Third External Evaluation Report

of the
Pond Dynamics/Aquaculture
Collaborative Research Support Program
for the period
September 1988 - August 1993

December 1993

Panel Members:

Homer Buck
Richard Neal
Roger Pullin

Funded by USAID Grant no. DAN 4023-G-00-0031-00 and
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THIRD EXTERNAL EVALUATION REPORT
of the
POND DYNAMICS/AQUACULTURE CRSP

Report by the External Evaluation Panel and
responses by the Management Entity
following the scope-of-work approved by USAID
for program performance from
1 September 1988 to 31 August 1993

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I. EXECUTIVE SUMMARY

The 5-year period to be reviewed in this report has been marked by considerable change, by some impressive records of achievement, and by some promising new initiatives. The most notable change has been the de-emphasis of the research on tilapia production at the El Carao station in northern Honduras, to facilitate an initiative to study problems that were restricting development of the shrimp industry in brackish water ponds in southern Honduras. The rationalization was that objectives of the tilapia research had been substantially achieved, and that a more favorable ratio of benefits to efforts expended could be achieved through addressing the problems plaguing the shrimp industry. The initiative in shrimp had the enthusiastic support of both the USAID Mission and the government of Honduras. Approval for making the change was granted by the PD/A CRSP Technical Committee on condition that a sufficient effort be maintained at the El Carao station to sustain momentum in the tilapia program, and to maintain the integrity of the global experiment. The 1992 site visits and subsequent developments at both El Carao and the laboratory at Choluteca, which supports the shrimp studies, suggest that the transition is going well; however, questions regarding the rationale for this change and some related issues were raised by the EEP.

Notable changes have also occurred in Rwanda. Progress in the sixth work plan was seriously impeded by the political unrest in the North. It caused major studies to be delayed, relocated, or temporarily abandoned. Coupled with the political problems was the termination of the remarkably successful tenure of Ms. Karen Veverica as US Research Associate. Fortunately, a number of good things happened within the early months of 1993:

1) The political crisis eased.

2) A promising replacement was found for Ms. Veverica in the person of Ms. Joyce Newman, who left the US on June 20, 1993 to take up her new position at Rwasave.

3) The resident, host country staff did an outstanding job of station operation and the pursuit of project goals during the period of uncertainty. There is now new confidence that the Rwanda CRSP can continue its impressive record of achievement.

The Thailand CRSP also continues to have an outstanding record of success. Contributions to the global experiment have been of high quality, and it has made many outstanding contributions to the scientific literature. The educational and outreach elements of the Thai project are remarkable, and the international role of the CRSP in SE Asia is expanding. Important potential exists for use of the Thai project as a springboard for aquaculture research and development in Laos, Viet Nam and Cambodia; however, special support will be required for this purpose. The research in Thailand continues to be a model project.

In a small way the CRSP has moved back into the Philippines. Field testing of recommended methods at research and farm sites in the Philippines is progressing. Cooperation with ICLARM appears to promise opportunities, particularly in regard to stock testing of improved tilapia strains in CRSP systems.

The Data Analysis and Synthesis Team (DAST) at the University of California, Davis has continued to develop several pond dynamics models which have clarified our general understanding of such sensitive parameters and/or relationships as primary production, sensitivities of phytoplankton to light, interrelationships between temperature and dissolved oxygen, and the effects of turbidity and depth on pond productivity. The models are now in use and suitable for continuing analysis of CRSP data.

At the same time the DAST team at Oregon State University has continued to translate the findings of CRSP field research projects into practical pond management guidelines that have global applications. The principal product to date is an expert system, PONDCLASS Version 1.1, for establishing guidelines for fertilization of aquaculture ponds. It has undergone a peer review, from which usable comments and suggestions have been incorporated into the program, it is being tested at several field locations, including Rwanda, Thailand, and the Philippines, and a final draft of a User's Guide is now available. The guide is organized to permit specific applications for each of three principal types of users: 1) research planners; 2) teachers, and 3) pond managers. This is the first phase of what is widely considered to be a landmark development in the science of fishpond management. A second version will provide guidelines for controlling fish growth. The User's Guide is being translated into French and Spanish.

A recent development of major significance has been the addition of a new temperate site into the PD/A CRSP program. It culminates lengthy negotiations with Egyptian counterparts representing Egypt's National Agriculture Research Project (NARP). It will include studies on polyculture, bioconversion, and biotechnology, and is funded under a separate contract. Participants will include new researchers from long-time CRSP institutions – including the University of Hawaii at Manoa and Oregon State University – and adds a new institution (the University of Oklahoma) and a new host country participant (the Central Laboratory for Aquaculture Research, Abbassa, Egypt).

A second major initiative has been the testing of CRSP models on a research station and on farms in the Philippines. This has been made possible by the 20% increase in funding provided the PD/A CRSP in May 1991, and by matching funds from the University of Hawaii and Central Luzon State University.

The EEP ranks the PD/A CRSP as 'exceptional' for several reasons: 1) for its faithful adherence to the original concept of a collaborative research support program; 2) for its application of a global experiment utilizing US and foreign inputs effectively to strengthen the knowledge base; and 3) for its potential to contribute to a new form of agriculture yielding food, income, and employment from underutilized resources in an environmentally sound way.

The External Evaluation Panel believes that the PD/A CRSPs most serious problem is its grossly inadequate level of funding. The scientists, technicians, and administrators of the program should be commended for their dedication and exceptional productivity in addressing a major problem with generally inadequate funding, yet continuing to progress at a highly commendable rate.

Executive Summary Response by the ME:
The ME agrees that inadequate funding is the most serious constraint to the functioning of the PD/A CRSP. The PD/A CRSP is funded at a significantly lower level than the other CRSPs, yet fulfills essentially the same requirements as other CRSPs. The ME also agrees that this review period has been marked by achievement and change. The ME interprets these changes as indicators of a dynamic organization that characterize a research community responsive to the changing social, political, and scientific environments in which we work. The ME believes that the strength of this CRSP is its ability to adjust to local conditions while maintaining its global focus.

For example, while the change of activities in Honduras does represent a response to needs perceived by farmers, the Government of Honduras, and the USAID Mission, the change also offers an opportunity to resume the brackish water research that was a part of the original CRSP research agenda. When funding constraints in 1987 forced the program to cut back from seven sites to three, CRSP participants decided that a brackish water site should remain a part of the Global Experiment. Unfortunately, the brackish water site chosen in Panama was forced to close due to political exigencies; the CRSP moved to Honduras and suspended brackish water research until an opportunity for establishing a brackish water station could be developed. The current intersection of the host country needs with the CRSP research agenda appears to be a win-win situation.

As the EEP notes, the political situation in Rwanda has interfered with research progress. Despite extremely difficult conditions, the Rwanda project is now back on schedule.

Additional comments by the ME will be found in italics in the body of the report.

II. THE EXTERNAL EVALUATION PANEL: DUTIES AND MEMBERSHIP

The External Evaluation Panel (EEP) is composed of three senior scientists selected by the Board of Directors (BOD) and approved by JCARD and BIFAD. One of the scientists (Buck) was appointed to the panel in 1987, the other two in 1992. Members participating in the present evaluation are:

Dr. Homer Buck, Illinois Natural History Survey (retired)

Dr. Richard Neal, National Marine Fisheries Service

Dr. Roger Pullin, International Center for Living Aquatic Resources Management

The panel reviewed and assessed the merits of component projects and the technical and administrative accomplishments of the program as a whole. The EEP did not review the research contract in Egypt or comment on the plans for that activity. The review process has been based on the review criteria attached in Annex A. Information for the evaluation process was obtained from the following sources:

1) Site visits to three continuing projects in Honduras, Rwanda, and Thailand, and to the recently rejuvenated project activity in the Philippines.

2) Review of responses to recommendations made by the EEP in the last triennial review.

3) Review of administrative reports, technical reports, publications, and other documents provided by the Management Entity (ME).

4) Annual meetings through attendance at seminars, presentations of research findings, policy discussions, and through interviews with research personnel.

5) Meetings with BOD, management personnel and USAID representatives.

III. INTRODUCTION

A. BACKGROUND AND OVERVIEW OF GOALS

The Pond Dynamics/Aquaculture Collaborative Research Support Program (PD/A CRSP) was initiated in September 1982 with the primary goal of increasing the availability of aquaculture-derived animal protein in selected developing host countries through a specific coordinated research program. It is a long-term program which focuses the technical resources of the developing countries and US institutions on the improvement of pond culture systems through the clarification of mechanisms that control pond productivity, and on the manipulation of these mechanisms to achieve greater and more efficient production of animal protein.

Secondary goals of the program are the training of fisheries researchers and technicians, and the strengthening of collaborating host country institutions so that a viable and efficient program of protein production can be sustained after the PD/A CRSP program is terminated.

The administrative and technical tasks required to establish projects in six host countries (Honduras, Indonesia, Panama, Philippines, Rwanda, and Thailand) and to manage the overall program were completed during the first operational year. Collaborative research involving CRSP personnel and government agencies and educational institutions of the six host countries was conducted from 1983 to 1987. Due to Gramm-Rudman budget reductions in 1986 and 1987, the CRSP was reorganized to include a single program in each of the geographical areas originally selected by USAID. Country sites retained were Panama, Rwanda and Thailand. When political developments required the CRSP to leave Panama in 1987, the Joint Committee on Agricultural Research and Development (JCARD) and the Board of International Food and Agricultural Development (BIFAD) approved the relocation of the CRSP to Honduras in April 1988.

Periodic external evaluation of program accomplishments is an important element of program management. The External Evaluation Panel was established for this purpose in accordance with stipulated management guidelines.

The first 5-year grant to the CRSP from USAID was for September 1982 to August 31, 1987. The second grant was for the 3-year period September 1, 1987 to August 31, 1990. We are now in year three of a 5-year grant for the period September 1, 1990 to August 31, 1995. The first review by the EEP was conducted in 1985, the second in 1988, and this review was initiated in September 1992.

B. HISTORICAL PERSPECTIVE ON THE PD/A CRSP

Aquaculture like agriculture is a contributor to food supplies in developing countries. Aquaculture is of particular interest because it contributes a high protein food and because its economic success and social acceptability have

resulted in rapid expansion of the practice in the developing world in recent years. Unlike agriculture, a solid base of knowledge has not yet been developed for aquaculture, production practices are varied and diverse, and applications meet with mixed success. The ancient art of aquaculture is being practiced widely in the developing world without the knowledge base required for efficient production.

The Collaborative Research Support Program's approach promised to be an ideal approach to filling the knowledge gap with regard to low-input aquaculture. Strong U.S. university expertise was joined with research teams in developing countries to elucidate the basic principles of aquaculture, to describe production relationships for environmental and nutrient factors, and to test improved production systems based on results of this research.

The original concept was that the CRSPs would bring new resources to bear on research problems, that the US universities had a unique contribution to make in this research, and that CRSPs would be focussed on areas where additional applied research promised important returns. The CRSPs were not designed to be extension or demonstration projects; other resources were applied to those aspects of agricultural development.

Over time, extension, training and institution building have become increasingly important aspects of the CRSPs from USAIDs viewpoint. Mission interest in short-term application of results and in the demonstration role of projects has increased. As the purposes and objectives of CRSPs have diversified and expanded, some of the original focus and emphasis has been lost. This is a matter of considerable concern from the EEP.

The PD/A CRSP has been a successful exercise in international collaborative research and has helped to emphasize to agencies and institutions involved in tropical inland aquacultural research and development the poor state of the art of tropical fishpond management, which results mainly from the lack of a science upon which to base inland aquaculture.

With such a large knowledge gap and a wide range of species and pond systems for study, the PD/A CRSP has from its inception made laudable efforts to focus its work and to elucidate some general principles of Pond trophic dynamics, as well as addressing more specific needs in the various host countries. Early attempts to produce generalizations from cross-site data sets were not entirely successful because of factors that were essentially beyond the control of the PD/A CRSP management and research teams, but some of which could perhaps have been foreseen. These include the difficulties faced by host-country national institutions to allocate adequate pond and other resources so as to generate a well-structured time series of data. Attempts to standardize conditions across sites were less than successful. The decision to utilize as the test animal an Auburn strain of tilapia was also questionable, because of possible inbreeding and selection for a cool environment.

Achieving a balance between the CRSPs attempts at a global experiment and more site-specific research and development is difficult. Results from these

activities can be mutually beneficial. The PD/A CRSP management and researchers have learned from past successes and failures and have restructured their agenda accordingly. For example, given that standardization of breeds and pond environments across sites is rarely attainable, multivariate statistical analyses and modeling using data sets from a wide range of treatments have been organized.

From such experiences, the PD/A CRSP has begun to fill some of the important knowledge gaps on pond dynamics. It still faces, however, the need to focus on strategic research for broad impact under different host-country conditions. PD/A CRSP efforts seek to complement the country-specific programs of individual national agricultural research stations (NARS) without pursuing too many diverse and separate lines of research.

Response by the ME:
The statements by the EEP on pages 5 to 7 contain some actual or implied inaccuracies. The statement on page 6, "As the purposes and objectives of CRSPs have diversified and expanded, some of the original focus and emphasis has been lost" would read more accurately, "As the purposes and objectives of CRSPs have diversified and expanded, some of the original focus and emphasis on applied research has been diluted." Also, the recurring emphasis on CRSP research in inland aquaculture belies the original mission of the PD/A CRSP to investigate brackish water systems. Finally, the paragraph recapping the history of the CRSPs research origins contains temporal and factual inaccuracies (see above paragraph, "With such a large knowledge gap . . ."). The paragraph does not contain any mention of certain historical events that changed the outcome of the point being made by the EEP. Early attempts were not 'unsuccessful' as much as that they produced uncertain results. The issue of reducing uncertainty in our experimental results subsequently became a primary focus of the program. It is now the foundation for our rigorous experimental protocols, which culminate in results that are statistically reliable and suitable for publication in peer-reviewed, scientific journals.

C. Relationship to International Research on Aquaculture

1. Background

During the last 5 years there has been a greater expenditure of effort than ever before on discussing and prioritizing international research needs in fisheries and aquaculture. These efforts, funded by many donors, have resulted in: 1) a published Study of International Fisheries Research (SIFR) (World Bank 1992); and 2) the Strategic and Medium-Term Plans of the International Center for Living Aquatic Resources Management (ICLARM) (ICLARM, 1992, 1993). ICLARM was admitted to the Consultative Group on International Agricultural Research (CGIAR) in May 1992. Moreover, regional aquaculture institutions (e.g., the Asian Institute of Technology (AIT), Bangkok, the Network of Aquaculture Centres in the Asia-Pacific (NACA) and the Southeast Asian Fisheries Development Center (SEAFDEC) have also increased their attempts to plan their research agendas either through strategic planning (AIT) or their

normal recurrent meetings (NACA and SEAFDEC). How does the PD/A CRSPs research agenda relate to such international and regional efforts?

2. The SIFR[1]

The SIFR (p. 32) assigns high priority to:

> Fish productivity (aquaculture and culture-based fisheries) (research) . . . to improve the biological and technical basis of developing country aquaculture in order to allow optimization of small-scale aquaculture systems and increased production from culture-based fisheries. To achieve full impact, the results of this research must be combined with relevant socioeconomic information.

The SIFR also calls (p. 34) for new scientific investigations described as:

> Ecologically oriented investigations of ways to optimize stock density and species composition in extensive systems; pond productivity, fish feeding, and ecosystem modelling to improve production of semi-intensive systems; and limitation of the adverse environmental impact of aquaculture on cultivated stocks.

The PD/A CRSP agenda fits well with these priorities, although the SIFR here, as in its other recommendations, advocates a strongly interdisciplinary, systems-oriented research approach rather than component research. A potential problem here is that some of the component research required to strengthen the relatively new science of pond aquaculture is unlikely to be done anywhere unless international research teams take up this challenge. Some reductionism is essential to understand the workings of the pond 'black box.' Numerous research organizations are increasingly taking a more holistic approach to aquacultural research to understand the pond's role in transforming the ecology of whole farm and wider ecosystems. The PD/A CRSP can help global efforts by undertaking key areas of component research that would complement the work of other systems researchers as well as pursuing its own pond systems studies. Alternatively it could shift to a broader resource system research agenda. It could probably not do both.

3. ICLARM

ICLARM (1992, 1993) is building an Inland Aquatic Resource Systems Program that will undertake collaborative research on the trophic dynamic of fishponds and rice floodwaters. These research plans are summarized (ICLARM 1993) as having the following scope and mode for the period 1994-98:

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[1] The Study of International Fisheries Research has now evolved into a Strategy for International Fisheries Research; with a full-time facilitator with office and secretariat hosted by IDRC, Ottawa, Canada.

Trophic dynamics of fishponds

Scope: Studies on foodchains in ponds and rice floodwaters that receive low-cost feeds (principally agricultural residues) and fertilizers (e.g., TSP, urea and organics); focusing on trophic dynamics (particularly C, N, P and energy fluxes) of bacteria, detritus, fish, meiofauna, phytoplankton and other aquatic life.

Mode: Decentralized on-station and farmer participatory research, in collaboration with AIT as the major ASI partner, the USAID Pond Dynamics/Aquaculture Collaborative Research Support Program, other ASIs, IARCs and NARS; radiotracer and other trophic dynamics methods will be used; data analysis will be linked to the CRSP work on ECOPATH and integrated resource systems models.

The 'integrated resources systems models' refer to a parallel thrust on Integrated Resources Management – basically a systems-oriented research on integrated agriculture-aquaculture farming systems.

Clearly with the PD/A CRSP, AIT and African and Asian NARS named as ICLARMs collaborators, the PD/A CRSP agenda fits well with these plans. There are also ongoing discussions to integrate PD/A CRSP datasets into ICLARMs collaborative efforts on ecological modeling (ECOPATH) and its large database (FISHBASE).

4. Regional Institutions (For example AIT, NACA, and SEAFDEC)

At the regional level, there are few mechanisms in Africa and Latin America through which to seek complementarity of the PD/A CRSPs work. For Subsaharan Africa, the principal opportunities would be to strengthen PD/A CRSP linkages with ICLARMs work, which is based in Malawi (the lead country for inland aquaculture and fisheries for the SADEC subregion) (ICLARM-GTZ 1991) and Ghana, and with FAO's regional program, entitled, Aquaculture for Local Community Development (ALCOM), headquartered in Harare, Zimbabwe. The PD/A CRSP Rwandan component has had some limited contact with these programs, but perhaps more structured linkages would be beneficial.

In Latin America several international groups have made efforts to facilitate regional communication and cooperation, but their activities are relatively small. The role of the Pan American Agricultural School in education of people from the region is noteworthy.

For Asia, the fact that AIT is a host institution for the PD/A CRSP ensures that their respective programs are highly complementary. AIT has prepared a draft strategic plan (AIT 1992a) and a separate document planning future outreach activities (AIT 1992b). AIT is becoming a key institution in post-graduate research and curriculum development in Asian aquaculture and the PD/A CRSPs close links with AIT will ensure that research results and methodological advances will be rapidly exchanged and used, especially in Indo China – the region where AIT is planning expanded outreach activities.

SEAFDEC's Aquaculture Department has only limited current and planned activities on freshwater species and systems, but has major activities on brackishwater shrimp and milkfish pond culture research (see plans for 1992-94 in SEAFDEC 1991a, b). Hence it is mainly the activity in Honduras, among the PD/A CRSPs activities, that could complement SEAFDEC's programme, which also has a significant training component.

The Network of Aquaculture Centres in Asia-Pacific (NACA) is an intergovernmental organization (NACA 1991). Thirteen countries attended its most recent Governing Council Meeting in Hong Kong, December, 1992, and there were representatives from AIT, ICLARM and three Thai universities. NACA has Regional Lead Centres in China, India and Thailand. All are concerned with freshwater aquaculture research. NACA's activities presently emphasize work on the environmental aspects of aquaculture development and on farmers' problems, particularly diseases. There is scope for exchanges between the PD/A CRSP and NACA, particularly with researchers at the Regional Lead Centres and research institutions in other NACA member countries who work on fishpond productivity. At the very least, the PD/A CRSP and NACA should exchange publications. This could be organized through the NACA Coordinator Dr. Banchong Tiensongrusmee and NACA Information Specialist, Mr. Pedro Bueno, NACA Secretariat, National Inland Fisheries Institute, Kasetsart University Campus, Bangkhen, Bangkok 10900, Thailand.

D. Summary of Earlier EEP Reviews as Paraphrased by the Current EEP

The first triennial review evaluated project activities and accomplishments in Honduras, Indonesia, Panama, the Philippines, Rwanda, and Thailand over the period September 1982 through August 1985. Panel members included:

Dr. James Avault, Jr., Louisiana State University

Dr. Kenneth Chew, University of Washington

Dr. Ziad Shehadeh, Kuwait Institute for Scientific Research

The EEP was favorably impressed by both administrative and technical management, expressed special commendations for the Program Manager, and believed the excellent record of achievement was due in large part to his pleasant personality, flexibility, and managerial capabilities. They felt that existing problems had been identified and were being effectively addressed, and that a very good spirit of cooperation existed between participating institutions, administrative committees, and the Program Manager/Management Entity. The EEP report made a series of recommendations which were listed on the following pages in the review of the second triennial review, together with the response from CRSP participants to the panel's recommendations.

The second triennial review evaluated active, continuing projects in Honduras, Rwanda, and Thailand over the period September 1985 through August 1988. Site

visits were also made to recently terminated country projects in Indonesia and the Philippines. Panel members included:

Dr. Homer Buck, University of Illinois

Dr. Kenneth Chew, University of Washington

Dr. Herminio Rabanal, Bureau of Fisheries and Aquatic Resources, Philippines

With the one or two exceptions mentioned in a following section, Panel members in general were quite favorably impressed by research personnel from all projects, by the volume of scientific publications and the number of presentations at scientific meetings, as well as by the strengthening of host country capabilities through enlargement of facilities, the development of teaching and training curricula, the training of students and support personnel, the extension of information and technologies, the initiation or encouragement of independent studies by host country personnel, and other ancillary activities.

In all countries reviewed, the panel found evidence of good interaction between US and host country personnel and institutions, as well as with the USAID missions.

In summary, the panel felt that in spite of reduced funding, and confinement to three host countries, the program was strong and viable, had an excellent probability of attaining its stated goals, and that continued support by USAID was merited. The panel offered the following recommendations:

1) That the site visits by the EEP be made prior to the annual meeting so that discussions at the annual meeting can eliminate some of the deficiencies recognized during a preliminary drafting of the EEP report.

2) That laboratory personnel (chemists, computer technicians, etc.) in host countries be placed on permanent status or be provided adequate competitive salaries in order to minimize turnovers and to increase stability, continuity, and integrity of the projects.

3) That consideration be given to the potential for more effectively extending information and technologies in host countries without diminishing the primary goals and research activities. Perhaps a review of opportunities for non-mainline activities would be appropriate in light of interaction with the farmers via extension needs.

4) In the interest of morale and program stability, it is recommended that consideration be given to adjusting stipends and fringe benefits of Research Associates to levels provided to overseas personnel by other agencies.

5) That efforts be extended to enlist assistance from host country agencies in supporting and training more students. Based on discussion in Rwanda, it is suggested that the USAID Mission and the Ministry of Education in Kigali might be helpful in this area.

6) That Research Associates (RAs) be more aggressive in stating their needs and problems to the Management Entity (ME), and that host country institutions be made more aware of how they might improve working conditions for the RAs in appropriate instances.

7) Encourage the Data Analysis and Synthesis Team (DAST), which handles the data and modelling program, to be current and to ensure that the flow of information back to host country collaborators is done in a reasonable time.

8) Due to limited resources available to the PD/A CRSP, perhaps there should be encouragement to seek out possibilities of 'buy-in' programs related to and integrated with the primary objectives of present programming. An example might be a 'buy-in' via USAID Mission or host country organizations.

9) More efforts need to be made by the ME to recognize and communicate with the field RAs. There is a perception that they are low on the ladder under the US and host country PI's, even though they are probably the most critical to the programs.

10) That the duties and importance of the EEP, and the funding of its activities be reevaluated.

Appendix B of the second triennial review presents a letter from the Management Entity (Howard Horton) to the Chairman of the EEP (Ken Chew) dated February 28, 1989, which addressed CRSP responses to recommendations made by the EEP in its first triennial review dated March 22, 1985. These responses may be summarized as follows:

a) RECOMMENDATION: That at least two members be added to the BOD from Host Country Institutions.

Response: The response was negative, primarily because the BOD felt that the change would contradict the spirit of the MOU between Auburn, U. of C. at Davis, and CIFAD, and would "reduce opportunities for the BOD to work closely with the ME to act on policy and funding matters". In his letter of February 28, 1989, Horton commented that "reasons for not altering the structure of the BOD are still valid, that expansion of the BOD to include two members from participating Host Country Institutions is not advisable or financially possible at this time."

b) RECOMMENDATION: That the Technical Advisory Committee (TAC) be strengthened by adding two members with expertise in the fields of data processing and management, pond ecosystems, brackish water ecosystems, or shrimp pond aquaculture.

Response: The response was strongly positive and more than adequately met by replacing the TAC with a Technical Committee (TC) composed of all US and Host Country PIs, plus three at-large members appointed by the BOD, by forming subcommittees on Work Plans, Technical Progress, Budgets, and Materials and Methods, and by adding expertise in soils (Claude Boyd), brackish water ecosystems (Bryan Duncan), pond ecosystems (Jim Szyper), shrimp pond aquaculture (Teichert-Coddington), and data processing and management (Kevin Hopkins).

c) RECOMMENDATION: The Research Team be formed as described in the proposal and that it be made a functional element of the program.

Response: Positive and satisfactory.

d) RECOMMENDATION: The administrative chain be abbreviated and communications with field projects be improved to permit quicker technical backstopping.

Response: Positive and satisfactory.

e) RECOMMENDATION: The research planning schedule be amended from an annual to a biennial exercise to allow thorough analysis of results before planning subsequent research.

Response: Positive and satisfactory.

f) RECOMMENDATION: Peripheral activities (extension, demonstration, training) be restricted and unauthorized deviations from core research be prevented to safeguard the central research objectives of the program.

Response: Positive and satisfactory.

g) RECOMMENDATION: The Central Data Management System be made operational on an urgent basis and the work of integration of data and development of theoretical models of pond productivity be initiated immediately.

Response: The CRSP response was that the Central Data Management System was operational, that the ME had added a Data Base Manager to its staff, and that a Data Synthesis Team had been appointed. Program Manager Horton added this comment: The actions described in the CRSP response have all taken place. In addition, the problems of refining templates and receiving and verifying data from seven CRSP projects in six countries have been overcome. As of May 1988, all of the CRSP data available from field stations have been received, verified, and made available to the Data Synthesis Team. Management of CRSP data is kept current on a daily basis. The Data Synthesis Team published its first conceptual model of an aquaculture pond as part of the Pond Dynamics/ Aquaculture CRSP Continuation Plan in May 1987. The Fourth CRSP Work Plan outlines procedures for the development of descriptive and mechanistic models to simulate pond processes. Plans and a timetable for the drafting of a manual of pond management practices also are presented. The gap between the accumulation of field data and the interpretation of results has been narrowed significantly.

h) RECOMMENDATION: The Research Team reexamine and amend where necessary standard methods for chlorophyll determination, wind measurement and analysis of organic manures.

Response: Positive and satisfactory.

i) RECOMMENDATION: The Research Team specify standard methods for chemical analyses of brackish water and ensure additional documentation of soil chemistry and benthic productivity in both freshwater and brackish water ponds.

Response: Neither clearly negative nor positive, seeming to take the position that the continued use of Standard Methods for the Examination of Water and Waste Water (APHA) should be a satisfactory response.

j) RECOMMENDATION: The Research Team ensure uniformity of the test species *Oreochromis niloticus* among projects by identifying a common source and verifying genetic makeup using standardized electrophoretic tests.

Response: Generally positive, taking the position that the study of genetic diversity of tilapia used at the seven CRSP research projects conducted at Auburn University showed that the degree of genetic diversity occurring was within acceptable limits, and did not challenge the integrity of the program.

k) RECOMMENDATION: The projects retain full-time host country technicians to assist with water analyses where counterpart staff are not qualified or personnel turnover rate is problematical.

Response: Positive and satisfactory.

l) RECOMMENDATION: The management entity initiate consultations with USAID (Washington, DC) and USAID country missions to encourage provision of additional logistic support to US field staff and to ensure continued commitment to ongoing projects by USAID missions as mission staff personnel change.

Response: Generally satisfactory, seeming to imply that activities requested were a normal part of management obligations and procedures.

m) RECOMMENDATION: The management entity establish a technical information service (titles, abstracts, information searches) for field projects to overcome problems of isolation and to enhance the professional expertise and development of field staff.

Response: Positive and satisfactory.

n) RECOMMENDATION: Increased interaction among field projects be encouraged through site visits and/or workshops under the guidance of the TAC.

Response: Regrettably negative, but understandably so because of budget constraints.

o) RECOMMENDATION: USAID consider a modest increase in budget to: a) strengthen collaborative research at US universities, b) increase output by US PIs in support of field projects, c) hire laboratory technicians for chemical analyses, d) strengthen the two apparently underfunded projects in Honduras and Panama, e) fund interproject workshops, and f) provide a technical information service.

Response: Unclear, but primarily negative, presumably because of budget constraints.

Response by the ME:
The paraphrasing of earlier EEP reports as presented in this section (D) fails in many respects to portray accurately the findings of those earlier reports. The paragraph summarizing the first triennial review (see page 10 of this report), complimentary as it is, neglects to mention the main theme of the review. The main theme was that communications between field personnel and US management staff and researchers were ineffective and inefficient. This important point is mentioned here because improvement in communications was precisely the theme of the second review.

The second review, as paraphrased in this report, also contains inaccuracies. The responses that are summarized on pages 12 to 15 of this report were removed from their original context. The responses that this EEP refers to are actually an amalgamation of two sets of responses: the Management Entity's 1985 response, and the Management Entity's 1989 comment on the 1985 responses and recommendations.

In particular, the following responses should be amended for clarification:

h. Recommendation: The Research Team reexamine and amend where necessary standard methods for chlorophyll determination, wind measurement and analysis of organic manures.

Response (from the original document): The CRSP responded that the recently issued (July 1985) Third Work Plan addressed these and other methods, and that the newly appointed Materials and Methods Subcommittee of the Technical Committee was responsible for continuous review of research methodology.

Comment: At the meeting of the Technical Committee in January, 1988, further review of research methodology resulted in the following changes: Measurements to be omitted were: Maximum and minimum temperature at the top and bottom of ponds on a weekly basis, total hardness, nitrate-nitrite nitrogen, orthophosphate, chlorophyll b and c, and salinity. Measurements to be added were: Dark bottle respiration, calculated whole-pond respiration, corrected and uncorrected chlorophyll a, suspended solids, total volatile solids, chemical oxygen demand, seepage rate, watershed area, and diel studies (intensive oxygen sampling). Diel study data are taken six times daily and include: Cumulative wind speed and solar radiation, and measurements of pH, alkalinity, temperature, and dissolved oxygen at the top, mid level, and bottom of each pond. In addition, the following Pond Dynamics/Aquaculture Collaborative Research

Data Report was issued August 20, 1987, and gives details of standardized methodology for CRSP research:

Egna, H.S., N. Brown, and M. Leslie (eds.) 1987. Volume one. General reference: site descriptions, materials and methods for the global experiment. Pond Dynamics/Aquacult. Collabor, Res. Data Rep., Program Manage. Off., Off. Inter. Agric., Oreg. State Univ., Corvallis. 84 p.

i. Recommendation: The Research Team specify standard methods for chemical analyses of brackish water and ensure additional documentation of soil chemistry and benthic productivity in both freshwater and brackish water ponds.

Response (from the original document): The CRSP response and current comment for this recommendation is the same as that given for the previous recommendation. We continue to use the Standard Methods for Examination of Water and Waste Water (APHA most recent edition) for methodology and experimental procedures.

j. Recommendation: USAID consider a modest increase in budget to: a) strengthen collaborative research at US universities, b) increase output by US PIs in support of field projects, c) hire laboratory technicians for chemical analyses, d) strengthen the two apparently underfunded projects in Honduras and Panama, e) fund interproject workshops, and f) provide a technical information service.

Response (from the original document): With the exception of eliminating Panama from the CRSP response [see the first triennial review for the full response], there are no further comments.

Readers of this third EEP report are encouraged to review the original first and second EEP documents in order to gain a better understanding of the issues, recommendations, and responses concerning the PD/A CRSP during the past decade.

IV. RESEARCH ACCOMPLISHMENTS AND PROGRESS

A. 'TATUS OF INTEGRATED BASELINE RESEARCH

1. Progress Toward Program Goals

In spite of having to interrupt and relocate some experiments due to political unrest in Rwanda, and in spite of the unavailability of suitable experimental ponds for some five or six months in Thailand, overall progress toward goals has been good. It should also be recognized that this CRSP has been continuously funded at a minimal operating level, even though this fault was recognized by reviewers and called to the attention of USAID. Considering these limitations and handicaps rather remarkable progress has been made. The scientists, technicians and administrators of the program should be commended for their dedication and exceptional productivity in addressing a huge problem with generally inadequate funding, yet continuing to progress at a highly satisfactory rate. Specific contributions to the objectives of site specific research are addressed on a country-by-country basis below.

It is useful in this context to examine general goals of the program, which are as follows:

a) "To preserve the global nature of the CRSP experiments."

This particular CRSP was designed as a global experiment, to compare basic parameters influencing productivity in widely different environments. Further it was designed to move from general baseline studies early in the experiment to more specific studies comparing fine manipulations as the research progressed. By design, the more specific comparisons were not of interest at all field sites. The global experiment might have broken down as site specific manipulations became more important; however, this did not happen because continuous feedback, exchange of results among sites, and integration of data through modeling were used to extend the global experiment.

The most serious threat to the global experiment has been pressure from some USAID country missions, from some collaborating host countries, and from USAID headquarters to shift away from research toward extension, training and demonstration activities. To date the global nature of the program has not been lost, but the ME and the Technical Committee should continue to be alert in this regard.

b) "To conduct experiments to refine management practices for fertilized ponds."

This experimentation has been conducted continuously and recommendations for improved management practices have resulted.

c) "To verify CRSP results with cooperating farmers."

As research progressed through the stages of basic comparisons of treatment impacts to testing of practical applications of treatment combinations designed specifically to demonstrate high yields, farmer testing has been encouraged and implemented in several countries.

d) "To continue adding observations to the global CRSP database."

This process continues as planned.

e) "To provide verified preliminary guidelines for management of fertilized ponds."

Guidelines have been developed, they are being verified and tested in host and nonhost countries, and they are being continually upgraded to reflect the state of research findings.

2. Project Impact

Impact should be assessed in both the international community and the host countries. Impact in the international community is subjective and difficult to quantify. However, when one considers both the quality and volume of information that has been produced, published, and/or presented at international meetings, and when one considers the potential power of the accumulated data base, which is unprecedented in both size and quality, one must believe that the impact is large, and will increase. Citation analysis could be used to clarify this issue. Impact in the host countries is more visible and can be quantified in such terms as increases in pond construction and fish yields, in numbers of fish farmers, technicians and researchers trained, through improvement of teaching, training and production facilities in host country institutions, and in establishment of productive linkages with other groups or agencies, both private and institutional, having an interest in improving the socio-economic welfare of the host country population. The principal clients of the CRSP extension efforts are government agents employed in extension and demonstration roles. All three PD/A CRSP projects deserve high marks in all of these areas, but more will be said concerning impact in the individual project reviews to follow.

3. Reporting and Dissemination of Information

A wide range of publications and presentations has been produced by the program. For purposes of this discussion they are lumped into the following categories: (1) internal publications produced for communication among CRSP researchers and to satisfy funding agency requirements, (2) oral presentations that are not published in the scientific literature, and (3) scientific, peer reviewed publications. Internal publications are adequate and of high quality. Oral presentations have been numerous and have provided an important mechanism for extending results to host country and other developing country nationals in leadership, extension, training and research roles. The most important, however, are the scientific publications that become a permanent part of the international literature base accessible to researchers, educators, trainers and

the public. The quality and distribution of scientific publications is good. Continuing attention should be given to this medium to ensure that significant research findings are all fully documented and widely available. Analyses of the existing database should provide numerous opportunities for additional technical contributions by CRSP and non-CRSP scientists.

4. Database Management

The PD/A CRSP Database is a resource of global importance. Ultimately it is the data that have been paid for by the public money used to fund the CRSP and these data should be used as widely as possible. This means that the database has to be publicized and made accessible to those end-users who could make the most of it – including researchers in developed and developing-country institutions who could reanalyze data for their thesis work or other projects. The December 1991 Special Report of Data Base Management mentions (p. 29) expansion of functions "to include global data analysis and a more aggressive marketing program". This could be facilitated by developing further interactions with other databases such as FISHBASE (ICLARM). These are the major challenges for the new Database management arrangement. The PD/A CRSP will also not last forever and the long-term management of the database and access to it should be considered.

5. Significant Contributions

To appreciate fully the contributions of this CRSP it must be understood that nearly all previous aquacultural research was designed as site specific experimentation and comparisons among sites were exceptionally difficult. The CRSP has introduced the concept of standardized comparisons and established a protocol for these comparisons. To the extent that these practices are adopted, 'trial-and-error,' 'one-of-a-kind' experimentation will be discontinued.

The systematic approach to aquacultural research including standardized protocols is contributing to many aspects of our understanding of the underlying principles of pond production. These aspects include the effects of human manipulation of pond conditions (inorganic and organic fertilization, water exchange, feeding, stocking levels, water depth) and environmental factors (water quality, soil quality, sunlight, atmospheric exchange of gases). Numerous, important contributions to the understanding of pond dynamics have been made and continue to be made by scientists in this CRSP.

The overall impact of the research on aquacultural production worldwide cannot be measured. The CRSP has been one of the most important sources of knowledge utilized in the gradual improvement of aquacultural methods in the tropics. Results are shared with research and educational institutions worldwide and the scientific progression toward more efficient aquaculture has been strengthened and advanced.

6. Concerns and Constraints

It is a continuing concern that the global concept has eroded or weakened with time, first through a reduction to three country projects, and secondly, that emphasis has gone through a transition from similar, simultaneous experiments in each country, to more site specific experiments designed to accommodate the needs and resources of the individual country. This last has been a natural, and perhaps inevitable evolution that is not necessarily bad. It can be argued that the global concept is retained through use of a common experimental species, common sampling and data collection procedures and through pursuit of similar goals. However, while the goals may be similar, pond inputs and certain procedures differ, perhaps necessarily. For example, in Rwanda, with its weak economic base, the most practical approach has been to exploit native vegetation as the principal organic input, whereas in Thailand chicken litter is readily available, and is a sensible choice. The initial effort in Honduras was directed toward the same type of low-cost input aquaculture that is being assisted in Rwanda and Thailand (particularly the Northeast), but the Honduran investigators now believe that they best serve the host country by offering direct assistance to producers that operate more intensive systems.

There are additional concerns in Rwanda over 1) the possible loss of project momentum with the replacement of Karen Veverica as leader, and 2) the current ineffectiveness of the extension program to Rwandan fish farmers. Both will be discussed more fully in a later section. Also the concern over the change in Honduras from emphasis on fresh water tilapia to brackish water shrimp will receive further attention.

Inadequate funding is a continuing constraint through limitations on project activities. Program effectiveness could be increased by a wider dissemination of information through workshops and seminars, through more frequent visits to host countries by US investigators, and greater participation by host country counter-parts in annual meetings and professional meetings. Inadequate funding also prevents the full participation of the EEP in annual project reviews.

To maintain the global nature of the CRSP a high level of coordination and comparative research is essential. Concern is expressed that the full potential of fully coordinated research is not being realized, and that comparative analyses are not utilized to the maximum extent. This shortcoming appears to be directly attributable to inadequate funding. Scientists and managers are endeavoring to provide this coordination and interaction; however, it requires expensive travel and communication that can be only partially covered by existing budgets. Full benefits to this emerging industry in terms of elaboration of the underlying principles of aquaculture can be realized only with increased financial support.

ME Response:
The ME echoes the EEP belief that aquaculture is an emergent science that requires further elaboration of underlying principles and shares with the EEP the belief that increased funding would greatly benefit the program. Such additional support would allow CRSP researchers to conduct cross-site visits, broaden

participation of host country counterparts in annual meetings, and enable the full participation of the EEP in annual reviews. Improved funding could also be used to enhance Global Experiment research. The Global Experiment continues to be the focal point of CRSP research. Researchers at all sites conduct at least one Global Experiment each year. With Egypt's joining last year, a site with new characteristics (arid rather than humid) has been added, further strengthening the Global Experiment by increasing researchers' ability to distinguish pond processes. Global Experiment research will continue to contribute greatly to our understanding of pond dynamics.

B. STATUS OF SITE-SPECIFIC AND SPECIAL TOPICS RESEARCH

1. Honduras

a. Progress toward objectives

Progress through approximately the first two-thirds of this reporting period was excellent. Work completed included the six studies listed in the fifth work plan, and at least two of the four studies of the sixth work plan. Work was also completed on a project entitled On-Farm Testing of PD/A CRSP Fish Production Systems in Honduras, made possible by the 20% supplemental appropriation in Fiscal Year 91. In addition, a handbook presenting guidelines for aquaculture in Honduras has been completed.

At about the mid-point in this reporting period the CRSP researchers began receiving strong encouragement to provide assistance to the developing shrimp industry surrounding the Gulf of Fonseca in Southern Honduras. Since its beginning in 1973, the industry has grown to include some 75 to 80 farms (50 to 60 of which are smaller than 5 ha; the rest are much larger) totalling an estimated 7500 ha. The growers have identified two principal problems: (1) poor growth during the dry season, and (2) growing concern over water quality and the potential for excessive pollution in the Gulf of Fonseca. The growers have united to form the National Association of Honduran Aquaculturists (ANDAH) which has been effective in lobbying for assistance. They have gained the support of the Honduran Federation of Agricultural and Agroindustrial Producers and Exporters (FPX, an USAID-assisted group which supports industrial development), as well as the Honduran government through its General Directorate of Fisheries and Aquaculture (DIGEPESCA). It is of considerable importance to ANDAH and FPX to demonstrate that possible pollution problems are being addressed. These three groups joined forces to persuade the CRSP researchers that the need for assistance is real, and perhaps worthy of CRSP attention.

Accordingly, at the annual meeting of this CRSP in Orlando, May 1992, the Auburn and Honduran staff requested approval for reducing activities in freshwater ponds in order to provide major assistance to the shrimp growers. The rationale offered was that the initial goals in tilapia production in freshwater ponds have been substantially achieved, that the work has reached a point of diminishing returns, and that a more favorable ratio of benefits to efforts

expended could be achieved through addressing the problems of the shrimp industry. The EEP notes this rationale is not intended to imply that *research* on tilapia production is complete. Approval by the Technical Committee and the Board of Directors was granted at the 1992 annual meeting on condition that a sufficient effort be maintained at the El Carao Station to sustain the integrity of the 'global experiment.'

At the time of the EEP site visit in October 1992, CRSP personnel in Honduras had been donated a suitable site for office and laboratory, and were in the process of transferring their water analysis personnel and equipment to the new site near Choluteca.

A recent update (June 1993) from Dr. Teichert-Coddington, and a trip report from Dr. Claude Boyd covering his visit to the Honduras sites in May 1993, report encouraging progress at both El Carao and Choluteca. A new biologist and field technician have been hired at El Carao, a new cycle of work has begun, and funds have been allocated to repair and maintain station vehicles to help ensure that the work will get done. Samples for determination of water quality which can be preserved on ice are being transported to Choluteca for analysis. Measurements of such parameters as DO, pH, and temperature are being done *in situ*. Dr. Teichert-Coddington plans biweekly visits to El Carao to help ensure the continuity and quality of the ongoing research program established earlier.

Dr. Teichert-Coddington also reports that the laboratory in Choluteca has been 'up and running' since March 1993, and was officially dedicated on 14 May. Dr. Claude Boyd represented Auburn University at the dedication of the new lab. There was an attendance of 65 individuals, including officials from USAID, the Honduras Department of Natural Resources, the Panamerican University, The Export Bureau (FPX), the Honduran Army, Officers of the Honduran Shrimp Farmers Association, shrimp pond owners, and shrimp pond managers.

On the basis of his site visits and discussions over the period May 11-14, Dr. Boyd was able to make a number of very positive observations:

1. The laboratory contains all of the apparatus required for making all water and soil analyses required in current and proposed studies, has a chemist and an assistant working on a daily basis, and is in fact superior to the lab that was maintained at El Carao.

2. The project at Choluteca is viewed as a landmark event by shrimp farmers and the USAID Mission, and their support should be strong so long as useful information can be produced.

3. There is special interest in possible degradation of water quality in the Gulf of Fonseca, as it relates to shrimp farming, and appropriate studies have been initiated.

4. Results of immediate use to the shrimp farmers have already been achieved. Early experiments have shown that there is no difference in shrimp production with a 20% protein feed and a 40% protein feed used at two stocking densities in either the dry or wet seasons. Also, low survival has been shown to be strongly correlated with water temperature and salinity, a relationship not previously recognized by the shrimp farmers.

5. Dr. Boyd believes that the CRSP effort at Choluteca is the first that a research organization has initiated to study shrimp pond dynamics and environmental problems affecting shrimp production in Latin America, and that it has an excellent potential for providing useful information to shrimp farmers in Honduras and other Latin American countries.

Based on observations during the EEP site visit in October 1992, it appears that the technologies for tilapia production developed by the CRSP program have been effectively extended, are well accepted, and have provided a basis for an expanding industry. This judgment is based on the high level of interaction by fish farmers with the El Carao station, on the growing need by fish farmers and would-be entrepreneurs for 'seed,' by the continuing expansion of existing farms, and the construction of new farms. Such observations suggest that CRSP extension objectives are being achieved.

b. Quality of research

In 1988 a computerized data logger system installed to record pond dissolved oxygen, water temperature, pH, and wind speed, was believed to be the first research of this type in a lesser developed country. Advanced, rather sophisticated studies of benthic respiration and organic carbon distribution in pond soils have recently been initiated under the leadership of Claude Boyd. The regular research staff and the technicians are all well trained and well seasoned, and set high standards for all levels of operation. The general quality of research is believed to be very good.

c. Reporting

While at least one study has had to be repeated, and others have been delayed, the data, once collected, have for the most part been reported in a timely fashion.

d. Linkages

David Teichert-Coddington and Bart Green maintain a close relationship with Dr. Dan Meyer, Chief of the Department of Basic Sciences at the PanAmerican Agricultural School (EAP) located in the Yeguare River Valley, 25 miles east of Tegucigalpa. Dr. Meyer's department has a small set of research ponds and an adequate analytical laboratory used for training of students and for research in aquaculture. Dr. Meyer feels that his program is enriched through its collaboration with the Honduras PD/A CRSP. CRSP personnel also collaborate

closely with shrimp farmers in Honduras to conduct applied research to develop sustainable production systems. No other aquacultural research is known to occur in Honduras.

e. Contributions

The PD/A CRSP has made major contributions to aquaculture development in Honduras in at least five major areas: 1) technological development in pond management; 2) production of 'seed;' 3) training of aquaculturists; 4) extension of information to fish farmers; and 5) publication and dissemination of scientific information. CRSP researchers have demonstrated methods for sustainable aquaculture production systems for both small-scale, subsistence farmers, as well as medium-level commercial producers that have been widely utilized. In on-farm trials farmers who used CRSP methods outperformed those using traditional methods. One CRSP system involving chemical fertilization resulted in yields 90% greater than from traditional methods. A second system involving fertilization and supplementary feeding produced yields 152% greater than the traditional system. These systems have been shown to be profitable.

Honduras PD/A CRSP researchers have improved methods for fingerling production of tilapia, other exotic species (grass carp, silver carp, and *Colossoma macropomum*), as well as a native species, *Cichlasoma managuense*). The introduction of hormonal sex reversal technology further advanced tilapia fingerling production. The El Carao station has become the principal source of fingerlings in Honduras. Fish farmers who purchase fingerlings at the El Carao station are provided with a prepared pond management plan that explains the most recent PD/A CRSP recommendations.

From 1988 through 1992 the Honduran CRSP has published 13 papers in refereed scientific journals. Four additional papers were submitted for publication in 1992. One additional paper was published in a nonrefereed journal. From 1988 through 1992 Honduras CRSP personnel have prepared 6 technical reports, and have made 16 presentations at scientific meetings, including 3 in 1992.

f. Education, training, and extension

An average of about 20 trainees or students come to the El Carao station annually for on-the-job training, and the Honduras PD/A CRSP has supervised thesis research and field training of 11 senior-year biology students from the National Autonomous University of Honduras. CRSP researchers have lectured on water quality and aquaculture to university and technical school students principally at the Escuela John F. Kennedy, as well as to Peace Corps volunteers, extension agents, and fish farmers. Technicians who have worked at El Carao are now leading government programs, or are leaders in the commercial freshwater aquaculture industry.

g. Institutional development

The host site, the El Carao station, is administered by the Ministry of Natural Resources (MNR), which was an original signatory to the founding of the Honduras PD/A CRSP. The host country staff at El Carao believe that the station has been very successful, and they credit this success to CRSP leadership. The studies have brought wide recognition to El Carao throughout Central America, and by such institutions as the FAO and various US Universities. The University of Honduras, the JFK school, and a number of business entities and technical schools send representatives to El Carao for training.

The El Carao station now has 40 ponds and a staff of 16 (4 biologists, 1 technician, 1 administrator, 1 secretary, 2 watchmen, 6 field laborers). Twelve ponds are devoted exclusively to studies designated in CRSP work plans.

h. Sustainability

The sustainability of the Honduras PD/A CRSP will be determined by: 1) the degree to which the El Carao station can rebuild its staff and maintain its productivity and leadership following a major redirection of effort and resources to the assistance of the shrimp industry; and 2) the degree to which the CRSP researchers can garner the necessary funds, cooperation, and logistical support to develop an effective program in support of the shrimp industry.

With regard to sustaining the El Carao station, there is unanimous agreement among all concerned (fish farmers, the MNR, the USAID Mission) that continued contributions and leadership from El Carao are vital to the further development of the tilapia industry in the North, and a number of possible sources of support for the station were identified during the site visit. Mr. Del McClusky, Head of Agricultural Export Division of the Rural Development Office in Honduras, who pledged Mission support, credited the CRSP with the development of the tilapia industry, and further believes that the volume of export of aquaculture products will in time eclipse those of banana and coffee, the present leaders. He volunteered that USAID wants to continue base funding to El Carao through PL-480 monies, and that the Mission plans to put money into the Tilapia Association to help El Carao, and to avoid loss or diversion of funds by the GOH. McClusky identified other possible sources of support. For the short term, he believes that FPX is receptive to hiring a full-time tilapia specialist, and will encourage them to co-finance the operation of the station. In the long run, McClusky believes that the station might be passed to either the FPX, the Tilapia Association, or to the Honduras Agricultural Research Foundation, which has an administrative structure and lab facilities, and is currently engaged in research on bananas, cacao production, and vegetable research, and is pledged to a diversification of the agricultural base.

In discussions at the MNR, Sr. Mario Pino, Director of DIGEPESCA, made it clear that CRSP activities have the full support of the President of Honduras, as well as his own agency, and suggested that CRSP personnel initiate formal

requests to him for support so that the needs can be documented to the Ministry and the Mission.

With regard to sustaining the new focus on the shrimp industry in the South, a number of actual commitments, and other potential sources of support, were identified during the site visit. The effort begins with the full support of the President of Honduras and the MNR, as evidenced by their donation of a building at the Agricultural Experiment Station near Lujosa, which can accommodate both laboratory and offices. The GOH will also supply one biologist and one technician. ANDAH pledged $15,000 in the first year to help establish the new lab and headquarters offices, and has pledged to increase its present assessment of $.05 per pound of shrimp sold by member producers to raise funds for support of shrimp research, and to make this support a future line item in their budget. They also pledged to reduce spending on publicity, and other areas, and to divert the money to research. In October 1992, FPX was supplying six specialists to assist development of the industry, and also operating a shrimp hatchery to help supply seed, and a packing plant for small producers. FPX pledged to raise additional funds in support of research. The Panamerican Agricultural College (EAP) will be conducting collaborative research in the area, and has pledged to help raise funds in support of the CRSP. All of the committed collaborators (ANDAH, FPX, EAP, and CRSP) were planning to sign a working agreement shortly after our site visit, and we have been informed that the agreement has indeed been signed.

i. Project management

Project management is judged to be good based on the following observations; 1) there seem to be no major management, procedural, or performance problems between the ME and Honduran on-site management; and 2) objectives are pursued in an efficient and orderly manner, projects are completed, data are reported and/or published, and problems are identified and addressed. The station has become the principal supplier in Honduras of fingerlings to fish farmers, and has the respect of fish farmers and other clients and collaborators.

Questions arise concerning the level of contribution to the global experiment from the Honduras site. Concern is expressed that development aspects of the project have dominated the project activities, and that the brackish water research will add little to the global experiment (see below).

j. Concerns and constraints

The overriding concern stems from the change of direction from fish production in freshwater ponds to shrimp production in brackish water ponds, and the transfer of equipment and personnel from El Carao to Choluteca. Collateral concerns include: 1) the development of fish farming for tilapia initiated and nurtured in Northern Honduras may lose momentum and falter because of a major diminution of leadership and assistance from the El Carao Station; 2) commitments made to the Sixth Work Plan may not be completed for the same reason; 3) the 'global' concept for the PD/LA CRSP may be diminished or

weakened; 4) the CRSP researchers may not have the experience or expertise to project the quality of research in brackishwater ponds that they accomplished in freshwater ponds; 5) that the level of support and collaboration needed (and anticipated) from the GOH, ANDAH, FPX, and others, may not be realized; and b) that this apparent divergence from earlier CRSP goals and objectives may weaken the rationale for continuation of the CRSP, unless fully justified.

The principal constraint is that there may not be sufficient funding and logistical support to maintain an adequate or effective level of activity at the El Carao station, and to properly initiate the new project at Choluteca.

ME Response:
The ME agrees that, as at other sites, insufficient funding is the principal constraint for conducting the research needed at this site. In the best of all worlds the project would support a full-time research associate at both the freshwater and brackish water sites. The specific concerns raised by the EEP deserve some elaboration.

1) *The EEP correctly recognizes that development of commercial fish farming in northern Honduras has been made possible by the presence of El Carao-trained personnel. The El Carao station continues to support the nascent industry through research on feeds and water exchange. In addition, freshwater fish culture is of interest in southern Honduras. Farmers are interested in developing tilapia farms and in cultivating tilapia in shrimp ponds or water supply canals during the wet season when salinities are low. Such a stocking strategy could reduce organic and nutrient discharges to the estuaries, and could efficiently accomplish several CRSP objectives.*

2) *Delays in completing the research schedule at El Carao in the fall of 1992 were primarily due to changes made by the Government of Honduras as a result of its response to structural readjustment. Hiring and wage freezes at the station and staff changes in the Dirección General de Pesca y Aquacultura caused great uncertainty on the part of the Honduran leadership at the station and at the government headquarters. Despite these difficulties, the CRSP was able to carry out laboratory studies of soil respiration, and Work Plan 7 studies are on schedule.*

3) *The ME reiterates that the global concept for the PD/A CRSP has from its inception included brackish water studies, and that the addition of a brackish water site reinforces the original global concept of the PD/A CRSP.*

4) *The on-site PD/A CRSP researcher and the Principal Investigators have extensive experience and expertise in monitoring water quality. Supplemental funding by FPX (Honduran Federation of Producers and Exporters) and ANDAH (National Association of Honduran Aquaculturists) have enabled the CRSP to access expert consultation in the area of estuarine nutrient transport, which will result in the construction of nutrient budgets for the major estuaries. Such strengthening of research linkages will benefit both the global experiment and the PD/A CRSP program.*

5) *The external support for the project has increased even beyond the level that the contributors originally agreed upon (see above example). Further examples of enhanced levels of support include: an FPX-organized regional conference for Central American shrimp producers to concentrate on environmental issues and sustainable production, and PL480 monies managed by the Pan American School (EAP) to help support student research at La Lujosa.*

6) *The ME believes that the rationale for continuation of the CRSP will be strengthened by the change of emphasis to brackish water research. This project demonstrates the flexibility of the CRSP structure to adapt to a changing environment while maintaining a global focus. The work at Choluteca contributes directly to the global concept by examining the physical and chemical dynamics of a brackish water system. This research directly integrates environmental management with pond management and responds both to USAID objectives for Honduras and emerging global concerns. Finally, the project breaks new ground in fostering private and public collaboration, a direction that may need to be encouraged rather than discouraged in the funding environment of the mid-1990's.*

2. Philippines

a. Progress toward objectives

The work in the Philippines is an outreach component of that for Thailand (see B.3 below) and is meant to afford an extra site for wider geographical comparisons. Progress has been good largely because of the good work and ingenuity of the staff of the Freshwater Aquaculture Center of Central Luzon State University (FAC/CLSU) which, despite the frequent power failures that are affecting most of the Philippines and that tend to damage computers and analytical instruments, has managed to keep the experiments on track and has contributed valuable datasets.

b. Quality of research

The research quality is good and useful data have been generated. A possible cause for concern is that the data seem to be used for analysis/interpretation elsewhere and hence the scientists actually based at CLSU may not be involved sufficiently in this research or in the design of subsequent experiments (see B2.h below). Their greater involvement would stimulate the production of more narrative reports from FAC/CLSU rather than just datasets.

c. Reporting

Reporting has been adequate in the form of datasets (see B2.b above). There could be more regular exchange of datasets between the groups in Thailand and the Philippines, together with narrative reports.

d. Linkages

The PD/A CRSP personnel at FAC/CLSU have established wide collaboration with other international collaborative research efforts, including the ICLARM-led project Genetic Improvement of Farmed Tilapias (GIFT), funded by UNDP and the Asian Development Bank, with the Philippine Bureau of Fisheries and Aquatic Resources (BFAR), FAC/CLSU and AKVAFORSK, Norway as the principal partners, and the research collaboration between FAC/CLSU and the University College of Swansea (UCS) Wales, UK, funded by the Overseas Development Administration of the UK. The ICLARM-BFAR-FAC/CLSU GIFT project had hoped to provide improved tilapia breeds for use in PD/A CRSP pond trials at FAC/CLSU, but this has had to be postponed pending the results of the GIFT project's current selection experiments. The use of GIFT fish in PD/A CRSP research remains a strong possibility for the near future. All-male 'YY' fish from the UCS-FAC/CSLU project are already in use in PD/A CRSP experiments. These collaborations will widen the international reputation of the PD/A CRSPs work and the effectiveness of its results, because new genotypes and new pond environments can be tested together.

e. Contributions

Given the present subsidiary role of this work site to that of Thailand, the data generated and contributions are really inextricably linked. There have not yet been any scientific publications from the new work in the Philippines.

f. Education, training and extension

There is a need to conduct on-farm experiments to validate on-station results under farmers' field conditions. Farmer awareness could also be stimulated through training and production of extension materials such as brochures, posters, and technologies.

g. Institutional development

FAC/CLSU is the Philippines' premier inland aquaculture center. The PD/A CRSP has so far done little to enhance its capabilities and staff development apart from provision of some useful equipment. This is largely because very little of the PD/A CRSP resources have been channelled to the Philippines. If these could be increased, significant institutional development could result both at FAC/CLSU and at one or more of the other Philippine institutions with which it has linkages. One obvious example is Don Mariano Marcos Memorial State University, La Union, which (like FAC/CLSU) has a College of Fisheries and an Institute of Aquaculture with brackish and freshwater ponds.

h. Sustainability

Sustainability of the work at FAC/CLSU will depend on substantial support. There is a st commitment on the part of FAC/CLSU to sustain and, hopefully, to increase their participation in the PD/A CRSP. Moreover, their contribution in

terms of providing opportunities at one of the best-sited aquaculture research facilities in Southeast Asia should be emphasized. CLSU/FAC has abundant water supply, good pond soils, and good laboratories. It needs recurrent support for operational expenses and staff development.

i. Project management

The work on site has been well managed and the FAC/CLSU team has been imaginative in keeping the work going when funds have been delayed (see j. below). The local USAID mission has had little involvement with the work but this is not meant as a criticism; the styling of the work in the Philippines as 'outreach' from Thailand and the minor nature of the resources expended at present do not warrant major involvement on the part of the mission and the work has proceeded well.

j. Concerns and constraints

One concern is that delays (up to 3 months) in receipt of funds have occurred. The reasons for this are not clear. The FAC/CLSU staff would appreciate prompt release of funds in future so that they do not have to 'borrow' from other project funds.

The state of the electrical supply at FAC/CLSU remains a constraint. Power outages last at least 6 hours a day and FAC/CLSU cannot afford to run its main generator, which consumes 27 litres of diesel/hour, for long periods. Provision of a small generator to provide back-up power to a single laboratory, for PD/A CRSP work, would greatly ease the situation.

Overall, there is a strong case for upgrading the Philippine work to a country site in its own right, rather than just as an 'outreach' component of the Thailand site.

This would, of course, require more resources and preferably a PD/A CRSP scientist based at FAC/CLSU. If such resources were available, FAC/CLSU and its linkages with other Philippine institutions and with farmer cooperators would facilitate a valuable program of work on pond dynamics research appropriate to the wide range of pond conditions in the Philippines. This would provide a better rationale for working the Philippines than a rather vague assumption that one site in Central Luzon can extend the work of one site in Central Thailand. There are much wider ranges of pond conditions in *each* country than there are differences between these two sites.

There is also a feeling among the FAC/CLSU team of being somewhat 'used' as data generators to augment the research in Thailand. It would be good to see an equal partnership evolve, with their further participation from the designing of experiments through to analysis and interpretation of data.

ME Response:
The ME agrees that the Philippines should probably be upgraded to a country site. Again, the problem of extremely limited resources is the primary constraint.

Additional funding that would allow the CRSP to become more firmly re-established in the Philippines is seen as the most productive means of overcoming the feeling that the site is being used only for data generation.

3. Thailand

a. Progress toward objectives

The Thailand CRSP continues to have an outstanding record of progress toward CRSP objectives. This progress is facilitated by strong US input from several universities, well-educated Thai counterparts, strong collaborative ties with other institutions and good facilities. Contributions to the global experiment have been of high quality and numerous scientific papers with specific contributions to aquacultural science have been published. Ongoing interaction with host country and regional aquaculturists has been active at all levels (farmer-researcher) and the impact of this interaction is apparent. Strengthening of local institutions has been successful although the wide array of inputs into their institutions makes credit difficult to assign.

b. Quality of research

Throughout the program the high quality of CRSP research in Thailand has been apparent. Close interaction with academic institutions, use of graduate students and careful management have all contributed to the quality of experimental design, data, analyses and publications. The Thai CRSP group has set a standard of excellence.

c. Reporting

Output of scientific publications has been of high quality, steady and plentiful. Routine internal communications and reporting are satisfactory. Reporting of extension and training information has been facilitated by close collaboration with educational and demonstration groups in Thailand.

d. Linkages

Linkage with the Asian Institute of Technology (AIT) has been a demonstration of positive, synergistic interaction. The competent and experienced AIT research staff have joined with the U.S. universities and the Thai Department of Fisheries to form an effective research team that is 'greater than the sum of its parts.' Field trials/demonstrations conducted by the Northeast Research Foundation at its field station have proven to be viable and productive. AIT particularly, has shared its expertise and capabilities (reflecting support from several other donors) in an effective and helpful way, without which the CRSP would have been much less effective. AIT, ICLARM, other donors, and the Thai Department of Fisheries all deserve special thanks.

The host organization, the Department of Fisheries (DOF) of the Government of Thailand, has been a most cooperative and generous host for the CRSP. From the

initiation of the project it has provided facilities and assistance. Of particular interest in recent years is the field testing of improved aquacultural methods at DOF field stations. The stations are extension and training labs and serve as sources of quality fry and fingerlings for the farm community. Field testing of CRSP methods at the field stations and on local farms has been an ideal mechanism for demonstrations of the methods and for feedback to researchers of results of on-farm applications.

Overall the collaboration between this CRSP and the DOF has been positive and fruitful.

e. Contributions

Applications of research to production situations are difficult to measure, particularly in the case of Thailand's aquacultural production, because it is advanced and extensive. A number of national and international agencies have ongoing input into the advancement of Thai aquaculture. The CRSP contributions are most evident in the areas of pond fertilization techniques, water quality management and studies of stocking density. The US universities working in Thailand brought strong limnological-pond water analysis expertise into the picture. This expertise has been utilized well in describing factors affecting productivity of ponds.

The use of field trials to test improved production methods has been an important contribution to the national extension/demonstration effort (see the following section).

f. Education, training and extension

Even though these objectives were not originally a part of the CRSP design (they have been added as the CRSPs have evolved over time), this CRSP has had consistent positive impact in all three areas. Thai coinvestigators, research assistants and laborers are educated and trained through participation in the research. These people accumulate technical skills and research experience that are applied in many other situations. Students from AIT and Kasetsart University participate as employees and on thesis projects within the project. Results of research are utilized in the classroom and are widely available to students and educators.

Extension is accomplished primarily through the DOF extension network which includes field stations scattered throughout Thailand where production methods are field tested and demonstrated. Farmers frequent these stations to purchase fry and participate in extension training. Extension agents work from these stations to reach farmers and to encourage them to apply new methods. Private voluntary organizations (e.g., the Northeast Research Foundation) play an active role in extension of improved farming methods developed in the project to poorer rural parts of the country. Interaction with these groups is excellent, and improved methods developed by the CRSP are in evidence in private hatcheries and farms.

g. Institutional development

Numerous institutions in Thailand are involved in aquacultural research and development. The CRSP has contributed to each cooperating institution with expertise, funding and guidance. Few remarkable examples of large advances are noted, but numerous examples of strengthening are apparent.

h. Sustainability

Sustainability is viewed both from the standpoint of a continuing role for Thai institutions in research on aquaculture and with regard to the continued use of new technologies by producing aquaculturists. The research capability of the DOF and of Thai scientists has benefitted from the CRSP. The repeated demonstration of the scientific method, and of new tools and methods to Thai participants and to AIT students has been an important learning process. Thais as well as students from surrounding countries studying at AIT will have increased capability to conduct modern aquacultural research as a result of this CRSP.

Advances in farming methods will be sustained to the extent they are truly improvements. The technological level of improved practices recommended are well within the capabilities, infra-structure and inputs available to Thai farmers. On the basis of interviews with farmers, Thai field station managers and demonstration/extension workers it was apparent to the EEP team that a number of improved practices have been introduced that are expected to be sustainable.

i. Project management

This CRSP project is particularly complex involving three US universities, and several international groups as well as the Thai government and university players. Project management has been a difficult task requiring exceptional leadership skills. The project manager is complimented for his success in maintaining a strong collaborative team that has continually met or exceeded expectations for the CRSP. The contributions of this CRSP project have been enhanced through close cooperation and lack of destructive rivalry.

j. Concerns and constraints

Very few concerns are expressed by the EEP. An ongoing constraint is the inadequate level of funding from USAID. Efficiency could be improved with increased funding and contributions could be multiplied, particularly in this environment involving numerous players and donors. Contributions of other donors to this USAID project should be acknowledged.

The Thailand CRSP should be encouraged to continue to address issues that will contribute to the global nature of this CRSP. Pressures to move farther toward a demonstration/extension mode are premature and should be resisted. Numerous other agencies and donors are prepared to extend new technology but few are able to develop it. This should not, however, interfere with buy-ins for supplemental

work of an extension/demonstration nature that USAID Bangkok chooses to support.

An unusual opportunity exists for the Thailand project related to development of aquaculture in neighboring countries. Fish are an important commodity throughout SE Asia and aquaculture is expanding to supplement traditional supplies as demand increases. Thailand is the likely source of new aquacultural technology for Laos, Cambodia and Viet Nam and is already serving that role. AIT is an educational base for countries of the region (including China) in technical fields, including aquaculture. USAID Bangkok is shifting to a regional rather than a national focus to support regional development in a broader context. If supported for this purpose this CRSP could provide the knowledge base and research methodology for improving the efficiency of aquaculture throughout the region thereby increasing international cooperation in the region and improving productivity of aquacultural systems.

ME Response:
The ME agrees that the Thailand CRSP is well positioned to serve as a regional resource for aquaculture development in the Indo-China area. As with other projects, the ME agrees that the inadequate level of funding is the primary constraint.

4. Rwanda

a. Progress toward objectives

In spite of delays and relocations of some studies caused by the political unrest in Rwanda, which closed access to some study areas, all but 2 of 18 studies projected for this reporting period have been completed (all four in work cycle 4, 8 of 9 in Work Plan 5, and 4 of 5 in Work Plan 6). The unfinished study in Work Plan 5 was redesigned for Work Plan 6. The on-farm trials in Study 3 of Work Plan 6 could not be completed because of the risk involved in entering the work area. However, the political climate has improved, and Study 3 will be completed in 1994.

It was reported at the 1992 annual meeting in Orlando (May 1992) that the fifth work plan had been completed, and that substantial progress was being made on all five primary studies in the sixth work plan, as well as on the four supplemental studies made possible through the 20% supplemental funding in the 1991 allotment. At the time of the site visit by the EEP in September 1992, it was reported that problems had developed which might make it difficult to complete Study 3 (Work Plan 6) on time (January-February 1993). However, at the time of the 1993 annual meeting in Portland (March 1993) the problems had been eliminated, and it appeared that field work for all studies in the sixth work plan would be completed by the termination date (August 1993).

As reported in the annual report for 1992, the principal deficiency for the Rwanda Project is in the analysis, organization and publication of results. Ironically, the deficiency results from the project's success. The continuous construction of new ponds, by fish farmers, and rapidly increasing interest in aquaculture,

particularly by women, has placed unprecedented demands on the research staff to conduct workshops, training sessions, and other outreach activities.

b. Quality of research

The overall quality of research in Rwanda is probably well characterized by the quality of performance at the water analysis lab at the Rwasave station. Interviews, discussions and observations at this lab suggest that the quality of product and performance is high. The lab technicians show every evidence of being industrious, well-trained, and conscientious. The quality of research activities in the field may perhaps be best judged by the integrity, work ethics, quality of training, and high standards of the research team and technicians. All were impressive. It may also be worth noting that in both the laboratory and field, Karen Veverica seemed to take every opportunity to teach, demonstrate, or otherwise improve the performance of all with whom she came in contact, including fish farmers, extension workers, agronomes, and technicians.

c. Reporting

As indicated earlier in this report, the principal deficiency in the Rwanda project has been the inability to analyze and report the data in a timely fashion. This has been due to the fact that Karen Veverica has been the only US researcher stationed at the project, and has been inundated by other activities (meetings, teaching, training, and workshops). However, this deficiency is being remedied. Although Ms. Veverica has been unable to devote the planned 25% of her time to data analysis and writing since returning to Auburn, due to other responsibilities, she has made substantial progress in the analysis of old data.

d. Linkages

There are currently no other aquaculture research activities in Rwanda. However, the Rwasave station has accommodated other entities in need of miscellaneous water analyses.

In the course of the site visit it became clear that the remarkable degree of harmony that had existed between the U.S. researchers and the Host Country personnel and institutions during the last site visit had in no way diminished. There seems to be an ideal working relationship based on mutual respect and high levels of performance by all parties. The Rwasave Station is no longer simply a CRSP operation, but has become an established part of the University. The National University of Rwanda makes a number of 'in kind' contributions to project operations, and since the last site visit has actually increased the value of its contribution in matching funds. The administrators believe their association with the CRSP Program and the Rwasave Station has enhanced the prestige of the University.

e. Contributions

In this reporting period the Rwanda project has completed 17 major studies (4 in cycle 4, 8 under work plan 5, 5 under work plan 6) and 15 site specific studies. Approximately 25 additional related studies have been conducted independently by host country personnel, by visiting scientists, by graduate students or trainees. The primary contribution of the three cycle 4 studies was to develop procedures that could produce predictable yields of fish utilizing composts developed from combinations of native plants (primarily grasses) and manures as the primary input. The primary contributions of the eight studies in the fifth work plan, and five studies in the sixth work plan were to improve our understanding of the factors affecting pond dynamics and fish growth under climatic conditions considered marginal (high elevations, low temperatures) for tilapia production, using the limited nutrient inputs available in economically depressed regions. The studies in work plan six also assessed the contributions of supplementing compost with nitrogen or a locally available, low-grade feed.

While the studies were completed, and the results are in the Central Data Bank, only a small part of the data has been published. There have, however, been three publications on site specific studies by US and host country personnel, as well as by trainees and visiting scholars.

The Rwandan researchers have demonstrated that fish production can be more productive than more traditional uses of land and labor. Mr. Christian Guggenberger, Project Director for Austrian Agenda Agricole, reported to the EEP that it is now widely recognized that fish production and bee keeping are the two most profitable uses of land. This has stimulated the demand for fish, and a rapid increase in pond construction. It is estimated that 100 of the total of 147 communes in Rwanda now have fish ponds, and that the total number of fish ponds now exceeds 3000. Fish farmers have become convinced that the CRSP methods work, and the on-farm research units are centers of intense interest and are widely copied. Average fish production has been elevated from about 0.4 to 1.5 t/ha/yr. Jean Damascene Bucyanayandi, the Host Country PI, believes that the increase in total fish production in Rwanda has been due more to improved technology, developed and demonstrated by the CRSP, than in an increase in the number of ponds. Much of this technological improvement must be credited to the USAID-funded FNP development project and this CRSP.

One of the most striking and rewarding impacts has been the increased interest by Rwandan women in fish farming. This interest has been stimulated and encouraged through workshops and colloquiums, and funded jointly by OSU, Auburn U, the CRSP ME, the USAID Mission in Rwanda, and WID Washington. By 1989 it was estimated that women made up 23% of fish farmers in Rwanda, and the number was growing.

The influence of the project has been substantially magnified through strengthening of linkages with such other entities as the Service Pisciculture Nationale (SPN), the Rwandan Department of Agriculture, the Peace Corps, Red Cross, Care, and others. This has led to establishment of two commissions that

should have substantial impact on future development. These are the Aquaculture Research Commission, and the Aquaculture Extension Commission. Each will be composed of approximately 10 people in key positions, including one or more fish farmers.

The research leader at the Rwasave Station (Ms. Joyce R. Newman) will be a member of the Aquaculture Research Commission which will have responsibility for identifying research needs in Rwanda. The Director of the Service Pisciculture Nationale, and leader of the Extension Service (currently Mr. Jean Bosco Kabagambe), will serve as President of the Extension Commission which will have responsibility for development of an effective extension program. Certainly one of the most important developments has been the strengthening of the Rwasave station and its incorporation into the University as a component of the Department of Agronomy.

Finally, one of the observations that most impressed the EEP on its 1992 site visit was the high level of esteem with which the CRSP program in general, and Karen Veverica in particular, were held by all entities with which they interacted, from fish farmers to the highest administrative levels in both the University and the government. The result seems to be an unusual degree of harmony between CRSP personnel, and all interacting entities, which should continue to have substantial beneficial impact.

f. Education, training and extension

Although training is not a formal component of the CRSP, all current PD/A projects are making important contributions in the areas of education, training and extension. This has been especially evident in Rwanda. The PD/A CRSP has become an integral part of the Rwasave Station, and the Rwasave Station has become an entrenched part of the University. During her tenure as US RA, Karen Veverica was awarded faculty status to facilitate her teaching of short courses in introductory ecology, fisheries, introduction to fish culture, and biological productivity. Ms. Veverica and her staff have conducted numerous workshops in such subjects as pond construction, use of fertilizers in fish production, seine management, and seine construction. The CRSP has funded conferences on various aspects of high altitude fish farming which have been attended by numerous nongovernment organizations, ministry personnel, university professors, students, FAO personnel, Peace Corps volunteers, aquaculture station managers, model farmers, extension and training specialists, and CRSP trainees. A colloquium on Rwanda Women in Aquaculture was attended by women fish farmers, extension agents, scientists, and government officials. Peace Corps trainees from Burundi and the Congo have also visited the Rwasave Station to learn about composting rates, fish growth at different elevations, and pond sampling as a farmer training tool. In both formal and informal discussions, various University administrators made very favorable statements about the PD/A CRSP with regard to its contribution in the development of the Rwasave Station, and the training of UNR staff as well as Rwandan extension agents and farmers. The laboratory and research facilities of the Rwasave Station were especially critical to Rwandan students after courses at

the U. of Rwanda were suspended because of Civil War. The station continues to be a primary target for student field trips by primary and secondary, as well as university students. The station also continues to be a resource for fish culture extension agents who meet with CRSP researchers for discussion and planning.

g. Institutional development

In 1990 the Rwasave Station was given departmental status as a research station by the National University of Rwanda (UNR), the first University station to be so recognized. By 1991 it had become the premier water quality analysis lab in Rwanda, and was earning substantial income for analytical services provided. It has attracted outside funding from the Catholic University of Leuven, Belgium, and the European Economic Community. The IDRC has also expressed interest in funding research at Rwasave. In spite of war-related shortages, and communications difficulties, the facilities have been continuously improved or enlarged. In this reporting period new construction has included 24 experimental ponds, a classroom/multipurpose room, a holding tank room and hatchery, plus a hatchery annex, all near the main station offices. A small lab and holding tank facility have been constructed near the new research ponds. In addition, the regular water chemistry lab was expanded into its storage room, and a separate, fire-proof chemicals storage room was added. There has been additional construction of pig, chicken, and duck pens, plus vegetable gardens. The station has become totally self-supporting. Primary income is from sale of fish and fees earned for water analysis. This income covers all operating costs, including salaries. The only salaries not covered are those of the US and host country Research Associates.

h. Sustainability

The Rwanda PD/A CRSP has an excellent staff, has established an outstanding research facility at the Rwasave station (widely believed to be the best in Africa), and has played a critical role in aquaculture development in Rwanda. Because of its self-sufficiency, and the apparent commitment of the UNR administration to aquaculture research and education, there would seem to be an excellent possibility that the Rwasave Station can sustain itself as a productive and integral part of the University well beyond the departure of the PD/A CRSP.

i. Project management

Based on observations during the 1992 site visit accomplishments were significant, and based on discussion with ME personnel, the Rwanda project is believed to be very well managed. As Program Manager, Ms. Veverica has felt that she has had no serious management problems, and that communications, transfer of funds, and other support systems among Rwanda, OSU, Auburn, and the ME were satisfactory. There seems to be a satisfactory division of responsibilities between research and management personnel, and high levels of performance by all. It is commendable that the Rwasave Station is now self-supporting through income from the sale of fish, and through fees paid by outside entities for water analysis. There is an apparent efficient utilization of labor and

resources as evidenced by the continuing improvement of facilities (new ponds, buildings, and pens) and establishment of new enterprises (animal and vegetable production).

j. Concerns and constraints

At the time of the site visit in September 1992 there were a number of serious concerns for the future of the project in Rwanda. Foremost of these was finding an adequate replacement for the US RA Karen Veverica, who was scheduled to return to Auburn in December 1992. A second concern was the lack of a Rwandan RA, which is an extremely critical position in the day-to-day station operation, and by original agreement was to be a member of the UNR faculty.

An additional major concern was the political unrest in Rwanda, which had caused a relocation of one important study, had created serious administrative and logistical problems, and had delayed clearance to enter Rwanda by Ms. Veverica's replacement from December 1992 to June 1993. However, in a recent update, it has been learned that Ms. J. Newman, Ms. Veverica's replacement, departed for Rwanda on June 20, 1993. It was also learned that Anaclet Gatera has continued to function effectively as Rwandan RA, even though the matter of his tenure at the University remains unresolved. It was further learned that the research program has moved forward, essentially on schedule, under the able leadership of Rwandan PI, Dr. J.D. Bucyanayandi.

An additional concern is that the Rwanda project continue to participate fully in the global experiment. Success in the extension of results is exciting and demanding. However, several development agencies have the funding and potential to extend aquacultural methods to Rwandan farmers, but none, other than the CRSP, is funded and equipped to increase the knowledge base through research. The danger of neglecting the research component in favor of extension activities is that, if the original goals of the CRSP are no longer deemed important, the CRSP itself may be in jeopardy.

It would appear that additional buy-ins might be possible, from USAID or other donors, and these should be encouraged as a mechanism through which the extension elements can be supported while the research continues.

Response of the ME:
The EEP assessment of the Rwanda project, taken as a whole, seems balanced. The majority of the comments that follow relate to specific factual details.

1) *The Rwanda Team has never abandoned its global research mandate, and in fact has acted within the Technical Committee as the impetus for continuing the global experiment. For example, they were among the first groups to follow up on the DAST's requests to conduct a maximum nutrient input study. Also, their research on farmer ponds across a broad range of elevations has significant global implications and is one of the best examples of farmer participatory research in this CRSP.*

2) *The concern for greater output of journal articles is acknowledged and PIs are taking measures to remedy this situation. A plan for completing technical reports has already been submitted to the ME. The ME is confident that the Rwanda team will fulfill its responsibilities in this regard; the Rwanda team is already credited with an excellent record of on-time submission of annual technical summaries for the CRSP Annual Report.*

3) *Training and extension, although not a primary mandate of this CRSP, are important to our overall objectives and raison d'être. The BIFADEC Guidelines clearly obligate each CRSP to fulfill some activities in these areas as part of the CRSP commitment to the development community. The EEP is surely aware of the tension that exists between research, which continues to be our primary objective, and outreach, which factors into a measurement of our program's impact. The Rwanda project deserves high praise for balancing these demands effectively. In our CRSP, the Rwanda team acts as the trend setter for extending research information to end users, for integrating social sciences concerns, and for adopting a philosophy that is grounded in sustainable agriculture and appropriate technology.*

4) *The EEPs concern about instituting a Rwandan RA has been resolved with UNRs recent consideration to add Mr. Anaclet Gatera to its faculty.*

Finally, the ME would like to commend the entire Rwanda team for their dedication to science, the CRSP, and outreach efforts in Rwanda in the face of continuing political hostilities near their project sites. Despite these serious political difficulties, research is progressing remarkably close to schedule. This is testimony to the institutional sustainability of the project.

5. Data Analysis and Synthesis Team (DAST)

For purposes of this review the DAST is viewed as a separate project within the CRSP. Previous External Evaluation Panels have expressed concern about the progress toward data analysis and synthesis; therefore, special attention was directed toward this team during this evaluation.

a. Progress toward objectives

The DAST has consisted of two cooperating units, one at the University of California, Davis and the other at Oregon State University. The Davis group has focussed on pond dynamics modeling including models of primary production evaluating sensitivity to light, turbidity and depth, and has continued work on dissolved oxygen and temperature simulation models. The Oregon State effort has been concentrated on the PONDCLASS expert system for application of project results, and on continued refinement of the decision support system for aquaculture.

Considering the relatively small amount of funding available to the DAST it has done an excellent job of utilizing, and synthesizing data from the CRSP. It has provided an outstanding demonstration of applications of the CRSP data featuring the global aspects of the data. The modeling efforts have continued to provide insight into the underlying principles of pond dynamics in a fashion that is totally consistent with the original plan for this CRSP. The models are valuable contributions to fundamental understanding of low-input aquaculture.

The expert system, PONDCLASS, has proven to be a useful tool for both predicting production applications, and simulating management operations to improve production, as well as a valuable research and research planning implement with broad applications. The system is functional and useful, nevertheless, its continued refinement promises to be rewarding. It is a unique system; the only one incorporating such a broad base of information, and a validation of the global experimental plan.

b. Quality of research

Both institutions have contributed top quality researchers to this effort and the result is a series of high-quality publications and products. The modeling research has undergone continuing peer scrutiny and review, and will meet the highest standards of quality.

c. Reporting

Reporting by the DAST to the ME, field units and other CRSP units has been timely and useful. Feedback to the Technical Committee is useful in planning research activities. No criticisms of the DAST are voiced by the EEP.

Please see item f. below with regard to reporting of field data to the Central Data Base and DAST.

d. Linkages

Coordination and communication within the project are excellent, and are important to the unity and function of the CRSP. The DAST plays a useful coordinating role.

External linkages to current modeling/computer technology experts and institutions appear to be solid and well utilized. Use of data, models and PONDCLASS by other aquacultural research and development groups is encouraged. Additional publications designed to promote use of CRSP outputs might be considered.

e. Project management

The two parent institutions have contributed consistently to the DAST effort and their assistance should be noted. CRSP funding alone has not been adequate to fully support the work of the DAST. The institutions have also used the CRSP

work as an educational/ research mechanism for graduate students in a manner that has contributed substantially to the overall progress of the CRSP.

General management of the project has been very good.

f. Concerns and constraints

The first concern regarding the low level of funding for the CRSP is documented elsewhere in this report; however, the impact of poor funding is particularly apparent in DAST activities. This large international project has operated over a number of years for data collection, but the synthesis and analysis of data appear to be underfunded. The focal point of the impact of the project is weak due to poor funding.

A second concern is that information from the field projects is in some cases unnecessarily slow in reaching the Central Data Base, and thus delayed considerably in reaching the DAST. The negative impacts of this lag are that the DAST is never up-to-date in terms of data input and value of feedback to researchers from the DAST analysis is reduced. This is a problem addressed but not solved by earlier EEPs (although it was reported by the ME to have been solved following the last evaluation). This EEP believes Board action is needed with respect to some of the field projects.

The DAST members expressed concern about data quality in some instances. Again this seems to be an inexcusable shortcoming that is relatively easy to correct but has a large negative impact.

Response of the ME:
The Management Entity is pleased with the progress made by the DAST during this review period, but particularly during this past year. Previous problems and delays were attended to professionally by all individuals concerned, and the development of tangible products, such as PONDCLASS, has added momentum to this important CRSP activity. The ME, however, wishes to see the DAST improve its knowledge of field projects and conditions, and therefore encourages DAST researchers to pursue opportunities for adding a more direct and immediate international focus to their work.

Partly because of the low funding received by the DAST in the past, and partly because the ME recognizes the global importance of the computer application, PONDCLASS, the ME has donated time, money, and effort to the DAST in producing the manual for PONDCLASS (including technical reviews, editing, design, and production). Although this effort greatly taxed the already heavily encumbered resources of the ME, we regarded it as highly rewarding. With the DAST's recent increase in funding, however, they report that they are better able to handle production and distribution of their materials.

C. INTEGRATION OF SOCIAL SCIENCES

Social science issues of interest in individual countries might include:

1) the economics of aquaculture, is it a worthwhile expenditure of resources and labor in the setting?

2) competition for scarce resources, is aquaculture competing for land, water, manures, imported commodities, and what impact will this competition have?

3) are aquacultural products exported, and if so what is the effect on availability of fish in local markets? who benefits from the export industry (eg. shrimp in Honduras)?

4) what implications will a shift to labor in support of aquaculture have in local cultures?

5) what are the roles of women, children, the poorly educated in aquacultural production?

Few if any of these or related issues have been addressed by the CRSP. If new funding were made available for this purpose social science research would be of interest. However, this CRSP is currently seriously underfunded and the EEP believes other research topics are of higher immediate priority.

CRSP researchers are sensitive to social issues at all sites and several observations are of interest. In Rwanda, farm women are actively involved in production. Women participate actively in the CRSP research in Thailand and are involved in university education that will lead to additional positions of responsibility. Generally, aquaculture appears to be an open door to participation of women at all levels.

D. BALANCE OF US-BASED AND HOST COUNTRY ACTIVITIES

This topic relates directly to the role of the DAST that is entirely US-based and is discussed above. As noted early the EEP believes too little funding is provided for the work of the DAST.

The Central Data Base is maintained in one of the U.S. institutions and this is appropriate.

Other research is not required in the US, and most is better conducted in the tropical, developing country setting, as is currently the case.

The conclusion of the EEP is that the current balance is satisfactory except for the research done under the DAST, which should be increased to realize the full contribution of the CRSP.

V. BENEFITS TO US INSTITUTIONS

Although some of the participating US institutions had previously conducted research or development projects in the developing world, the global experiment is a new approach that has made possible comparative studies from a variety of sites. The data base developed through the CRSP is a unique resource that has and will continue to provide the raw data for studies of interest to U.S. researchers, aquaculturists and environmentalists. The number of thesis projects arising directly from this database is 80, nine of which are with US universities. In addition, the studies have important implications to US aquaculture which has been largely approached as a feedlot type system rather than as a production system taking fullest advantage of the natural ecosystem's capability to produce food and recycle wastes.

VI. FUNDING AND FISCAL MANAGEMENT

A. MANAGEMENT ENTITY

In 1987, a federal audit, which was part of a program audit, was conducted of the first 5-year CRSP grant (through 1987). Every year, in accordance with OMB A-128 Single Audit for States, the Oregon Secretary of State Audits Division performs a systems audit. Thus far, both the federal and state audits have given the CRSP a clean bill of health and have reported no problems.

There are no indications the ME has used funding unwisely or illegally; to the contrary, it has managed funds carefully and economized to make the meager funding go as far as possible. In a number of cases the universities involved (and in one case AIT) have had to loan money from other sources to the CRSP to keep it operating. In these instances the fault lay with USAID, because it was slow in providing funds, rather than with the ME.

The EEP advises the ME to continue to monitor airline ticket costs closely to ensure it is taking full advantage of low ticket prices when available.

B. PROJECT FUNDING AND MANAGEMENT/COST SHARING

A summary of cost sharing information for 1991-92 is presented below as an example. Cost sharing in earlier years was roughly comparable.

		US Cost Sharing 1991-92	Host Country Contribution 1991-92
Research Program			
Honduras:	Auburn	$ 21,232	$ 45,000
Rwanda:	Auburn	$ 31,322	$ 28,451
	OSU	$ 13,546	
	UAPB	$ 1,394	
Thailand:	MSU	$ 12,124	$ 43,000
	UH	$ 20,500	
	UM	$ 91,653	
Subtotal		$ 191,771	$ 116,451
US Research Program			
DAST:	UCD	$ 19,600	
	OSU	$ 8,754	
Special Topics:			
Soil Studies, OSU		$ 5,914	
Subtotal		$ 34,268	
Totals		$ 226,039	$116,451

In the opinion of the EEP both the US institutions and host country organizations have been generous with cost sharing (largely in-kind for host institutions). In one case (the Philippines) the host country contributions are exceptionally high, and, while the level of commitment indicated is admirable, it leads to questions of sustainability. The EEP believe the ME should take steps to bring this situation into balance with that of other host countries.

C. BUY-INS

A modest number of small buy-ins have occurred over the course of this CRSP, however, considering the strong interest by USAID Missions and Regional Bureaus in seeing the extension and training aspects of the CRSP strengthened, it is surprising that more funding has not been provided through this mechanism. The opportunity continues to strengthen technical capabilities for this fast-growing form of high protein food production through buy-ins. Additional buy-ins seem likely, for example from the European Economic Community and the Catholic University in Rwanda.

ME Response:
The ability of this CRSP to leverage buy-ins is constrained by the low level of core funding. Despite this difficulty, the CRSP has been able to leverage buy-ins averaging $150,000 per year (approximately 15% of the core budget). When the $1.3 million dollar Egypt project is factored in, this average is much higher. The ME agrees that increasing the number and the dollar amount of buy-ins is a desirable goal.

VII. OBSERVATIONS ON THE ROLES OF CRSP ORGANIZATIONAL UNITS

A. MANAGEMENT ENTITY

The ME currently plays the role of an executive secretariat or care-taker for the CRSP rather than providing scientific leadership. This arrangement apparently suits other elements of the CRSP and the net result is good. Other CRSP elements have assumed the leadership roles in planning and designing research strategy and in directing the research itself. Although the current arrangement is working well to date, both the Technical Committee and the Board of Directors should be aware that the complexity of the CRSP research is increasing as the few early research themes shift to more, highly specialized themes and coordination is increasingly difficult. The maintenance of an identifiable global experiment will require ongoing attention by all players.

It is important with this mode of operation (an executive secretariat approach) that the ME personnel recognize the limits of their expertise and fully utilize the scientific expertise of the Technical Committee and the cooperating scientists. The authority of the ME should not extend to scientific decisions under the current arrangement.

The role of the ME has improved since the previous EEP report. Communication between the ME and other project elements is good. Paperwork and other documentation are distributed appropriately and evidence of regular interaction with the project groups is visible. Very few complaints were registered with the EEP.

Response of the ME:
The BIFADEC guidelines clearly outline the responsibilities of a CRSP Director and Management Entity. The comments made by the EEP do not consider the context of the ME as outlined by BIFADEC (see p. 48). The EEP misunderstands the range of responsibilities and authorities that fall under the purview of the Director and Management Entity.

Nowhere in the lengthy BIFADEC description is it stated that the Director or ME is to provide scientific leadership for the program. The current Director, like previous Directors of this CRSP, has never assumed this role, which has always rested with the Chairperson of the Technical Committee. A review of previous administrative reports shows that the general nature of the directorship and ME has not changed. Consequently, the focus on the MEs 'executive secretariat' responsibilities, to the exclusion of other responsibilities, is unfortunate given the present gender composition of the ME.

Principal responsibilities of the ME, as stated in the document 'Guidelines for Collaborative Research Support Programs (CRSPs)', from BIFADEC Guidelines, Sec. V.A.2. Management Entity (ME):

a. *Complete or develop a global plan with regional strategies at the outset of the implementation phase;*
b. *Work with AID/Washington, S&T Bureau, Regional Bureaus, and USAID Missions, and with representatives of participating U.S. institutions in confirming tentative site selections and developing MOUs and specific programs with annual work plans and budgets in each prime country or countries in each ecological zone or geographic region where located.*
c. *Work with U.S. institutions in developing component projects in each prime site to form an integrated, multi-disciplinary program representing major constraints, including socio-economic, of the ecological zone or region for which the country was selected; the country program should include institution building and training components for the prime countries primarily.*
d. *Assure that baseline data is made available, either through socioeconomic studies and policy assessments or by updating of existing studies and assessments in each prime country site for measuring future progress.*
e. *Confirm arrangements with those countries which are to serve as scientific linkages with the prime country or countries in each ecological zone or region.*
f. *Work with participating U.S. institutions to develop the research programs in the United States that are a part of the overall program in the respective ecological zones or regions.*
g. *Allocate resources for research among disciplines and the participating institutions, maintaining balance between U.S. and overseas research activities, in a manner most appropriate for cost-effective achievement of goals.*
h. *Develop a reporting and publication system that will assure appropriate publicizing and use of research findings of the CRSP overseas and in the United States, aimed at the different institutional audiences and different national and ethnic groups that the CRSP deals with.*
i. *Establish an effective working relationship with AID Washington offices, U.S. institutions, international centers and agencies, as well as with host country institutions.*
j. *Coordinate and provide creative leadership and direction to planning and implementation of the CRSP, especially its overseas components.*
k. *Represent the CRSP in specific official contacts within the United States and abroad, dealing with AID, BIFAD, and JCARD.*
l. *Administer in both fiscal and programmatic terms the research program under the programmatic guidance of the Board of Directors and the administrative authorization of the ME institution.*
m. *Take measures to have the CRSP structure established as outlined in preceeding (sic) sections, assuring that functions are described, the charter is established, and by-laws written, in accordance with provisions of the grant document.*
n. *Organize the ME staff and serve as secretariat for these bodies, with minutes to be taken and recorded.*
o. *Nominate members for the External Evaluation Panel on the advice of the Board, considering recommendations of the TC, participating institutions, and other sources, obtain clearances of nominations by the Board, JCARD/BIFAD and AID.*
p. *Describe functions for a strong role for the EEP and the manner for its operation, with schedules to keep it informed to facilitate its work, assuring a thorough evaluation and report annually, with institutional and country site visits on a rotational basis.*
q. *In coordination with the participating U.S. institutions, prepare, manage, and evaluate annual budgets and work plans for research and training.*
r. *Develop subgrant agreements with participating institutions, and subcontracts where necessary to supplement the technology from other sources where not available in CRSP member institutions.*

s. *Establish a system for advanced planning and control of travel, utilizing the control systems available to participating institutions, and requesting approval from AID Washington for clearance of all international travel.*
t. *Arrange for meetings among personnel of CRSP institutions and host countries as necessary with due consideration of cost factors.*
u. *Establish a system of communication with participating U.S. institutions, to involve deans, department heads, directors of resident instructions and international programs, and directors of experiments stations in the CRSP and inform them about the program, its progress and problems. This is to integrate the CRSP with related research and educational activities of the institution.*
v. *Prepare and submit annual and other reports to AID/Washington in a timely manner as required in the grant document.*

B. R&D/USAID WASHINGTON

R&D Office oversight and project management appear to be satisfactory. The role of the R&D Office and of CRSPs in general is brought into question by overwhelming pressure from Regional Bureau's and USAID Country Missions to use CRSP resources in an extension/demonstration/training mode. The EEP does not believe the R&D Office has been sufficiently forceful in 'selling' the importance of research in supporting development. The Regional Bureaus are happily using the results of past research but somehow fail to grasp the need for ongoing research as the basis for tomorrow's extension activities. As research funds are reduced around the world it becomes increasingly important for development agencies to recognize that much research needed for future development is not being funded by others, and will not be funded except by development groups.

The EEP believes this is one of the outstanding CRSPs in terms of impact per dollar spent. Fisheries experts in R&D have sustained the program against officials who are not fully aware of the importance of this CRSP. The EEP urges the R&D Office to continue to stress the importance and potential importance of farm-raised fish in developing countries and to work toward broader recognition of the ecological soundness, the social and economic attractiveness and the sustainability of fish farming. Further, the benefits to be derived from ongoing research to improve the efficiency of low-input aquacultural production need to be stressed.

The R&D Office has provided appropriate guidance and direction to this CRSP and has effectively managed the project over the years. Technical and organizational guidance has been provided when necessary, nevertheless the project has had the freedom to operate in a relatively independent fashion.

C. BOARD OF DIRECTORS

The Board of Directors (BOD) is the primary policy making body for the PD/A CRSP. It was formerly know as the CRSP Executive Council. It is comprised of one administrative member each from Auburn University, CIFAD, and the University of California, Davis. Some of the Board's principal functions are to: 1) advise the ME on CRSP policy; 2) select the CRSP Director; 3) review annual summaries and fiscal reports; 4) approve formation of ad hoc committees;

5) appoint at-large members of the Technical Committee; 6) appoint review panels, including the EEP; 7) review the performance of the CRSP Director; and 8) review planned research activities for consistency with CRSP policy before submission to the ME for funding. The Board members appear to be generous of their time, to meet their obligations in an exemplary manner, and to direct CRSP activities in reasonable harmony with the ME.

D. TECHNICAL COMMITTEE

The TC is composed of the Principal Investigators (Host Country and US institutions) of the CRSP projects, the CRSP Data Synthesis Team, and two members-at-large appointed by the BOD[2]. The CRSP Director and USAID Program Manager serve as ex-officio members. The TC has four standing subcommittees: Work Plans, Materials and Methods, Budgets, and Technical Progress. In addition to its advisory function in purely technical matters, the TC 1) develops biennial work plans; 2) prepares annual budget recommendations for CRSP research activities; 3) reviews technical progress and proposes appropriate modification of the technical plan; and 4) continuously reviews materials and methods utilized in CRSP research, and recommends modifications where appropriate. While the committee may not always function in total harmony with the ME, the differences are never irreconcilable, and the best interests of the CRSP seem to always be served.

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[2] ME clarification on the composition of the Technical Committee:
Voting members of the Technical Committee include one Principal Investigator from each Host Country institution and one from each funded project at a U.S. institution. Other U.S. and Host Country scientists participate in the Technical Committee meetings as non-voting members, and the CRSP Director and USAID Project Manager serve as ex-officio members.

VIII. PLANS AND PROSPECTS

A. APPROPRIATENESS OF RESULTS FOR USER GROUPS

For purposes of evaluation it should be remembered that this CRSP was established and designed strictly as a research program. In the early stages researchers were cautioned not to get involved in extension work and proposed activities were rejected if they leaned toward extension rather than research. Now the EEP is asked how well the extension aspects have succeeded. Obviously the program has evolved over time to include greater emphasis on extension, nevertheless, the original goals and design of the program should be kept in mind as well as the fact that the program was not designed, organized or staffed as an extension program. This topic is addressed here in two parts: first, "are the results of the research appropriate for extension?" and second, "are the results being extended?"

The research conducted through this CRSP is applied research designed to increase our understanding of low-input culture systems specifically in order to manipulate these systems more effectively at the production level. Results are presented both in scientific publications and reports targeting other scientists and in informal communications with co-workers, extension workers, farmers and government employees. Some results require interpretation by biologists before they can be applied, but, for the most part, results are readily usable and the impacts of results on production methods are clearly available.

These results are being utilized by extension workers in every host country and are being applied at the production level. Innovations and applications of research findings are apparent in every country that have originated from the CRSP research. On the low technology extreme (Rwanda) simple procedures for utilization of compostable organic matter, quality fish stocks and stocking procedures reflect direct input from CRSP experimentation. The more technologically advanced end of the spectrum (Thailand), where aquaculture is relatively sophisticated, utilizes CRSP results in its hatchery technology, fertilization rates for specific nutrients, feeding and stocking rates, polyculture species combinations and water management procedures. Evidence is abundant in all countries that CRSP results have been extended effectively, primarily through previously established extension channels.

B. ADEQUACY OF WORK PLANS

The PD/A CRSP personnel are to be commended on the overall quality of work plans submitted. In particular, the design and project-wide use of standard formats and experimental protocols is excellent and has set a very good example for others to follow.

Beginning with the Fourth Work Plan experiments conducted at various sites were 'different but related.' A weakness noted is that documentation regarding how the experiments under a given Work Plan are related seem to be lacking?

Although the TAC and individual researchers may have excellent reasons for each new experiment, it is not clear to the EEP how these 'related' aspects are being synthesized and used by DAST, or what particular results are anticipated.

C. UNIFYING CONCEPT OF THE GLOBAL CRSP

The PD/A CRSP is a good example of international collaboration among US and developing-country institutions. This collaboration could be even more effective if more financial resources were available for cross-site visits. The PD/A CRSPs results (and database) are important for researchers and developers in several regions where the PD/A CRSP has no work sites; for example, Eastern/Central Europe and South Asia. At present, the CRSPs 'products' probably reach such potential end-users only via scientific publications or not at all. The challenge therefore is to expand linkages and awareness of the CRSPs work across the world. If this is done, then future collaboration among groups with common interests is likely to become self-sustaining.

IX. PROJECT/ACTIVITY RATING

The EEP has carefully evaluated all four country projects and the Data Analysis and Synthesis Project and has found them all to be highly satisfactory. It is noted the EEP did not review or evaluate special related studies such as the Soils project at Oregon State University, the Women in Development activity or the Egyptian 'buy-in,' as these were determined to be outside the scope of the EEP review.

It was not deemed useful or appropriate to rank projects or to compare projects to one another. Each has its own strengths and weaknesses and these are discussed in detail earlier in this report. The level of local support, the aquacultural research expertise in each country and the level of aquacultural development vary widely from country to country and make comparative rankings of doubtful significance.

None of the projects fell short of the highly satisfactory rating indicated above.

Overall the CRSP is ranked as 'exceptional.' It is exceptional in its faithful adherence to the original concept of a collaborative *research* support program, in its application of a global experiment utilizing US and foreign inputs effectively to strengthen the knowledge base and in its potential to contribute to a new form of agriculture yielding food, income and employment from underutilized resources in an environmentally sound way.

X. OTHER OBSERVATIONS AND DISCUSSION

The EEP noted an ambiguity that it believes should be addressed by the BOD and the R&D Office of USAID. As noted above the expectations that this research program contribute substantially to extension have divided the activities to a degree (partially related to the orientation of the parent institutions). The resulting ambiguity in the CRSP, uncertain and variable guidance regarding the balance of research and extension activities, is disruptive and weakens the research effort. If extension is the primary purpose of the CRSP it should be totally reorganized and restaffed. If research is the primary purpose some activities may need adjustment and refocussing. With funding a serious constraint, the EEP believes it is not useful to endeavor to accomplish both goals. The BOD and USAID should address this issue squarely and provide clear guidance to the CRSP participants.

XI. RECOMMENDATIONS AND RESPONSES

Recommendations made by the EEP are presented below. Responses by the Management Entity, with input from the Board of Directors and Technical Committee, are in italics.

1) The CRSP funding level should be increased 40% to 50% and should be adjusted for inflation annually.

The importance of the contribution of this particular CRSP has been underestimated by USAID and will not be fully realized without additional support. The timing and focus of this CRSP are opportune with regard to the development of aquaculture in developing countries and the scope of the potential contribution is exceptional.

The current funding level limits the CRSPs operation. Even though participants have managed well on limited funding, the benefits of increased funding are believed to be large in relation to costs.

ME Response:

The EEP recommendation brings to light that our program is underfunded in relation to its importance to sustainable economic growth and emerging environmental concerns. A 40 to 50% increase (to approximately $1.5 million per annum) would help our CRSP enhance its effectiveness and would bring our funding level closer to that of the other CRSPs (the average annual USAID allocation for the eight currently funded CRSPs is $2.4 million, based on 1993 figures).

2) The PD/A CRSP should be continued for at least 10 additional years.

When compared with other forms of agriculture and animal husbandry, aquaculture is in its infancy. The basic understanding of the mechanisms of production is being laid today in a relatively rapid and organized fashion that permits rapid development of the technology. It is unreasonable to expect that this task will be completed in a few years through a small program such as this CRSP. Compared to other CRSPs the contributions possible here are both sweeping and fundamental. If sustained this CRSP can be an important factor in the modernization and development of a new food production technology that is environmentally sound.

ME Response:

The ME strongly supports this recommendation. As the EEP has pointed out, aquaculture is in its infancy. Aquaculture is forecasted to continue its rapid expansion, as it supplies the increasing worldwide demand for fish which is occurring at the very time that the world fisheries are in precipitous decline. The present U.S. trade deficit in fisheries products–which has ranged between $4.5 and $7 billion per year since 1987–is the largest for any U.S. agricultural commodity and is second only to petroleum among natural products (USDA Issues & Trends, 1993[3]). The continued growth of aquaculture will be directly related to the resources invested in aquaculture research. The PD/A CRSP experience in Honduras can stand as an object lesson in the efficacy of research--after 10 years of CRSP research, almost all government officials involved in fish farming received their training through the CRSP. The number of fish farms, both small- and medium-scale, has risen dramatically in the time the PD/A CRSP has been active, and many of these farm managers also received their training (formal or informal) through the CRSP. These are benefits that can only be reaped through long-term, consistent investment in the combination of research and outreach that has been the hallmark of this CRSP.

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3 *U.S. Department of Agriculture. 1993. Dynamics of the research investment. Cooperative State Research Service, Washington, D.C.*

3) Buy-ins should be increased and expanded.

Host country USAIDs and Regional Bureaus have pushed this CRSP toward extension and training at the cost of reduced research contributions. The EEP supports increased extension and training to the extent the costs are contributed by host country missions (through buy-ins) and the primary role of the CRSP (research) is protected.

ME Response:

The ME agrees with the EEP that all possible avenues for expanding the present funding of this CRSP need to be explored. There is increasing pressure from USAID/Washington, USAID Missions, and host country institutions to engage in more outreach activities while maintaining the original research focus of this CRSP. Clearly, the productivity of the program has increased, but the Board questions whether such increases are sustainable without adequate funding. The Board fears that the demands of balancing research and outreach to the satisfaction of all donors and collaborators is stressing the resources of an already inadequately funded program. Unlike other CRSPs, where Technical Committee members attract most buy-ins, the ME has initiated almost all buy-ins during this review period. Although the low level of core funding for this CRSP exacerbates the difficulty of leveraging buy-ins, informal buy-ins over the last three years have averaged over $150,000 per year, representing a 15% boost in the PD/A CRSPs core budget.

4) The global research focus should be maintained and strengthened.

The CRSP leadership, especially the ME and the Board of Directors, should keep the unique goals and approach of the CRSP clearly in mind, and should use this uniqueness as a selling point for the CRSP. The temptation to shift to several individual national research activities should be resisted, even where these activities could be outstandingly successful when compared to current national and bilateral research and development projects. The ongoing global approach has an important and very different contribution to aquaculture through compilation and assimilation of worldwide research experience and application to local conditions.

Response:

Since its inception, the goal of the CRSP – to improve the efficiency of pond production systems through sustainable aquaculture – has remained unchanged. The investigation of fundamental pond processes and interactions is one of the main research objectives of this CRSP. The scientific approach chosen towards this end was the Global Experiment, which continues to be the focus of the CRSPs international research activities. The Board of Directors and the ME share the EEPs appreciation of the efficacy of the Global Experiment. The Board has been insistent that each country project maintain a global focus by inclusion of at least one global experiment in each experimental cycle. The Board cautions, however, that researchers should be responsive to the site-specific needs of the host countries and USAID missions. Site-specific experiments contribute significantly to the CRSPs overall program goal.

5) Use of the database should be improved and expanded.

The host-country PIs should increase their efforts to supply data from their experiments to the central database in a timely manner and in a format that will expedite inputting. The database should be regarded by all PD/A CRSP personnel as a reference source and research tool for contemporary and future PD/A CRSP researchers and for researchers, teachers and developers from other institutions, and as one of the most important products of the CRSP. The existence of the database and its contents and potential uses should be publicized more widely in developed and developing countries.

ME Response:

The EEP recommendation echoes the findings of a report written in 1991 by an ad hoc committee of our Technical Committee. The Management Entity, however, believes that the EEP has not sufficiently acknowledged the vast improvements, since the previous EEP review, of the process by which data are added to the central database. The field researchers and the database manager deserve commendation for expediting this process, and for improving the overall quality and accessibility of the database. The ME and Board of Directors remain committed to seeing that the database is regularly updated and that the time lag is reduced between data collection in the field and data verification by the database manager.

A recent organizational change not noted in the EEP report is that the central database has been moved from the Management Entity to the University of Hawaii after a lengthy proposal and review process last year. As a result, one of the new activities that the database manager will perform is to publicize the data base to a wider audience and to write a guidebook for database users. The ME also continues to actively promote the database through various information outlets.

6) Social and environmental impacts of aquacultural development should be identified.

In the planning of all research activities, all PD/A CRSP personnel should pay particular attention to the likely social and environmental impacts of future development that will build upon their research results. Such impacts could be positive (for example, better nutrition and health, enhancement of soil fertility, lessening of erosion) or negative (health risks, and genetic and nongenetic changes when farmed aquatic organisms come into contact with wild aquatic organisms). Such potential impacts have been considered in past PD/CRSP activities but this could be made more explicit in future proposals and reporting.

ME Response:

The ME agrees that the social and environmental impacts of aquacultural development are worthy of study. The Scope of Work defined for the EEP (but not fulfilled due to time limitations) called for reviews that would have elucidated many of the social sciences and environmental activities undertaken by the CRSP. The program's low level of funding, however, has constrained activities in this area. Despite the shortage of resources, the CRSP has been able to design parts of its core research program so that social and environmental impacts can be identified without jeopardizing the integrity of the core research program. The brackish water studies in Honduras are one example of how the CRSP has added environmental impact to its research agenda, while remaining committed to its global mission. A gender analysis project in Rwanda, funded primarily through a buy-in initiated by the ME, helped identify social impact and potential for aquaculture.

7) Special care should be taken with transfers and introductions.

In all transfers and introductions of live aquatic organisms for PD/A CRSP research activities, the researchers concerned should explore the breeding history, genetic characteristics and likely genetic impact of the organisms being shipped upon farmed and wild populations in recipient locations, and should follow appropriate international codes of practice for all shipments of exotic species.

ME Response:

The ME agrees with the EEP that transfers or introductions of species require extreme caution and sensitivity. The ME believes that researchers should set an example for aquaculture practitioners in this area (see Cataudella and Crosetti 1993[4]). The CRSP has always taken special care with regard to all aspects of scientific research. CRSP researchers follow the relevant USAID guidelines which are based on the National Environmental Policy Act (NEPA 1970). Additionally, host country scientists, as required by international codes of practice, inform and seek consent of their own governments.

[4] *Cataudella, S., and D. Crosetti. 1993. Aquaculture and conservation of genetic diversity. Pages 60-73 in R.S.V. Pullin, H. Rosenthal, and J.L. Maclean (eds). Environment and aquaculture in developing countries. ICLARM Conf. Proc. 31.*

8) The impacts of results should be monitored and documented.

The PD/A CRSP should make increased efforts to monitor and document the impact of its results upon clients (considered to be other researchers in the same field of work in developed and developing countries, governmental agencies, developmental agencies, and NGOs/PVOs) and upon beneficiaries (considered to be the producers and other employees associated with pond aquaculture operations and the consumers of pond aquaculture produce). The principal mechanisms should probably be citation analysis and direct feedback from clients, and solicitation of opinions from agencies and individuals that have substantial experience of and contacts with the circumstances of beneficiaries.

ME Response:

The CRSP recognizes the value of monitoring and documenting the impact of our results. The Technical Progress sub-committee of the Technical Committee is currently charged with the responsibility for monitoring the progress made by each project toward its stated goals. The ME elicits descriptions of project impact from on-site researchers. The ME struggles, as do other CRSPs, in finding appropriate and affordable venues for distribution of such documentation. To date, several publications highlighting the impact of specific technologies have been printed and distributed through the CRSP Council. The PD/A CRSP documents its results to a worldwide audience through its mailings of Research Reports *and* Aquanews. *More detailed reports, brochures, and summaries of client questionnaires are distributed to government and development agencies in the U.S. and host countries. Distribution of reports such as* Rwanda Women in Aquaculture: Context, Contributions and Constraints and Gender Variable in Rwanda, *and of tools such as PONDCLASS, is undertaken at a grassroots level. CRSP researchers are to be commended for using existing in-country extension and outreach infrastructure to leverage their ability to communicate research results to wider audiences.*

9) The CRSP should continue to address issues of equity.

The PD/A CRSP should consider, as part of its future social science research agenda, the equity issues associated with the development of pond aquaculture and should continue to tailor its research activities to produce results that will benefit resource-poor producers. The advice of social scientists who have experience in this area of work, for example in the recent expansion of shrimp farming, should be sought.

Program planners should remain sensitive to social issues so that CRSP activities benefit the public generally rather than just the affluent, politically strong and more vocal minorities.

ME Response:

The CRSP recognizes the importance of continued attention to equity issues. Aquaculture contributes not only to subsistence food production, but also to small-scale cash-generating activities at home, and to wage-earning activities in small industries. Women and resource-poor farmers are direct beneficiaries of these activities. The CRSP is pursuing opportunities to integrate equity issues into the research framework, and will endeavor to encourage women and host country participants in the planning, implementation, and evaluation of program activities.

10) Linkages in related fields of development-oriented research should be expanded.

The PD/A CRSP should expand its interactions and linkages with national, regional and international institutions engaged in the same field of research or in allied fields. In particular, greater contacts should be sought with US institutions engaged in natural resources management and farming systems research where pond aquaculture is or could become a component of their programs and with institutions in developing regions where pond aquaculture is important, for example, Eastern Europe and South Asia.

ME Response:

The ME agrees with the EEP recommendations that new linkages should be explored. In the past three years, our program has nearly doubled its formal and informal linkages with researchers in related fields. Our CRSP is well positioned to make great advances in pursuing new opportunities but funding constraints severely limit our ability to move ahead.

11) Translation efforts should be enhanced.

The PD/A CRSP should consider how the translation into major languages (particularly French and Spanish) of its major publications and software products could be expanded and how this could be financed. It has made laudable progress in this so far, with minimal resources.

ME Response:

The Management Entity agrees that translated versions of our major publications and software would be an important enhancement of our outreach efforts. The EEP expands on a theme covered in our present grant that our computer software program, PONDCLASS, should be made available to a wider international audience through translations into French and Spanish. Thus far, the French translation of PONDCLASS was done entirely free of charge by the Rwanda CRSP researchers, who deserve commendation for their generous efforts. External funding opportunities for additional translation efforts will be considered as the CRSP writes its continuation proposal (1995 to 2000).

12) The ME should ensure full use of technical expertise existing within the CRSP.

Since the ME is staffed with personnel whose expertise is stronger in the program management area than on scientific topics, the ME personnel should limit their interaction during planning and analysis discussions on technical issues to ensure adequate opportunity for input from technical people on such issues.

ME Response:

The BIFADEC Guidelines call for cooperation of CRSP groups in lending technical and programmatic support to the Management Entity, and for the ME to "coordinate and provide creative leadership and direction to planning and implementation of the CRSP, especially its overseas components." The CRSP grant further institutionalizes this commitment to foster cooperation by naming the Director and USAID Project Manager as ex-officio members of the Technical Committee and Board of Directors. Therefore, under the CRSP organizational framework, scientific expertise of the ME is put to use in understanding research needs and priorities, in presenting and documenting technical achievements accurately, and in planning the overall program agenda.

The ME presently provides limited input during technical discussions and is called on primarily as a resource. Because of both daily and long-term familiarity with the CRSP, the ME is in the best position to be most knowledgeable of the grant and with the research commitments the CRSP has made to the development community. Furthermore, the EEP did not review the academic qualifications of ME staff. In fact, four of the five faculty members associated with the ME during this review period have direct research experience and academic credentials in the aquatic sciences; one member has in-depth technical writing and training expertise. It may appear that program management is stronger than scientific expertise because the ME has such a successful record of obtaining funding, even during times of donor malaise. The MEs involvement in technical and administrative matters that concern the Technical Committee has resulted in more than a 150% increase over previous administrations in overall program funding.

The EEP recognizes that "the role of the ME has improved since the last report. Communication between the ME and other project elements is good." The ME affirms that the open channel of communication between the Technical Committee, which comments technically and administratively on matters, the Board of Directors, and the ME is vital to the continuing health of the program.

The Technical Committee benefits from interaction with the ME during planning discussions of technical issues; therefore, the suggestion to limit interaction between these groups could be detrimental. These open discussions embody the spirit of the CRSP.

The connection between these groups has become integral to the success of the CRSP in the arena of international development assistance. To facilitate communication, the ME will continue to function as a resource. And in keeping with the premise under which all CRSPs were created, the advisory bodies and ME will continue to play a role in setting the tenor of the research program. The ME, therefore, intends to continue to use the scientific expertise existing within the CRSP.

13) AID should fully fund the external evaluation panel's activities.

Funding of EEP activities by the project being evaluated is considered poor practice and could be interpreted as a conflict of interest. Further, the honorarium currently offered is totally inadequate compensation for the time and effort expended by EEP members.

ME Response:

The ME fully agrees with this recommendation and hopes that future external reviews will be funded by the Agency.

14) The objectives of the brackish water research in Honduras should be clarified and the rationale for conducting this research as part of the CRSP should be explicitly stated.

It is understood that shifts in emphasis in Honduras have been made with full support of the BOD; nevertheless, the EEP raised questions relating to how this work supports the goals of the Pond Dynamics CRSP that were not answered to the full satisfaction of the EEP. The magnitude of this shift (especially freshwater vs. saltwater; fish vs. shrimp; static ponds vs. ponds with water exchange, photosynthesis-based food chain vs. artificial feeds, focus on productivity vs. focus on impact of effluents) in research emphasis apparently stretches the original concept of this CRSP rather substantially. The EEP recommends the rationale for this shift be stated more clearly.

ME Response:

The brackish water research shares the CRSPs overall goal of increasing the availability of animal protein in developing countries by increasing the efficiency of pond aquaculture systems. All CRSP projects, whether freshwater or brackish water, seek to elaborate and refine models in pond dynamics, to test these models under field conditions, and to disseminate guidelines for pond management. Furthermore, the brackish water project addresses the following specific objectives of the PD/A CRSP, articulated on pages 9-10 of the Continuation Plan:

- *To develop technology, through research, to overcome major problems and constraints affecting the efficiency of pond aquaculture in developing countries;*
- *To maintain or improve natural resource quality through proper management of aquaculture systems;*
- *To stimulate and facilitate the processing and flow of new technologies and related information to researchers, to extension workers, and ultimately to fish farmers in developing countries;*
- *To create opportunities for greater multidisciplinary research in aquaculture and to enhance the socio-economic and ecological aspects of the CRSP;*
- *To use an ecosystems approach to arrange the research agenda and integrate technologies.*

Indeed, the PD/A CRSP was originally designed to include brackish water studies, and would have continued this engagement even after the CRSP budget

reduction in 1987, had the political situation in Panama not necessitated a relocation of the project to Honduras. The Continuation Grant includes brackish water studies as one of the deliverables for the CRSP during this review period, in order to validate earlier research and to fill in gaps in the global database. The Continuation Grant therefore obligates the CRSP to continue its commitment to brackish water studies. Thus the move to Choluteca is a continuation of the CRSPs original mandate to increase the efficiency of aquaculture systems.

15) The CRSP should consider restatement of, or identification of new long-term goals.

This CRSP is a dynamic research activity that has changed with time for political, financial and scientific reasons. In accord with Recommendation No. 2 (long-term continuation of the CRSP) the EEP believes all CRSP elements should consider whether the long-term goals can be more clearly stated to reflect the progress made in this area of research and the anticipated future contributions of the CRSP. The EEP believes redefinition and refinement of goals to reflect changes in the aquacultural industry and changes in the needs of that industry are essential to the justification of continuation.

ME Response:

The EEP recommendation seems practical given that the original goal of the program was conceived nearly fifteen years ago. The redefinition of our principal research framework will be the focus of discussion at our 1994 annual meeting. The redefined framework is intended to form the backbone of our continuation proposal (for 1995 to 2000). The original long-term goal of the CRSP – improving the efficiency of pond aquaculture systems through sustainable management – continues to be a worthwhile endeavor. However, the ME agrees that a broader ecosystems perspective which engages the community of people involved in aquaculture would strengthen this CRSP and help it to respond more positively to environmental and geopolitical changes.

16) Responsibilities of the EEP should be fully documented.

Although the scope of work for this report was extensive, annual responsibilities of the EEP, particularly for reporting and participation in annual CRSP activities are not clear.

ME Response:

The ME has attempted to institutionalize the participation of the EEP. The BIFADEC Guidelines for CRSPs (pp 38-40) are fairly specific on this count. The ME, in an *effort to make the guidelines more accessible to researchers and reviewers, synthesized the guidelines and other documents into a* Policy and Procedures Manual, *which addresses the EEP on pages 4 and 5; responsibilities are explicitly outlined in paragraph D. The Scope of Work is intended to complement this statement of responsibilities by adding the necessary level of specificity concerning the research undertaken during the review period.*

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SEAFDEC. 1991a. Report of the fourteenth meeting of the Program Committee of the Southeast Asian Fisheries Development Center (SEAFDEC), Manila, Philippines, 24-27 September 1991. 259 p.

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Annex A

Scope of Work

EXTERNAL EVALUATION PANEL REVIEW
POND DYNAMICS/AQUACULTURE CRSP

EVALUATION TEAM:

External Evaluation Panel (EEP):
- Dr. Homer Buck (retired), Salem, Illinois
- Dr. Richard Neal, Deputy Director, Southwest Fisheries Science Center, National Marine Fisheries Service, La Jolla, California
- Dr. Roger Pullin, Aquaculture Program Coordinator, International Center for Living Aquatic Resource Management (ICLARM), Manila, Philippines

Board of Directors (BOD):
- Dr. Robert Fridley (Chairman), Dean, College of Agricultural & Environmental Sciences, University of California at Davis
- Dr. Philip Helfrich, Director, Hawaii Institute of Marine Biology, University of Hawaii at Manoa
- Dr. R.O. Smitherman, Professor, Department of Fisheries and Allied Aquacultures, Auburn University

Management Entity (Oregon State University):
- Hillary Egna, Director, PD/A CRSP
- Marion McNamara, Assistant Director, PD/A CRSP

USAID/R&D/AGR:
- Dr. Lamarr Trott, Senior Fisheries Advisor
- Harry Rea, Fisheries Advisor

SCOPE OF WORK:

I. RESEARCH STATUS: ACCOMPLISHMENTS AND PROGRESS

Note: Each project should be reviewed individually in addition to being part of the review for the entire program.

A. Status of Baseline Research

Note: Baseline refers to the core research plans that are described in the grant documents (1982-87, 1987-90, 1990-95).

Discuss accomplishments, contributions and constraints regarding:

1. Progress made towards U.S. and host-country research objectives. Discuss quality of research (e.g., sampling and analysis), and consistency with work plan specifications and schedules.
2. The extent to which CRSP results and technologies (products and processes) have been adopted by end users (e.g., host-country scientists, extension agents, educators,

farmers). If results have been adopted, trace the path between the CRSP and the end user. Has the project had an impact? Using appropriate indicators, report changes in production or consumption due to project research (e.g., yields per hectare, total production). Should project funds be redirected to increase the probability of impact or technology adoption?

3. Reporting and information dissemination (e.g., CRSP annual reports, journal publications, bulletins, technical papers produced and released for public use).
4. The relation between the research being conducted at a particular site and the research being conducted in the host-country, IARCs, and elsewhere. Is it complementary, duplicative, or unique?
5. The most significant research contributions generated by this project (include products, processes, systems, publications) for the host-country and the U.S., if applicable. Identify the prime beneficiaries of this research and suggest how the results could be extended to other target groups.
6. Other activities, concerns, constraints and topics of interest which arise during the review.

B. Status of Site-Specific and Special Topics Research

Discuss accomplishments, contributions and constraints using, but not limited to, the 6 criteria listed above.

C. Evidence of Natural and Social Sciences Integration

Identify relevant economic, gender and other social sciences issues that are being considered in the context of this CRSP. Has proper consideration of gender and social sciences issues been taken into account? Suggest modes in which existing project funds could be redirected to better address or incorporate relevant social sciences issues.

D. Balance of Domestic and Overseas Activities

Assess the general mix of domestic and overseas project activities with respect to program and project constraints. Should the balance be altered?

II. INSTITUTIONAL DEVELOPMENT, TRAINING AND EXTENSION

A. Institutional Development

With regard to the project's role in strengthening host-country's aquacultural research and development systems, cite changes over the past five years and since the life of the project regarding:

1. The project's integration into national agricultural research systems through teaching courses, offering workshops, creating water quality laboratories. Does the CRSP have a strong presence at each site, or is the CRSP's identity folded into larger national programs?
2. Other institutional development activities in which the project is engaged.

B. Training and Extension

1. Discuss specific training and/or extension activities in which the project is involved. This may include training of host-country researchers, educators, extension agents, and farmers as well as personnel from NGOs/PVOs, Peace Corps and other organizations/institutions which may be providing aquaculture development assistance.
2. Evaluate the balance between research and training and/or extension at each site or for each project

C. Collaboration and Cooperation

Discuss the level of collaboration and cooperation between:

1. U.S. and host-country investigators. Evaluate the process for planning research, preparing budgets, and making decisions on training and publications.
2. U.S.-based Principal Investigators/Contracting Institutions and U.S. field personnel. Examine project travel agendas to evaluate whether the proposed travel is adequate to "backstop" or implement international research.
3. U.S. and host-country participants and USAID Mission staff. Describe the interaction, interest, and involvement of USAID Mission and Embassy staff.
4. U.S. and host-country Principle Investigators and Research Associates and the Program Management Office, the Board of Directors, and the Technical Committee.
5. CRSP researchers from different disciplines. Is there evidence of strong interdisciplinary research at each project site?
6. Other PD/A CRSP Projects/Sites and Other Linkages (e.g., with international research centers, NGOs, other donor projects). Discuss those not included in item I.A.4 and I.B.4 above.

D. Evidence of Institutionalization

1. Benefits to the U.S. institutions. Note faculty recognition for international activities, integration of domestic and international research programs, internal project management and institutional management support, and student/professor interactions.
2. Benefits to the host-country institutions.

III. FUNDING AND FISCAL MANAGEMENT

1. Identify problems regarding funding, budgeting, release of funds, procurement, and other fiscal matters in the U.S. and host-country. Make suggestions for resolving these problems.
2. Evaluate the adequacy of current management, policies, and procedures. Discuss follow-up on use of funds and equipment.
3. Review U.S. (U.S. university and USAID) and host-country contributions to the budget (annual, for the 5-year period, or for the life of a particular project). Note whether the host-country and U.S. university contributions were in-kind or cash. Include other funding over and above that provided by USAID and participating U.S. and host-country institutions with comments as to the uses and impact of such additional

funding. Include buy-ins by USAID missions and/or direct grants/contracts from USAID missions.

4. With regard to buy-ins, evaluate the buy-in process and how buy-in activity may be enhanced at each site.
5. Compare project financial inputs, current project activity, and project accomplishments. Does the funding level seem adequate for the activity?

IV. DATABASE MANAGEMENT

Assess the status of the CRSP database with regard to completeness, accessibility and ease of use. Make recommendations, if applicable, for improvement.

V. CRSP PROGRAM PLANS AND PROSPECTS

1. Comment on the appropriateness of CRSP research and technologies for end users. Should the project/program focus less on small farms and more on mid-size or larger farms? How can the program more effectively integrate social sciences and gender perspectives? What approaches should be used to encourage the application of results?

2. Assess the overall program balance between research and outreach. To what degree should the CRSP focus on extending information?

3. Comment on the overall mix between U.S. and international activities. Are U.S. and international objectives and activities complementary?

4. Evaluate whether the current work plans and project proposals adequately address program objectives. Is each project site continuing to contribute to the "global experiment? Is the global focus of the CRSP maintained in the overall structure and emphasis of the current projects? Should certain projects be phased out? Should the focus, or unifying concept, of the CRSP be revised or is the current global plan adequate for guiding the CRSP into the future?
   Note: Although the original "global experiment" ended in 1987, with the completion of the first three experimental cycles, the concept of conducting research with a global focus has remained intact with the inclusion of specific experiments at each site that follow a common protocol.

VI. PROJECT/ACTIVITY RATING

For each project, summarize findings and recommendations into a succinct synopsis encompassing the project's strengths and weaknesses. Recommendations should clearly and concisely specify who (Technical Committee, Management Entity, Board of Directors, Principle Investigators, Field Staff, USAID) would be responsible for implementing the recommendation.

A simple rating or ranking system may be used, as deemed appropriate (e.g., highly satisfactory, satisfactory, unsatisfactory) to evaluate all on-going research projects and activities in the program as well as the overall program:

Rwanda/AU	DAST/UCD
Rwanda/OSU	DAST/OSU
Rwanda/UAPB	Special Studies:
Thailand/UM	Soils/OSU
Thailand/MSU	WID/OSU
Thailand/UH	Fiscal and Administrative Management
Philippines/UH	Database Management/OSU
Honduras/AU	Overall Program

Note: Effective January 17, 1991, all evaluations of Research and Development Bureau projects must include the following cross-cutting themes which can be incorporated into the text of an evaluation scope of work or added as an attached to the scope of work. Most of these have been incorporated into the above scope of work. However, to ensure that these themes are considered, a copy is attached. Please note that the name of the Bureau changed after the effective date of this requirement. As a result S&T appears throughout the attachment.

Attachment

S&T Cross-Cutting Evaluation Themes

1. Cost-sharing. S&T projects are rarely financed by S&T alone. We frequently depend on the financial and substantive participation of other parts of AID through buy-ins (which are the subject of topic 2). S&T also usually assumes participation of other non-A.I.D. organizations, which we call cost-sharing. In the context of evaluation, we need to examine this "non-A.I.D." participation. Cost-sharing is an important factor which contributes to project success. We should logically encourage cost-sharing as a means of mobilizing resources for our project objectives.

-- Is cost-sharing considered a part of the original project design? If not, should it have been?

-- Do project implementation instruments reflect requirements for cost-sharing? Did cost-sharing from the contractor, grantee or project participants have an effect, positive or negative, on the project?

-- Have outside parties provided resources for the project? Can we assess the efficacy and impact of this contribution if any?

2. Buy-ins. For many S&T projects, a substantial amount of a project's financing comes through buy-ins. We can conservatively estimate that the total buy-in contribution to S&T projects is in excess of $300 million. The use of this mechanism to support a major part of S&T efforts is becoming institutionalized and consequently essential to our oversight and accountability function.

-- Is there a buy-in component under the project? If yes, is that buy-in component described in project design? Is there a process for tracking activities financed through the buy-ins? Are there mechanisms in place to measure the substantive effects of buy-ins?

-- Have the buy-ins made a positive contribution to the project? Have the buy-ins complemented the S&T-funded portion of the project and enhanced the overall effect of the project?

-- Has the project changed its focus as a result of the buy-ins? Have project objectives changed to incorporate the buy-ins? Is achievement of the project's original objectives dependent or independent of the buy-ins? In what way?

-- What are the attributes of buy-in experiences which have worked well, e.g., attributes of success? Similarly, what has not worked well?

3. Sustainability. Institutionalization of S&T-supported interventions is critical to longer-term sustainability.

-- How is sustainability addressed by our project? Is sustainability addressed directly in project design? Is capacity building a part of the project? Is there verifiable progress on institutionalization from project efforts to date?

-- Does the project take into account the financial and institutional requirements to continue operation of the project activities after A.I.D. funding is terminated?

-- Can we assess the extent to which the project target audience is motivated to ensure long term sustainability?

4. Women in Development. Gender considerations are implicit in most A.I.D. projects. Agency policy is to emphasize and support the active participation and substantive contributions of women in the development process. As a result, project designs have been considerably improved in respect to language application and use. However, this has created a need for oversight of gender-related effects and issues.

-- Were gender issues discussed in the PP?

-- Were gender issues taken into account during project implementation?

-- Can project impact be disaggregated by gender? Do project data reflect gender considerations?

5. Peer Review. All projects having a cumulative cost over $100,000 for research must have a peer review plan as part of the PP. For projects having a research component costing less than $100,000 the Office Director may determine if peer review is needed.

-- If research is a major part of the project, does it have a peer review plan?

-- What is the extent of peer review under the project as implemented to date? Are peer review mechanisms documented? Has practice followed the agreed approach? Have peer review mechanisms met, in substance, the Bureau and Agency objective set forth in the guidance?

6. Information Collection and Dissemination. Dissemination of findings should be an important part of S&T projects. Project components addressing information collection and dissemination are often critical to project success.

-- Are the collection and dissemination of information identifiable components of the project? Were these components planned in the PP?

-- Does the project support a reference library or "data base"? What are the project's mechanisms for dissemination? Are project data being disseminated?

-- Has the project had an ascertained effect attributed to dissemination?

U.S. AGENCY FOR
INTERNATIONAL
DEVELOPMENT

January 3, 1994

Hillary Egna, Director
Pond Dynamics/Aquaculture CRSP
Office of International Research and Development
Snell Hall 400
Cregon State University
Corvallis, OR 97331-1641

Subject: Acceptance of the Report of the External Evaluation Panel Review

Dear Ms Egna,

As you know, the Scope of Work (SOW) for the recently completed External Evaluation Panel (EEP) review of the Pond Dynamics/Aquaculture CRSP was very comprehensive. During the course of the review and during the preparation of their report, the EEP members determined that, for various reasons, they would not be able to address all components of the SOW.

I recently received a copy of the final draft of the EEP's report. Based on my review of the report, I feel that the EEP has provided sufficient information on the majority of the components of the SOW, and that the omissions are relatively minor and do not detract from the value of this report. Therefore, the report fulfills the EEP's responsibilities under the SOW.

Sincerely,

Harry Rea

Harry Rea, Fisheries Advisor
Office of Agriculture
Economic Growth Cluster
Bureau for Global Programs, Field Support and Research