

3. 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. This chapter and the next two address the former; research support activities are reported in Chapters 4 through 4.3.

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 (see Chapter 1). 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 CRSP Technical Committee and is the first work plan designed within the framework of the *Continuation Plan 1996-2001*. 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 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. In the chapters that follow, reports relating to cross-cutting research activities are grouped under the heading, "Global Research."



UAPB researcher Dr. Rebecca Lochmann demonstrates fish dissection and tissue sampling techniques to station technicians during a visit to the Sagana Fish Farm in Kenya in June 1997.

TABLE 1. RESULTS FRAMEWORK FOR RESEARCH AREAS WITHIN THE PRODUCTION SYSTEMS PD/A CRSP BUILDING BLOCK.

PRODUCTION SYSTEMS				
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.	* Illumination of the role of heterotrophy on pond production. * Development of pond bottom management techniques through a better understanding of pond soil-water interactions.
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.	* Reduce inputs of fertilizers and/or feeds to produce 1 unit of fish. * Improved capabilities for prescribing optimal feed/fertilizer inputs to meet economic and environmental criteria. * Improved efficiency, efficacy, and safety of steroid use. * Development of procedures that guarantee the safety of animals and farmers during steroid use. * Successful production of sufficient amounts of YY-males. * 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.	* 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. * Development of production procedures for new species, combinations of species and/or the establishment of new aquaculture systems.

TABLE 3. RESULTS FRAMEWORK FOR RESEARCH THEMES WITHIN THE ENVIRONMENTAL EFFECTS PD/A CRSP RESEARCH AREA.

ENVIRONMENTAL EFFECTS				
RESEARCH THEME	OBJECTIVE	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 CRSP's 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
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.	* 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.
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.	* Provision of information on nutritional status and needs of rural poor. * Assessment of technology transfer impact on rural poor. * 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, U.S. 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.