food and Agriculture Development. In addition, the Director attended the 1997 International Center's Week in Washington, DC. Also in the reporting period, networking was stepped up between the PMO and various professional associations (NASULGC, AIARD, World Aquaculture Society, American Tilapia Association, etc.) and organizations (UN-FAO, ICLARM, etc.).
- The Director and PMO and Information Management staff also contributed to the planning and development of two other CRSP Council activities: the CRSP Symposium to be held in conjunction with the annual meeting of the American Society of Agronomy in Baltimore, Maryland, in October 1998, and the USAID-CRSP Exhibit "Mutual Benefits for Developing Countries and the United States" on display from September through December 1998 at the Ronald Reagan Building in Washington, DC.
- Over the course of the reporting period, two meetings of the BOD were held during the Program's Annual Meeting in Las Vegas, Nevada, on 12 and 13 February 1998, and two teleconferences were held on 7 October 1997 and 12 May 1998. In addition, a letter vote was conducted in June 1998. The ME also participated in meetings with the EEP at the Fourth International Society for Tilapia in Aquaculture (ISTA) Conference in Florida (November 1997) and at the Annual Meeting (February 1998) and by teleconference in December 1997 and in July 1998.
- The PMO collaborated with The University of Michigan, the Asian Institute of Technology, and lead university Virginia Polytechnic Institute to develop a proposal in response to a USAID Request For Application (Management of Aquatic Ecosystems through Community Husbandry [MACH] project, targeted to address problems of floodplain ecosystems in Bangladesh).
- In April 1998 the PD/A CRSP was informed of a \$1.2 million budget cut as compared to the amount authorized in the program's current grant (1996-2001) for the third year of operations. After discussions with the Agency, the Director was able to obtain an additional \$200,000 for special projects. Substantial efforts were made in public relations, educational awareness, and federal relations throughout the remainder of the reporting period.

RESEARCH AND RESEARCH SUPPORT AGENDA

Research conducted by the PD/A CRSP since 1982 has helped to remove some of the constraints facing aquaculture development. Still, aquaculture continues to be hampered in several important areas. In developing the *Continuation Plan 1996-2001*, the CRSP undertook an in-depth constraints analysis. That analysis led to the identification of a number of major constraints that limit the development of extensive to semi-intensive sustainable aquaculture systems. Chief among these were:

- Inefficient and inconsistent aquacultural productivity
- Negative environmental effects resulting from aquaculture operations
- A poor understanding of social and economic factors
- Insufficient human capacity development
- Poor or outdated information management
- Limited networking capacities

The *Continuation Plan 1996-2001* responds to the first three of these factors by setting a **research agenda** that addresses constraints to aquacultural productivity, environmental effects, and social and economic aspects of aquaculture. The second three constraints are addressed by a **research support agenda** committed to improving human capacity development,

information management, and networking. To carry out that agenda, the program has a Research Support component comprising three projects:

- An Education Development project dedicated to strengthening human capacity in participating countries and regions;
- A project that manages the CRSP Central Database, the largest repository of standardized data related to aquaculture; and
- An Information Management project for reporting and disseminating project and program outputs via publications and a central website.

The PD/A CRSPs multidisciplinary team of researchers represents a wide range of US and international aquacultural experience. During the reporting period, participating US institutions included:

- Auburn University;
- Oregon State University;
- Southern Illinois University at Carbondale;
- The University of Michigan;
- University of Arizona;
- University of Arkansas at Pine Bluff;
- University of California at Davis;
- University of Delaware;
- University of Hawaii;
- University of Georgia;
- University of Oklahoma; and
- University of Texas.

Research activities were conducted at host country sites in Honduras, Peru, Kenya, Thailand, and the Philippines, at the participating US institutions, and with new collaborators in Mexico, Guatemala, and Panama. Memoranda of Understanding, representing a formal tie between a US and host country institution, which were in place during the reporting period include those between:

- International Center for Aquaculture and Aquatic Environments, Auburn University, and the Secretaría de Agricultura y Ganadería, Republic of Honduras;
- Southern Illinois University, Carbondale, and the Instituto de Investigaciones de la Amazonia Peruana and the Universidad Nacional de la Amazonia Peruana;
- Oregon State University Fisheries and Wildlife Department and the Department of Fisheries, Kenya; and
- The University of Michigan and the Asian Institute of Technology, Thailand.

RESEARCH PROGRAM FRAMEWORK

The *Continuation Plan 1996-2001* program framework, and the foundation for the current portfolio of PD/A CRSP research projects, consists of two building blocks: research in sustainable production systems and research support activities.

The sustainable production systems research framework is organized into the areas of production optimization, environmental effects, and social and economic aspects. Each area is further subdivided into specific *research themes*, which are the thematic areas of research needed to remove constraints to the development of more sustainable aquaculture. The results framework for research areas as presented in the *Continuation Plan 1996-2001* is summarized in Table 1, and the results

framework for research themes is provided in Tables 2 through 4. Research areas and their respective themes are listed here:

Research Area:	Production Optimization
Research Themes:	Pond Dynamics Feeds and Fertilizers Reproduction Control Aquaculture Systems Modeling New Aquaculture Systems/New Species
Research Area:	Environmental Effects
Research Themes:	Effluents and Pollution Appropriate Technology Responsible Science Policy Geographic Information Systems: Planning, Policy, and Global Data Analysis
Research Area:	Social and Economic Aspects
Research Themes:	Marketing and Economic Analysis Adoption/Diffusion Food Security Regional Analysis: Human-Environment Interactions Decision Support Systems Product Diversification

EIGHTH WORK PLAN

The CRSPs *Eighth Work Plan*, describing activities to be conducted by the CRSP during the period 1 August 1996 to 31 July 1998, was developed by the TC and is the first work plan designed within the framework of the *Continuation Plan 1996-2001*. The *Addendum to the Eighth Work Plan*, containing approved methods and schedules changes to work first described in the *Eighth Work Plan*, was printed in Spring 1998. Changes approved since the *Addendum* was published will be collected and published in a forthcoming *Second Addendum to the Eighth Work Plan*.

Previous activities were described in the *Interim Work Plan* which covered the period from 1 September 1995 to 31 August 1996. The *Interim Work Plan* was necessitated by a cost-extension to the preceding grant which was scheduled to end with the Seventh Work Plan.

The first three CRSP work plans specified identical experiments (called Global Experiments) at all CRSP sites to provide a baseline for comparisons among sites. This approach was changed starting with the Fourth Work Plan when different but related experiments were also conducted at the various sites. The particular topics studied at each site were based on the research and information needs in each country, as identified by the Technical Committee.

In comparison with previous work plans, the investigations contained in the *Eighth Work Plan* reflect the broadening of research which was proposed in the *Continuation Plan 1996-2001* as well as increased integration among sites. In addition to specific research activities implemented at prime sites in Africa, Asia, and Latin America, the *Eighth Work Plan* includes, for the first time, work plans for cross-cutting research. Cross-cutting research is research that may be conducted at one or more PD/A CRSP sites and whose results may have wider application than results from prime and companion site investigations. This research builds upon and expands results obtained through earlier PD/A CRSP efforts.

Table 1. Results Framework for Research Areas within the *Production Systems PD/A CRSP Building Block*.

PRODUCTION SYSTEMS				
PD/A CRSP RESEARCH AREA	OBJECTIVE	CAUSAL ASSUMPTIONS	MEASURE	TARGET
Production Optimization	* To increase the overall sustainability of aquacultural production systems through production optimization.	* Productivity and sustainability can be increased with better management of pond inputs, waste reduction, use of underutilized resources, and the conservation of non-renewable resources.	* More sustainable, efficient production systems appropriate for the biophysical environment.	* Improved scientific understanding of pond processes. * Improved pond management strategies. * Significant advances in reproduction technology. * Development of alternative aquacultural systems.
Environmental Effects	* To minimize the detrimental environmental impacts of aquaculture operations through improved pond management.	* Sustainable aquaculture is possible only in a healthy environment. Detrimental effects of aquaculture operations can be reduced or eliminated through changed management development.	* Reduced detrimental environmental impact of aquaculture operations.	* Development of methodologies to assess and reduce negative environmental impacts of aquaculture operations.
Social and Economic Aspects	* To increase our understanding of the social and economic implications of aquaculture development.	* Successful aquaculture development is contingent upon the social and economic constraints of each location.	* Improved viability of subsistence and commercial aquaculture farms at various sites.	* Positive net returns to capital investment. * Positive financial and nutritional impact on participating household communities.

Table 2. Results Framework for Research Themes within the *Production Optimization PD / A CRSP Research Area*.

PRODUCTION OPTIMIZATION			
RESEARCH THEME	OBJECTIVE	CAUSAL ASSUMPTIONS	MEASURE
Pond Dynamics	* To further our understanding of the influence of pond processes on pond productivity.	* Knowledge of pond processes and organisms is necessary to improve productivity and fine-tune existing pond management guidelines as well as to reduce production losses and waste as aquaculture systems become more intensified.	* Improved predictability of pond processes and pond productivity.
Feeds and Fertilizers	* To optimize use of pond inputs.	* Optimal fish growth can be achieved if the culture species' nutritional needs are addressed.	* Reduce inputs of fertilizers and / or feeds to produce one unit of fish.
Reproduction Control	* To develop short- and long-term solutions to reproduction technology problems.	* Guaranteed seed supply and reliable broodstock is essential for the undertaking and maintenance of fish farming. Gender manipulations add management options which increase economic viability in intensified systems.	* Development of procedures that guarantee the safety of animals and farmers during steroid use. * Successful production of sufficient amounts of YY-males. * Successful use of piscivorous fish to control excess tilapia offspring.
Aquaculture Systems Modeling	* To analyze and synthesize research results into models which better describe system processes.	* Models demonstrate the state of our current understanding of systems and system processes and provide direction for further inquiries.	* Simulations which adequately describe biophysical processes in ponds.
New Aquaculture Systems / New Species	* To develop alternative aquaculture systems through the use of new or underutilized resources or through resource partitioning. * To develop culture systems for local and native species.	* Production can be tailored to local conditions through diversification of aquaculture systems.	* Foundation for the use of other species and / or new species combinations in pond aquaculture.
			* Illumination of the role of heterotrophy on pond production. * Development of pond bottom management techniques through a better understanding of pond soil-water interactions.

Table 3. Results Framework for Research Themes within the *Environmental Effects PD/A CRSP Research Area*.

ENVIRONMENTAL EFFECTS			
RESEARCH THEME	OBJECTIVE	CAUSAL ASSUMPTIONS	MEASURE
Effluents	* To improve effluent water quality and water use efficiency.	* Reduction of excess nutrient loads will lessen environmental impact.	* Reduced nutrient loading.
Appropriate Technology	* To develop socially acceptable and environmentally friendly aquaculture technologies.	* Modification of current practices, tools, and facilities will lessen environmental impact.	* Demonstration of the effectiveness of CRSP guidelines to reduce effluent load. * Development of innovative approaches which result in a reduction of pond inputs, energy and/or excessively intensive management practices.
Responsible Science Policy	* To develop policies and guidelines that will govern the CRSPs work with exotic species, pharmaceuticals, and biotechnology.	* Communication and cooperation between potential host countries and the CRSP will be facilitated by a codified set of guidelines.	* Improved interaction with host country researchers and government officials in the area of exotics/drugs. * Faster processing of necessary paperwork by host country officials.
GIS: Planning, Policy, Global Data Analysis	* To analyze and synthesize existing information at local, national, and regional scales.	* Integrating tools are required to assess potential and impact of aquaculture operations at scales above individual ponds.	* Assembly of datasets containing relevant summaries of CRSP research and data.

Table 4. Results Framework for Research Themes within the *Social and Economic Aspects* PD / A CRSP Research Area.

SOCIAL AND ECONOMIC ASPECTS			
RESEARCH THEME	OBJECTIVE	CAUSAL ASSUMPTIONS	MEASURE
Marketing and Economic Analysis	* To develop marketing strategies for aquacultural products based on analysis of markets.	* Financial success is dependent upon meeting market demands.	* Improved pricing of aquaculture products. * Improved sales of products. * Reduced risk of adopting CRSP pond management technologies.
Adoption / Diffusion	* To identify barriers to the acceptance of new aquaculture technologies.	* Aquaculture technology will be adopted if the social, economic, and technological requirements of the local community are addressed. In order to create a successful aquaculture development, these requirements must be known by decision-makers.	* Provision of guidance to extension workers to further increase acceptance of CRSP technologies in host countries.
Food Security	* To improve understanding of food security issues and their relationship to aquacultural practices.	* Extensive fish farming can successfully provide a source of necessary animal protein for the rural poor.	* Assessment of food security needs of the rural poor, and the impact of aquaculture on dietary intake of animal protein. * Provision of information on nutritional status and needs of rural poor. * Assessment of technology transfer impact on rural poor.
Regional Analysis: Human-Environment Interactions	* To develop an information base of the effects of socio-economic conditions on the development of a local, national or regional aquaculture industry.	* Aquacultural development is often seriously constrained by the regulatory, social, and economic environment. These large-scale constraints must be known in order to implement a successful aquaculture development strategy.	* Development of recommendations that enable host countries to establish a successful aquaculture development strategy.
Decision Support Systems	* To refine computer applications to assist planners and managers in the development of economically efficient production technologies.	* Profitability can be improved through computer exploration of the effects of different management strategies on pond production potential and economic performance.	* Delivery of completed DSS to CRSP researchers, in-country personnel, development agencies, US producers and extension agents. * Positive feedback from DSS users.
Product Diversification	* To develop a range of aquaculture products.	* Consumption of aquaculture products will increase if consumers are given a variety of product options.	* Development of processes and guidelines for the production of new aquacultural products.

