



# INTRODUCTION

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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 1998 to 31 July 1999.

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-G-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 factor affecting the operations of the Pond Dynamics/Aquaculture CRSP in the third year of operations under its current 1996–2001 grant was a USAID funding cut of \$1.2 million as compared to the amount authorized in the grant for the same period. Despite the enormous funding setback, the CRSP carried out an impressive array of activities in the reporting period. The major decisions and accomplishments by the Program Management Office, Board of Directors, External Evaluation Panel, and Technical Committee are noted below.

- The PMO coordinated a lengthy and rigorous process for determining Ninth Work Plan allocations, an allocation process made more difficult than usual in the context of the FY98 budget cut. While the actual proposal review took place in the previous reporting period, a two-part proposal ranking exercise necessitated an additional administrative step to clarify the relative weights of scores. Once a decisionmaking framework was established, the portfolio of proposals receiving meritorious scores was further assessed and then narrowed to achieve balance among both geographic regions and CRSP research themes. Ninth Work Plan funding decisions were made in October 1998.
- The CRSP's former Honduras project, under the direction of researchers from the Department of Fisheries and Allied Aquacultures, Auburn University, declined an award for funding of Ninth Work Plan research and advised the ME of its intent in January 1999 to withdraw from the program. A combination of factors likely contributed to this decision, among them a USAID decision to discontinue funding for shrimp research and the program's fiscal and management direction away from fully supporting expatriate researchers' salaries. In April 1999, Auburn University dissolved its existing Memorandum of Understanding with the Secretaría de Agricultura y Ganadería in Honduras.
- The ME was apprised by Auburn University in September 1998 of a possible Honduras project subcontract shortfall. Over the course of several months and many negotiations with USAID, PD/A CRSP Director Hillary Egna was able to enlist the support of USAID to grant a one-time closedown award of \$55,000 for the PD/A CRSP Honduras project.
- On 22 March 1999 the Management Entity issued a restricted Request for Proposals (RFP) for a lead institution for a new CRSP Honduras project with a deadline of 12 April 1999. Two proposals were received, and these were sent out for review to the BOD, EEP, TC, and a number of reviewers external to the program. Elements in each proposal received favorable reviews, but neither alone was evaluated as sufficiently substantive to be awarded as written. After discussion, the proponents agreed to redesign and merge their proposals. New subcontracts with the Department of Biological and Agricultural Engineering, University of Georgia, and with the Department of Agricultural Economics and Rural Sociology, Auburn University, were in progress by the end of the reporting period. The University of Georgia has lead responsibility for the Honduras project, with Auburn University as a collaborating US institution. The Honduran counterpart institution is the Escuela Agrícola Panamericana.
- The PD/A CRSP's Ninth Work Plan, describing research activities to be conducted from 1 August 1998 through 30 April 2001, was printed in early 1999. The CRSPs reduced FY98 budget necessitated major revisions to the

original Ninth Work Plan research portfolio to ensure adequate coverage of critical target areas, including the elimination of the Global Experiment and other studies and curtailment of several research support activities. In addition, the start dates of Ninth Work Plan investigations were staged over a nine-month period to allow for funding of as much of the original research portfolio as possible. The staged start dates of Ninth Work Plan research projects are listed in Appendix 4.

Projects having completed Eighth Work Plan research were first to receive funds for Ninth Work Plan investigations, in accordance with the ME policy that there be no overlap between the two work plans. Building into this policy some flexibility, the ME allowed a one-time exemption to this policy; by request to the ME, a principal investigator could carry forward one Eighth Work Plan study while receiving funds to commence Ninth Work Plan research.

The following projects were granted exemptions to carry forward one Eighth Work Plan study: Kenya project (Auburn University and Oregon State University); Adoption/Diffusion project (Auburn University); Reproduction Control project (Auburn University); and Thailand project (University of Michigan). By the close of this reporting period, the Thailand project had completed its outstanding Eighth Work Plan investigation.

- The PD/A CRSP has typically held a centralized annual meeting, providing a forum for meetings among a number of program components—program researchers and administrators, the TC, the BOD, and EEP—over the course of several days. No annual meeting took place in 1999 as a consequence of the FY98 funding cut. The decision to not hold an annual meeting was arrived at in consultation with the BOD, EEP, and TC. Despite the cancellation of the annual meeting, these advisory bodies were involved in program activities by mail vote.
- The BOD and EEP participated in several major program activities in the reporting period including providing input for Ninth Work Plan allocation decisions (September and October 1998) and reviewing proposals for the Honduras Lead Project award (April 1999).
- As a result of the cancellation of the annual meeting, the 1999 TC membership election was held by mail vote in lieu of in person. Newly elected to the TC were CRSP principal investigators John Bolte, Claude Boyd, Tom Popma, and Salvador Tello, and external at-large member Marc Verdegem; Joe Molnar was re-elected. A complete listing of Technical Committee and Subcommittee members appears in Appendix 2.
- Other TC activities in the reporting period included providing input for Ninth Work Plan allocation decisions; reviewing proposals for the Honduras Lead Project award; and developing a less administratively intense process for principal investigators to report work plan changes owing to the need for the PMO to cut back on administrative services as a result of the FY98 budget cut.
- As mentioned above, the process for documenting work plan changes was modified in the reporting period. Instead of a requirement to secure the prospective approval of the TC and PMO, principal investigators will now report changes to work plans in the regular process of annual reporting. Changes that significantly alter the objectives or scope of a research plan are still required to be brought forward for consideration before being implemented. While the process for reporting changes has been modified, the changes will continue to be tracked and documented in work plan addenda.
- The PMO produced the *Second Addendum to the Eighth Work Plan* in early 1999 to document changes necessitated in the course of research to an experimental design or schedule. Changes occurring since the compilation of the Second Addendum will appear in a forthcoming Addendum, which will also likely include any changes that have been necessitated to investigations funded under the Ninth Work Plan.
- The Scope-of-Work for the 1997 EEP report was approved by USAID and distributed to EEP members in January 1998. A revised Scope-of-Work was developed at the request of EEP members in September 1998, and the report submittal date was amended from 30 April 1998 to 1 December 1998. The EEP submitted its final report to the PMO in mid-December 1998. The report was distributed to program participants for comment, and this input was incorporated into the MEs response. The *Annual External Evaluation Panel Review Report of the PD/A CRSP for the Period January 1997–January 1998*, containing the EEPs report and the responses of the ME, was published in mid-January 1999 and thereafter distributed to USAID and program participants.
- The work of the PD/A CRSP was represented in an exhibit of 24 photographs entitled “Mutual Benefits for Developing Countries and the United States,” at a display in the USAID Information Center at the Ronald Reagan Building in Washington, DC, from 21 September through 31 December 1998. The PMO worked closely with the CRSP Council to bring the exhibit together. The exhibit was designed to display the activities and accomplishments of the nine CRSPs in the developing world and the US. A virtual tour of the exhibit continues to be available on the Internet at <[www.ianr.unl.edu/crspi/virttour.htm](http://www.ianr.unl.edu/crspi/virttour.htm)>.
- The opening of the CRSP photo exhibit coincided with the September meeting of BIFAD, the Board for International Food and Agricultural Development. Director Egna attended the exhibit opening as well as the BIFAD meeting.
- The Director participated in CRSP Council meetings (both by teleconference and in person) throughout the reporting period. In addition, the Director attended the 1998 International Center’s Week in Washington, DC, in October.

- A special symposium entitled “CRSP: A Unique USAID Partnership with Higher Education” was a feature of the October 1998 Annual Meetings of the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America. The meetings, with a theme of Protecting Land, Water, and Biological Resources, were held in Baltimore, Maryland. CRSP Director Dr. Hillary Egna co-authored a paper, “Introduction, Historical Development, and Overview of the CRSPs,” which was presented at the symposium. Additionally, the PD/A CRSP presented a poster authored by Egna and John Baker entitled “The Pond Dynamics/Aquaculture CRSP: Contributions to International Aquaculture.”
- As part of a joint CRSP Council activity, the PD/A CRSP participated in a case study project coordinated by the Association of International Agriculture and Rural Development (AIARD) to illustrate the win-win benefits of investments in international agriculture and rural development to both the United States and developing countries. The first phase of the project included a compendium of case studies distributed on the Internet and in hard copy to policy and decision makers, universities, nongovernmental organizations, and private sector companies.
- Director Egna and Assistant Director Cormac Craven attended a March 1999 USAID workshop in Newport, Oregon, at the invitation of USAID’s Africa Bureau and Management Systems International (MSI). “Reengineering Partnerships in USAID’s Environmental and Natural Resource Management Programs in Africa” was the title of the two-day workshop designed to promote a more “outcome/results” approach to environmental and natural resource management projects, rather than focusing on the function or process of a project.
- At the invitation of Food and Agriculture Organization of the United Nations, Director Egna attended the March 1999 “Joint FAO/NACA Expert Consultation for the Development of a Regional Collaborative Programme on Sustainable Aquaculture for Rural Development (SARDev)” in Thailand. Egna presented a paper with CRSP researcher Dr. C. Kwei Lin entitled “The Pond Dynamics/Aquaculture CRSP: Developing Technologies and Networks for Sustainable Aquaculture and Rural Development.”
- In June 1999, proponent and PD/A CRSP Director Hillary Egna submitted a proposal entitled “Improving Nutritional Status of Children under Five through Enhanced Micronutrient Availability, Access and Utilization” to USAID’s Center for Economic Growth and Agricultural Development, Office of Agriculture and Food Security, Global Bureau. Collaboration among existing organizations with which the CRSP enjoys linkages and exploration of new potential partners is axiomatic to the competitive advantage of this potential buy-in from USAID, as is the ability to call upon the established PD/A CRSP host country institution network. A decision on the award was not anticipated until sometime into next year’s CRSP reporting year.
- Two new memoranda of understanding between CRSP host country partners and US institutions were executed in the reporting period. Central Luzon State University, Philippines, and the University of Hawaii formalized their working relationship in September 1998. In June 1999, the MOU between Universidad Juárez Autónoma de Tabasco, Mexico, and Oregon State University was officially in place. In addition, a new MOU between the Escuela Agrícola Panamericana, Honduras, and the University of Georgia was in progress at the close of the reporting period. A complete listing of active memoranda of understanding appears on page 83.

### 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 and advisors represents a wide range of US and international aquacultural experience. During the reporting period, participating US institutions included:

- Auburn University
- The Ohio State University
- Oregon State University
- Southern Illinois University at Carbondale
- University of Arizona
- University of Arkansas at Pine Bluff
- University of California, Davis

- University of Delaware
- University of Hawaii
- University of Georgia
- The University of Michigan
- University of Oklahoma
- 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 formal ties between US and host country institutions, which were in place (or in progress) during the reporting period include those between:

- Auburn University and the Secretaría de Agricultura y Ganadería, Republic of Honduras (dissolved in April 1999)
- Oregon State University and the Universidad Juárez Autónoma de Tabasco, Mexico
- Oregon State University and the Department of Fisheries, Kenya
- University of Hawaii at Manoa and Freshwater Aquaculture Center, Central Luzon State University
- Southern Illinois University at Carbondale and the Instituto de Investigaciones de la Amazonia Peruana and the Universidad Nacional de la Amazonia Peruana
- The University of Michigan and the Asian Institute of Technology, Thailand
- University of Georgia and Escuela Agrícola Panamericana, Zamorano, Honduras (in progress as of 31 July 1999)

### 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

### NINTH WORK PLAN

The Ninth Work Plan of the Pond Dynamics/Aquaculture CRSP was developed by the CRSP Technical Committee and describes activities to be conducted by the CRSP from 1 August 1998 through 30 April 2001. CRSP work plans have typically covered two-year periods. This holds true under the Ninth Work Plan for individual investigations, but while the overall time frame is greater than two years, no one investigation extends beyond a two-year period.

Increasing the time period of the overall work plan was necessitated by the CRSPs substantially reduced USAID budget allocation for the third year of the *Continuation Plan*—thus the start dates of Ninth Work Plan investigations were staged over a nine-month period to allow for funding of as much of the original research portfolio as possible.

Despite the staged funding approach, the budget cut also necessitated major revisions to the portfolio to ensure adequate coverage of the critical areas within the newly imposed financial constraints, such as the elimination of the Global Experiment (see below) and other studies and curtailment of several research support activities. Ninth Work Plan research is underway in Mexico, Honduras, Peru, Kenya, the Philippines, and Thailand, as well as in the US.

Earlier PD/A CRSP work plans—the first through the third—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.

The body of investigations funded under the Eighth and Ninth Work Plans reflects the broadening of research as was proposed in the *Continuation Plan 1996–2001* as well as increased integration among sites. In addition to prime site activities, CRSP research now underway includes a cross-cutting, thematic approach for investigations 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. Status updates on Eighth Work Plan research that had not yet concluded by the end of the current reporting period are contained herein, as are updates on research funded under the Ninth Work Plan.

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Researchers will find in the course of conducting their work that methods or schedules may need to be modified. The Program Management Office tracks such changes to assure continuing accountability for program awards. Reflecting methods and schedule changes to the funded research under

the Eighth Work Plan, work plan addenda were printed in Spring 1998 and Spring 1999. Additional changes to Eighth Work Plan research as well as changes to Ninth Work Plan research will be collected and printed in a forthcoming work plan addendum document.

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	TARGET
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.	* Illumination of the role of heterotrophy on pond production. * Development of pond bottom management techniques through a better understanding of pond soil-water interactions.
Feeds and Fertilizers	* To optimize use of pond inputs.	* Optimal fish growth can be achieved if the culture species' nutritional needs are addressed.	* Improved capabilities for prescribing optimal feed/fertilizer inputs to meet economic and environmental criteria.	* 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.	* Improved efficiency, efficacy, and safety of steroid use. * Successful production of sufficient amounts of YY-males. * Successful use of piscivorous fish to control excess tilapia offspring.	* Development of procedures that guarantee the safety of animals and farmers during steroid use. * Demonstration of the functional nature of YY-males for producing all male tilapia offspring. * Demonstration of the effects of piscivorous fish on tilapia production.
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.	* Improved representation of systems processes.	* 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.	* Development of production procedures for new species, combinations of species and/or the establishment of new aquaculture systems.	* Foundation for the use of other species and/or new species combinations in pond aquaculture.

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

RESEARCH THEME	OBJECTIVE	ENVIRONMENTAL EFFECTS		
		CAUSAL ASSUMPTIONS	MEASURE	TARGET
Effluents	* To improve effluent water quality and water use efficiency.	* Reduction of excess nutrient loads will lessen environmental impact.	* Reduced nutrient loading.	* Demonstration of the effectiveness of CRSP guidelines to reduce effluent load.
Appropriate Technology	* To develop socially acceptable and environmentally friendly aquaculture technologies.	* Modification of current practices, tools, and facilities will lessen environmental impact.	* Reduced resource use in socially acceptable ways.	* 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.	* Analysis tools to determine environmental effects of proposed aquaculture locations.	* 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	TARGET
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.	* Provision of information which (when applied) will allow the targeted aquaculture industry to access new markets and increase the volume of sold goods.
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.	* Successfully identified barriers to adoption of CRSP practices.	* 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.	* Improved understanding of the socioeconomic conditions that constrain aquaculture development.	* 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.	* Increased use of DSS by target clientele.	* 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.	* Availability of new aquaculture products in local markets.	* Development of processes and guidelines for the production of new aquacultural products.

