

# TRIENNIAL REVIEW

- *Three Year Summary*
- *External Evaluation*
- *Continuation Proposal*



**Title XII**  
**Collaborative Research Support Program**  
**Pond Dynamics/Aquaculture**

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**TRIENNIAL REVIEW**

**POND DYNAMICS/AQUACULTURE  
COLLABORATIVE RESEARCH SUPPORT PROGRAM**

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The Pond Dynamics/Aquaculture Collaborative Research Support Program is an international community of researchers and institutions dedicated to strengthening health and nutrition in developing countries by improving the efficiency of pond aquaculture systems. The Pond Dynamics/Aquaculture CRSP is supported by a grant from the U.S. Agency for International Development (AID Grant No.: DAN-4023-G-SS-2074-00) and by contributions from the participating institutions.

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## EXECUTIVE SUMMARY

The Pond Dynamics/Aquaculture Collaborative Research Support Program (CRSP) has completed three years of operations. A comprehensive program review was conducted in the third year. This report summarizes the findings of this review in three parts:

- Part A: Triennial Summary of CRSP Activities
- Part B: External Evaluation
- Part C: Continuation Proposal

### A. Triennial Summary

1. The AID designated participants in the CRSP are Auburn University; the University of California, Davis; and the Consortium for International Fisheries and Aquaculture Development (CIFAD). CIFAD is composed of the University of Arkansas, Pine Bluff; the University of Hawaii; the University of Michigan; Michigan State University; and Oregon State University which serves as lead institution.
2. Oregon State University serves as Management Entity of the CRSP.
3. The CRSP participants collaborate with agencies or institutions in six developing countries: Honduras, Indonesia, Panama, Philippines, Rwanda, and Thailand.
4. The CRSP Research Program is composed of three elements: a global experiment in pond dynamics; host country special topics research projects; and research projects at U.S. institutions.
5. The global experiment is the major CRSP research activity. It was designed to remove a major constraint to expanding pond aquaculture worldwide in pursuit of the CRSP goal of increasing the availability of animal protein in less developed countries through pond aquaculture.
6. The strategy is to improve the efficiency of pond culture systems by improving production technologies and developing quantitative production functions to facilitate rigorous economic analyses of aquaculture systems.
  - a. Pond aquaculture is presently a highly developed art form. Although high yields may be obtained under favorable circumstances, the overall performance of pond aquaculture systems is highly variable. In order to improve the reliability of these systems, it will be necessary to better understand the dynamic, physical, chemical and biological processes regulating their productivity.
  - b. It is not presently possible to develop quantitative production functions for economic analysis of pond aquaculture without making numerous and often tenuous assumptions

because the dynamic mechanisms regulating the productivity of the ponds are poorly understood and the existing data base is inadequate.

7. The experimental design for the global experiment involves monitoring specified environmental and fish production variables in accordance with standardized work plans in 12 or more ponds at each of seven geographical locations. The variables observed, frequency of observation, and materials and methods is uniform for all locations. The field data are filed in a centralized data base so that standard statistical methods can be used to evaluate dynamic processes within ponds, between ponds within locations, and between locations.
8. As the CRSP data base becomes more comprehensive with time, it can be used to develop predictive models of the processes occurring in pond culture systems. The models will be used to 1) provide guidance for ongoing and future research, 2) predict the performance of existing and proposed pond systems subject to specific inputs and constraints, and 3) to improve the operation and efficiency of pond culture systems.
9. The CRSP developed work plans for three experimental cycles during the past three years. Each experiment consists of two series of observations; one during the dry season and one during the rainy season.
  - a. The objective of the first experimental cycle is to collect a detailed baseline on all ponds when treated with a standard level of inorganic fertilizer.
  - b. In the second experimental cycle, ponds treated with inorganic fertilizer are compared to ponds receiving organic fertilizer.
  - c. In the third experimental cycle, the responses of ponds to different levels of organic fertilizer addition are compared.
10. Some country projects encountered greater delays than others in initiating the experiments. However, all projects are making good progress. It is anticipated that the projects will be in synchrony by December, 1986.
11. The host country special topics research projects represent a small but important component of the CRSP. The intent is to strengthen linkages with host country institutions and to contribute to building institutional capabilities. Additionally, it is politically expedient to direct some proportion of the CRSP effort to shorter term local problems. Projects completed and in progress are summarized in the text.

12. The CRSP organized a U.S. research component during the third year in response to a directive from AID/S&T. This component was proposed in the original CRSP proposal but deleted from the CRSP grant because of funding constraints. The U.S. research component has been implemented without additional funding.
13. During its first three years, the CRSP management structure included a Program Management Office organized within the Management Entity, a Board of Directors (formerly called the Executive Council), a Technical Advisory Committee, a CRSP Research Team composed of U.S. and host country Principal Investigators, and an External Evaluation Panel. This structure has served CRSP needs for the early years, but revisions are proposed in the continuation plan (see Part C) to strengthen technical guidance in future years.
14. Invoices paid by the date of preparation of this report indicate that the research projects were on the average 94 percent expended with respect to AID funds obligated. The projects are probably 100 percent expended.
15. Expenditures for program management exceeded the budget during the first three years. This is mainly because of unbudgeted expenses incurred during the triennial review.
16. U.S. institutional cost sharing reflects continuing institutional commitments to the CRSP. Similarly, host country contributions are indicative of substantial commitments to participate in the CRSP.

#### B. External Evaluation.

1. Part B includes the report of the CRSP External Evaluation Panel (EEP), the AID Management Review, and CRSP responses to recommendations resulting from the external evaluations.
2. External evaluations were conducted in a positive, constructive manner. The EEP Report and the AID Management Review indicate that the CRSP has made good progress towards achieving its objectives during the first three years. Both reports include constructive recommendations for improving some aspects of CRSP operations.
  - a. The CRSP has responded positively to these recommendations, and nearly all have been adopted.
  - b. Certain recommendations of the EEP are directed towards AID rather than the CRSP; these relate to CRSP funding and Agency policy.

## C. Continuation Proposal

1. This part describes proposed plans for continuation of CRSP research and Program Management activities. Three years of experience in CRSP operations, the External Evaluation, and the recently issued BIFAD Guidelines for CRSPs were used in planning for continuation.
2. The CRSP proposed to continue its global experiment on pond dynamics and its U.S. and host country special topics research projects.
3. The CRSP intends to continue operation of the present field projects through completion of the third experimental cycle. The research locations will be reconsidered annually thereafter. The number and location of field experiments may be revised if necessary to serve research needs or satisfy funding constraints.
4. The development of CRSP work plans will change from an Annual to a Biennial format.
  - a. Planning for the fourth experimental cycle will commence during year four and be completed at the CRSP Annual Meeting in March, 1987. This planning will be based upon analysis and synthesis of the CRSP data base for the previous cycles, and will result in formulating specific statistical hypotheses. The fourth cycle will involve field experiments designed to test these hypotheses.
  - b. Planning for the fifth cycle will begin in year six and be completed at the Annual Meeting in year seven. This work plan will emphasize field calibration and verification of descriptive models.
5. Data analysis and synthesis for field experiments is in progress. It is anticipated that this process will be completed for the first two experimental cycles during years four and five, and for the third cycle early in year six. The actual development of descriptive models will begin during year five.
6. The CRSP will continue to operate under the tripartite agreement between Auburn University, the University of California Davis, and CIFAD.
7. To strengthen CRSP technical guidance, the former Technical Advisory Committee and CRSP Research Team have been replaced by a new body called the CRSP Technical Committee. It is composed of host country and U.S. Principal Investigators and at-large members designated by the Board of Directors. There will be four standing subcommittees of the Technical Committee; Work Plans, Budgets, Materials and Methods, and Technical Progress.

8. The EEP will review CRSP documents, attend the CRSP Annual Meeting, and report its findings to AID, the Management Entity and the CRSP Board of Directors. It will also accomplish a second comprehensive program evaluation in year six as part of AID's second triennial review.
9. The financial plan assumes level funding at \$1.3 million per year for the next five years. Anticipated distribution of AID funds to research and management activities, and estimated non-federal contributions are summarized.



PART A  
TRIENNIAL SUMMARY OF CRSP ACTIVITIES

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## INTRODUCTION

The Pond Dynamics/Aquaculture Collaborative Research Support Program (CRSP) is one of several agricultural CRSPs supported by the U.S. Agency for International Development under the authority of Title XII of the International Development and Food Assistance Act of 1975. The CRSP was initiated on September 1, 1982 following the awarding of Collaborative Research Support Grant DAN-4023-G-SS-2074-00 to Oregon State University as Management Entity for the CRSP. With additional funding contributed by participating institutions in the U.S. and several developing countries, the CRSP represents an international community of researchers and institutions dedicated to strengthening health and nutrition in developing countries by improving the efficiency of pond aquaculture systems. The participating U.S. institutions are: Auburn University; the University of California, Davis; and the Consortium for International Fisheries and Aquaculture Development (CIFAD). The latter is composed of the University of Arkansas, Pine Bluff; the University of Hawaii; the University of Michigan; Michigan State University; and Oregon State University which serves as the lead institution. Participating agencies or institutions in developing countries include: Directorate of Renewable Natural Resources, Honduras; Institut Pertanian Bogor, Indonesia; National Directorate of Aquaculture, Panama; University of the Philippines in the Visayas; National University of Rwanda; and the National Inland Fisheries Institute, Thailand.

The Pond Dynamics/Aquaculture CRSP is unique relative to other agricultural CRSPs in several ways. The most visible difference is that it is funded at a substantially lower level than some CRSPs. A less obvious difference is that whereas other CRSPs are composed of a cluster of related but autonomous projects organized on disciplinary or geographical bases, this CRSP is organized around a single global experiment involving all of the participants. Finally, it is worthy of mention that this is one of the CRSPs that was planned by the participating institutions.

Because the Pond Dynamics/Aquaculture CRSP is a new program and because the major emphasis has been placed upon accomplishing a complex experiment at the field locations in developing areas, the technical output to date has been understandably limited. However, the CRSP has made excellent progress in implementing the several activities, accomplishing the baseline studies and progressing to the more advanced aspects of the technical plan during the first three years. It is also noteworthy that the implementation of CRSP activities has had a positive affect on the development of institutional capabilities in the participating countries.

The purpose of this report is to summarize the evolution and present status of the CRSP research and management activities.

## CRSP RESEARCH PROGRAM

The CRSP Research Program is composed of three components; the global CRSP experiment, special topics research projects in the host countries, and a U.S. research component composed of projects accomplished at the participating U.S. universities. These research activities, their purposes and their present status are described in this section.

### THE GLOBAL CRSP EXPERIMENT

The long-range goal of the CRSP is to increase the availability of animal protein in less developed countries through pond aquaculture. The strategy adopted by the CRSP in pursuit of this goal is to undertake the basic research required to improve the efficiency of pond culture systems. A technical plan consistent with this strategy was developed under a planning study funded by USAID (Specific Support Grant AID/DSAN-G-0264). The approach taken to the development of the CRSP technical plan was to accomplish a review and synthesis of the State-of-the-Art of pond aquaculture and to undertake overseas site visits to determine research needs in less developed countries. The findings from these surveys were then translated into planning guidelines.

In the course of the planning activities it became apparent that there are two important aspects of improving the efficiency of pond culture systems. First, there is a need for technological improvement to improve the reliability of pond production. Second, there is a need for economic optimization consistent with local cultures.

The need for improved production technologies is manifest in the extensive variation observed in performance of pond aquaculture systems. Pond aquaculture has been practiced as a highly developed art form for a very long time and the literature is replete with reports about practices that have produced high yields. However, when the same practices are applied to other ponds the results are not reproducible. It is clear that there are subtle differences regulating the productivity from pond to pond but the nature of this regulation remains obscure.

The need for rigorous economic analyses of pond aquaculture systems is typically encountered in attempting to formulate appropriate fisheries and aquaculture development strategies, both in developing countries and in the U.S., where it would be desirable to determine if contemporary pond management practices are the most efficient approach to fish production. In order to answer this question, it is necessary to develop quantitative production functions to facilitate economic analyses of the various strategies or combinations thereof. It is not presently possible to develop these functions without making numerous and often tenuous assumptions because the dynamic mechanisms regulating the productivity of the ponds are poorly understood and the existing data base is consequently inadequate.

The common denominator in improving production technologies on the one hand and facilitating economic analyses on the other, is clearly related to understanding pond dynamics.

### Experimental Design

During the planning of the CRSP it became apparent that the inadequacy of the existing pond aquaculture data base was a major constraint to improving the efficiency of pond culture systems. There is an abundant technical literature about pond aquaculture that can provide general operating guidelines for the operation of pond culture systems. However, because there is a lack of standardization in experimental design, data collection, and analysis, the various reports can not be statistically compared to one another and consequently are of limited utility in predicting the performance of pond culture systems. The approach taken by the CRSP to develop quantitative expressions that can be used to improve production technology and facilitate economic analyses has been to develop a standardized data base that can be used to quantitatively evaluate pond performance over a broad range of environments.

The statistical design for the experiment involves monitoring several environmental and fish production variables at seven geographical locations. The different locations provide a spectrum of pond environments. Observations specified in annual work plans are made on 12 or more ponds at each location. The pond variables observed, frequency of observation, materials and methods for determination, and standardized reporting units are presented in Tables 1-4.

Observations at each location may be analyzed by the research team involved at that location. Additionally, all data is filed in a centralized CRSP data base. Standard statistical methods can then be used to test statistical hypotheses about correlations between variables and evaluate the sources of variance within ponds, between ponds within locations, and between locations. Because of the relatively large number of locations and ponds at each location, the experimental design has substantial statistical power.

### CRSP Work Plans

The CRSP technical plans are developed by a research team composed of the U.S. and host country Principal Investigators of each country project and the CRSP Technical Advisory Committee. Each workplan represents a detailed experimental protocol for one experimental cycle. A cycle involves two series of observations of four to five months duration. One set of observations is made during the dry season and the other during the wet season.

Three work plans have been developed to date. These work plans follow an orderly progression of investigating pond dynamics. The rationale has been to initially manage all ponds in exactly the same way and establish a detailed baseline of pond variables under this treatment. Then in subsequent experiments the pond environments are manipulated in different ways and the responses observed.

The first work plan was developed at a meeting of CRSP participants in Davis, California on March 2-3, 1983. This plan specified standardized methods for pond preparation and monitoring. All ponds were prepared in

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TABLE 1  
DAILY MEASUREMENTS  
MATERIALS AND METHODS

PARAMETER	PROCEDURE	INSTRUMENTATION	ANALYTICAL METHOD	REPORTING UNIT
Solar Radiation	Install solar monitor and quantum sensor at study site and read at 24 hour intervals.	LI-COR Solar Monitor Model LI-1776 and Quantum Sensor Model LI-190SB (Appendix F)	—	E/m <sup>2</sup> /day
Rainfall	Install three rain gauges at study site; read and empty at 24 hour intervals; report average of 3 readings.	No type specified	--	cm/day
Wind Speed	If instantaneous windspeed and direction meter already in use, read at appropriate intervals to correlate with thermal and oxygen stratification of ponds. With preferred totalizing anemometer, read between 8:00-9:00am and calculate average hourly wind speed.	Instantaneous wind speed and direction meter comparable to Taylor Model 110930 acceptable if already in use. For new purchase, recommend totalizing anemometer comparable to WEATHERtronics Model 2510 (Appendix F). If practicable, the instrument should be located in pond complex near ground level.	--	km/hour

TABLE 1 (Continued)  
 DAILY MEASUREMENTS  
 MATERIALS AND METHODS

Air Temperature	Install 3 maximum-minimum thermometers in the shade near ponds; read at 24 hour intervals and report average maximum and avg. minimum.	Maximum-minimum thermometer comparable to Taylor Model 5460 (Appendix F).	--	Max: °C Min: °C
Pond Depth	Install staff gauge in each pond and read to nearest 0.5 cm at same time each day. (Maintain 0.9 m average depth on daily basis).	No type specified	--	m

8.



TABLE 2  
WEEKLY MEASUREMENTS  
MATERIALS AND METHOD

PARAMETER	PROCEDURE	INSTRUMENTATION	ANALYTICAL METHOD	REPORTING UNIT
Dissolved Oxygen*	Near center of each pond at 25 cm below water surface, midwater and 25 cm above the bottom. Take readings weekly at dawn and as part of even week diurnal study at 4 hour intervals beginning 30 minutes before sunrise until after sunrise.	YSI Model 57 Dissolved Oxygen Meter. Calibrate meter each month using the Winkler Method or HACH Digital Titrator kit/Dissolved Oxygen. (Appendix F).	Winkler or Iodometric Method (American Public Health Association, 1980) (Appendix F).	mg/l
Pond Temperature Extremes	In 3 ponds, place one maximum-minimum thermometer at 25 cm below the water surface and one at 25 cm above the bottom. Take weekly readings.	No type specified.	---	max: C min: C
Pond Temperature*	Near center of each pond, take readings at 25 cm below the water surface and 25 cm above the bottom. Take readings once per week at 2:00 p.m., and as part of even week diurnal study at four hour intervals beginning 30 minutes before sunrise until after sunset. If a probe is used, calibrate using a precision thermometer.	YSI Model 57 Dissolved Oxygen Meter with Temperature Indicator (Appendix F).	---	C

\*Indicates parameters to be measured as part of even week diurnal studies.

TABLE 2 (Continued)  
WEEKLY MEASUREMENTS  
MATERIALS AND METHODS

PARAMETER	PROCEDURE	INSTRUMENTATION	ANALYTICAL METHOD	REPORTING UNIT
pH*	Measurements taken from three pooled 90 cm column samples per pond. Once per week at 2:00 p.m., and as part of diurnal study at 4 hour intervals. Pooled samples can be taken to the laboratory and measured within one hour. Meter should be calibrated with standard buffers at pH 7 and pH 4.	pH Meter with Combination Electrode comparable to Orion 2000 Series with Ross Model 81-55 Electrode (Appendix F).	---	pH Units
Total Kjeldahl Nitrogen	Weekly, at 2:00 p.m. For each pond, pool three 90 cm column samples. Composite samples should be refrigerated and analyzed within 24 hours.	Kontes or comparable Kjeldahl Nitrogen apparatus (Appendix F).	Semi-Micro-Kjeldahl Method (Michigan State University Limnological Research Laboratory, 1984) (Appendix F); or in-country analysis by qualified laboratory.	mg/l
Secchi Disk Visibility*	Weekly, early morning (same days as chlorophyll analyses with one sampling period coinciding with even week diurnal study), at 2 locations in each pond, calculate Secchi Disk Visibility using procedure described by Lind (1974). (Appendix F).		---	cm

\*Indicates parameters to be measured as part of even week diurnal studies.

TABLE 2 (Continued)  
WEEKLY MEASUREMENTS  
MATERIALS AND METHODS

PARAMETER	PROCEDURE	INSTRUMENTATION	ANALYTICAL METHOD	REPORTING UNIT
Chloro- phyll a	Collect one sample per pond by pooling three 90 cm column samples. Take samples weekly with one sampling period coinciding with even week diurnal study.		Spectrophotometric Determination (American Public Health Association, 1980) (Appendix F).	mg/m <sup>3</sup>
Alkalinity*	Weekly at 2:00 p.m. as part of even week diurnal study, collect one sample (by pooling three 90 cm column samples) from each pond. Keep samples cool in refrigeration unit or ice chest, and analyze within 24 hours. (The special water chemistry analyses carried out at the beginning and end of experiments can be used to determine CA <sup>++</sup> contribution to total hardness, see Table 4).	Hach Digital Titrator Test Kit/Alkalinity (optional) (Appendix F).	Low or High Standard Alkalinity Method (as appropriate) (American Public Health Association, 1980), or Hach Test Kit (Appendix F).	mg CaCO <sub>3</sub> /l
Total Hardness	Weekly at 2:00 p.m. collect one sample (by pooling three 90 cm column samples) from each pond. Samples should be refrigerated and analyzed within 7 days.	Hach Digital Titrator Test Kit/Total Hardness (optional) (Appendix F).	EDTA Titrimetric Method (American Public Health Association, 1980); or using Hach Test Kit (Appendix F).	mg CaCO <sub>3</sub> /l

\*Indicates parameters to be measured as part of even week diurnal studies.

TABLE 2 (Continued)  
WEEKLY MEASUREMENTS  
MATERIALS AND METHODS

PARAMETER	PROCEDURE	INSTRUMENTATION	ANALYTICAL METHOD	REPORTING UNIT
Ammonia	Weekly at 2:00 p.m. collect one sample (by pooling three 90 cm column samples) from each pond. Samples should be refrigerated and analyzed within 24 hours.	Kontes or comparable Kjeldahl Nitrogen apparatus.	Nesslerization Method (Michigan State University Limnological Research Laboratory, 1984). (Appendix F).	mg/l
Nitrate	Weekly at 2:00 p.m. collect one sample (by pooling three 90 cm column samples) from each pond. Samples should be refrigerated and analyzed within 24 hours.	---	Cadmium Reduction Method (Michigan State University Limnological Research Laboratory, 1984) (Appendix F).	mg/l
Total Phosphorus	Weekly at 2:00 p.m. collect one sample (by pooling three 90 cm column samples) from each pond. Samples should be refrigerated and analyzed within 24 hours.	---	Persulfate digestion and Ascorbic Acid/Colorimetric Method (American Public Health Association, 1980) (Appendix F).	mg/l
Dissolved Orthophosphate (Filterable Reactive Phosphorus)	Weekly at early morning, same as for total phosphorus (shown above).	---	Preliminary filtration and Ascorbic Acid/Colorimetric Method (American Public Health Association, 1980) (Appendix F).	mg/l

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TABLE 3  
MONTHLY MEASUREMENTS  
MATERIALS AND METHODS

PARAMETER	PROCEDURE	INSTRUMENTATION	ANALYTICAL METHOD	REPORTING UNIT
Fish/ Shrimp Group Weight	At 30 day intervals throughout each experimental cycle, collect grab sample equivalent to 10% of initial stock from each pond and weigh as a group. Indicate number of individuals in grab sample.*	---	---	kg/# individuals
Fish/ Shrimp Mean Weight per Individual	For a representative 10% subsample of the grab sample referenced above, weigh and count individuals. Express as mean weight per individual.	---	---	g
Fish/ Shrimp Mean Length per Individual	For the representative 10% subsample referenced above, determine "total length" of each individual and express as mean length per individual.	---	---	cm
Tilapia Reproduction	Concurrent with measurement of fish growth, note the number and collective weight of any fry collected during monthly sampling.	---	---	g/# individual

\*Note: If substantial variation is observed or if reproduction is suspected, divide sample into centimeter groups; count and weigh each group. Any female tilapia observed should be removed and replaced with a male of similar weight. Any animals collected other than those stocked should be counted, weighed, measured and discarded. Record observations on reproduction of fish health.

TABLE 3 (Continued)  
MONTHLY MEASUREMENTS  
MATERIALS AND METHODS

PARAMETER	PROCEDURE	INSTRUMENTATION	ANALYTICAL METHOD	REPORTING UNIT
Fish/ Shrimp Health	During monthly sampling, record observations regarding fish/shrimp health. If disease/disorder is noted, estimate incidence.	---	---	text
Primary Produc- tivity**	Monthly, take water samples and incubate for four hours in paired light-dark bottles suspended at mid-depth in ponds. Use solar monitor data to extrapolate results to entire photoperiod.	LI-COR Solar Monitor Model LI-1776 and Quantum Sensor Model LI-190SB (Appendix F).	Oxygen method, adapted from the American Public Health Association (1980) (Appendix F).	mg carbon fixed/m <sup>3</sup> /day
Phyto- plankton Composi- tion***	Monthly and when changes in the community are observed, collect samples using a plankton net with an attached collection bottle. Use a compound microscope and appropriate references to identify major groups (green, blue-green, or diatom) and relative abundance of each group (abundant, common, rare).	---	---	group/ relative abundance

\*\* Optional modified diurnal curve method used in shallow Phillipine shrimp ponds, see Appendix F.

\*\*\*Indicates analyses that are recommended, but not required.

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TABLE 3 (Continued)  
MONTHLY MEASUREMENTS  
MATERIALS AND METHODS

PARAMETER	PROCEDURE	INSTRUMENTATION	ANALYTICAL METHOD	REPORTING UNIT
Zooplankton Composition***	Monthly and when changes in the community are observed, collect at least three 90 cm column samples per pond or use trap or zooplankton net, as appropriate. Use a microscope to identify at the order level and note relative abundance (abundant, common, rare).	---	---	order/ relative abundance
Benthos Composition***	Monthly and when changes in the community are observed, collect at least three cores of mud per pond. Process samples through a No. 30 sieve, sort organisms and fix in 10% formalin or a 70% ethanol solution. Identify at the order level and note relative abundance (abundant, common, rare).	---	---	order/ relative abundance

\*\*\*Indicates analyses that are recommended, but not required.

TABLE 4  
OCCASIONAL MEASUREMENTS  
MATERIALS AND METHODS

PARAMETER	PROCEDURE	REPORTING UNIT
<u>Pond Soil Characteristics:</u> pH, Phosphorus, Extractable Bases (Ca, Mg, K, Na), Organic Matter, Total Nitrogen, Nitrate Nitrogen, Ammonium Nitrogen, Cation Exchange Capacity, Soluble Salts, Metals (Al, Fe, Zn, Mn, Cu), Sulfate Sulfur, Lime Requirement, Free $\text{CaCO}_3$ or $\text{CaCO}_3$ Equivalent, Exchangeable H, Exchangeable Na.	At the end of an experiment and before beginning another, collect twelve 15 cm core samples from each pond, combine and dry as described in Appendix D. Take an appropriate subsample for each pond and analyze using either a qualified local laboratory or U.S. Laboratory.	As appropriate
<u>Morphometric Characteristics:</u> Maximum Length, Maximum Width, Area, Depth, Volume	At project initiation and subsequently whenever pond facilities are altered, map ponds as described in Appendix F. Note inflow out outflow locations, pertinent surrounding elevations and buildings and structures on the site. Measure or calculate the listed morphometric parameters.	m, $\text{m}^2$ , $\text{m}^3$ (as appropriate)
<u>Hydrologic Characteristics:</u> Surface Inflow Precipitation Outflow Evaporation Seepage (calculated)	In the course of each pond experiment, a water budget will be determined for each pond. Surface Inflow/Outflow and Evaporation should be determined using procedures described in Appendix F or comparable approaches. The contribution of precipitation should be calculated using rainfall data, while seepage must be estimated based on measurement of the other parameters.	$\text{m}^3/\text{day}$

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TABLE 4 (Continued)  
OCCASIONAL MEASUREMENTS  
MATERIALS AND METHODS

PARAMETER	PROCEDURE	REPORTING UNITS
<u>Water Quality Characteristics:</u> Alkalinity, Total Hardness, pH, Ammonia, Nitrates, Orthophosphate, Total Phosphorus,, Chlorides,* Sulfates,* Boron, Calcium,* Copper, Iron, Magnesium,* Potassium,* Sodium* and Zinc.	At the end of an experiment and before starting another, collect a pooled sample of three 90 cm columns of water from each pond and water supply source. Samples should be analyzed on-site, by local laboratories or by the Michigan State University Limnological Laboratory (Appendix E).	As appropriate
<u>Fish/Shrimp Production:</u>  Initial Stocking		
- group weight - mean weight per individual - mean length per individual	Initial stock will be weighed as a group and counted. Tilapia will be sexed individually (Appendix F). A 10% sample will be weighed and measured (use total length for tilapia measurements). Refer to sections on stocking in Chapter 2.	kg/# individual g cm
<u>Termination of Experiments</u> - mean weight per individual - total number harvested - group weight (calculated) - survival (% of initial number stocked)	All fish/shrimp will be removed from each pond 150 days (90-120 days for shrimp) after stocking. A random sample equivalent to 10% of the initial stocking will be weighed and measured. The total number of fish/shrimp from each pond will be determined and the total biomass per pond will be calculated. Any fish other than tilapia will be counted by species, weighed and measured.	g # individuals kg %

\*Listed by the Technical Advisory Committee as being of greatest importance.

the same way, fish were stocked at the same levels and specified variables observed during both the wet and dry seasons.

The plan for the second experimental cycle was developed at a meeting of CRSP participants in Atlanta, Georgia on April 10-12, 1984. At this meeting, participants reviewed accomplishments and discussed problems encountered during the first cycle of experiments. They then developed a detailed plan for the second experimental cycle. In this experiment the responses of ponds receiving organic fertilizers were compared to ponds receiving inorganic fertilizers.

The third cycle of pond dynamics experiments was developed by the CRSP participants at their meeting in Honolulu, Hawaii on March 18-20, 1985. Based upon their experiences to date, they developed an experimental plan to compare the responses of ponds to varying levels of organic fertilizer addition.

### Data Management

Consistent with its long term goal, the CRSP proposes to develop practical pond management models to improve the efficiency of pond culture systems. The development of quantitative models will be dependent upon efficient management of standardized data resulting from the several projects.

Standardized data are tabulated at each research location for each experimental cycle in accordance with CRSP work plans. Each project team may accomplish independent analyses of their data and publish results if they so desire. However, in all cases, the data tabulations are filed in a centralized CRSP Data Base maintained by the Management Entity. In this way, the entire data set is available to all CRSP participants, but especially to the CRSP Data Synthesis Team. The latter body is appointed by the CRSP Board of Directors to accomplish data analysis, synthesis, and model development. The various activities of Team members are supported as part of the U.S. Research Component described below.

## HOST COUNTRY SPECIAL TOPICS

This component of the CRSP research program was developed to provide opportunities for host country and U.S. researchers to collaborate on original research directed towards the needs and priorities of the host country. The intent was to strengthen linkages within the host country institution and to contribute to the development of research capabilities within the institution by providing opportunities for scholarly involvement of faculty and advanced students. Additionally, this component provides the host country agencies and institutions with access to the personnel resources of the CRSP in seeking solutions to shorter term local problems.

Proposals for these special topics research projects are developed collaboratively by the host country and U.S. participants. The proposals are reviewed by the CRSP Board of Directors but are not subject to outside peer review. The intent is to preserve the autonomy of the investigators. In reviewing the proposals the Board is satisfied with a statement of endorsement by the host country institution. Recently the Board has implemented the additional policy of requiring the investigators to discuss the proposed project with U.S. AID Missions to assure that the projects are consistent with AID and host country development strategies and priorities.

Although the special topics research projects are an important component of the CRSP, they are not a major component in terms of funding support or time expenditures. Twenty to twenty-five percent of research associate time is typically devoted to this activity.

The CRSP places highest priority on the longer term global research outlined above. However, it is noteworthy that it is politically expedient to place some emphasis on shorter term research needs. Host country agencies and institutions and U.S. AID Missions often consider basic research activities to be of low priority. Consequently, administrators sometimes have difficulty justifying participation in the CRSP. The CRSP support for the special topics research activities helps justify this participation. Thus, although the CRSP places highest priority on the longer term research goals, support for this component may be considered a cost of doing business in many countries.

## U.S. RESEARCH COMPONENT

It is implicit throughout Title XII of the International Development and Food Assistance Act of 1975 that activities authorized under this Title should be mutually beneficial to developing countries and the United States. In planning this CRSP there was a consensus among the CRSP participants that improving the efficiency of pond culture systems through collaborative research involving both U.S. and developing country institutions would be highly "mutually beneficial". However, subsequent to awarding the CRSP grant the Agency interpreted "mutually beneficial" to mean that the CRSP should fund research activities both in the U.S. and in developing countries and instructed the CRSP to direct some proportion of its funds to support research activities at the U.S. institutions.

It is noteworthy that the original CRSP proposal included this component under the heading of Supplemental Research Projects. In retrospect the term supplemental was a poor choice as it was interpreted to mean non-essential. AID subsequently deleted these projects from the CRSP grant.

A U.S. research component was organized during the third year of the CRSP and several projects have now been funded. These projects address timely research problems that cannot be addressed in the overseas components and consequently strengthen the CRSP overall, even though it has been necessary to divert funds away from the overseas activities to support them.

In organizing the U.S. research component the CRSP has endeavored to insure that the projects included in this activity are of high technical merit. Formal project proposals are submitted to the CRSP management. The proposals are subjected to critical peer review by outside reviewers not affiliated with institutions participating in the CRSP. The proposals and peer reviews are then submitted to the CRSP Board of Directors for consideration. In approving or rejecting proposals, the Board considers the relevance of the proposed work to CRSP goals as well as the technical merit and quality of the proposed work. The Board has recently approved funding for four activities and rejected three proposals. Two additional proposals are presently in review. The recently implemented projects are:

- Chang, W. (University of Michigan). Data synthesis and modeling
- Fast, A. (University of Hawaii). Water quality management in intensive culture marine shrimp ponds using bivalves and fish.
- Tubb, R., L. Curtis and W. Seim. (Oregon State University). Metabolism and excretion of methyl testosterone in mature and sexually undifferentiated Tilapia nilotica.
- Piedrahita, R. (University of California, Davis). Data synthesis and modeling.

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## STATUS OF CRSP RESEARCH

The CRSP presently supports projects in six countries. The six country projects, the Host Country and U.S. institutions, and the Principal Investigators and on-site Research Associates are listed in Table 5. Note that the Panama project is composed of two subprojects; a brackish water project and a fresh water project.

### Status of the CRSP Global Experiment

The present status of the six country projects is summarized in Table 6. Inspection of Table 6 reveals that each of the projects is progressing towards completion of the existing work plans, and that the several projects are progressing at different rates. This asynchrony results because of delays encountered in implementing the fresh water activity in Panama and the Rwanda and Thailand projects. Under the present CRSP operating plan the projects should be essentially synchronized by the end of calendar year 1986.

The delay in implementing the fresh water project in Panama resulted because it was necessary to move the work from the originally intended Divisa Station to a new facility at Gualaca. This move was necessary because the ponds at the Divisa Station that were intended for CRSP use had to be diverted to fingerling production in order for the National Directorate of Aquaculture to satisfy increasing demands for fingerlings for Panamanian farmers. The Gualaca Station offers a number of advantages to the CRSP and the move is mutually beneficial to the CRSP and the Host Country Agency.

Initiation of the CRSP experiment in Rwanda has been delayed because of delays encountered in completion of the new Fish Culture Station near the UNR Campus in Butare. To bring the project back on schedule, the first and third experimental cycles will be accomplished concurrently and the second cycle will be postponed indefinitely.

The CRSP experiment in Thailand was initiated at the Nong Sua Fish Hatchery on schedule. However, this hatchery experienced a serious flood shortly after initiation of the work. The project was immediately moved to the Ayutthaya Fresh Water Fisheries Center in July 1984 and the first experimental cycle repeated. The project is now nearly back on schedule. Although unfortunate, the flooding at Nong Sua may have been fortuitous because the Ayutthaya site is proving to be an excellent research location.

### Status of Host Country Special Topics Research Projects

The following projects are presently in progress:

Honduras - Improvement of Fingerling Production Techniques. Increasing interest in aquaculture in Honduras has resulted in an increased demand for fingerlings from government stations. This project is investigating improved methods for the production of hybrid Tilapia fingerlings. Improved production of all male monosex cultures of Tilapia fingerlings using steroids for sex reversal is also being investigated. Finally, methods for inducing spawning in Chinese carps are being investigated to

TABLE 5  
 STAFF SUMMARY: COLLABORATIVE RESEARCH PROJECTS  
 1982-1985

PROJECT/INSTITUTIONS	PRINCIPAL INVESTIGATORS	RESEARCH ASSOCIATES
<b><u>HONDURAS</u></b>		
RENARE	Ing. Mario Berrios (1982-1983) Lic. Jonathan Espinoza O. (1983-present)	Ing. Pes. Hermes Alvarenga
AUBURN UNIVERSITY	Dr. Ron Phelps	Mr. Bart Green
<b><u>INDONESIA</u></b>		
Institute Pertanian Bogor	Dr. Muhammed Eidman	Mr. Komar Sumantadinata
Michigan State University	Dr. Cal McNabb Dr. Ted Batterson	Dr. Bette Premo (1982-84) Dr. Charles Annette (Acting, 1985)
<b><u>PANAMA</u></b>		
National Directorate of Aquaculture	Dr. Richard Pretto M.	Mr. Orlando Garcia Lic. Nely Serrano Mr. Angel Torres
Auburn University	Dr. Ron Phelps	Mr. David Hughes Mr. David Teichert- Coddington

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TABLE 5 (Continued)  
 STAFF SUMMARY: COLLABORATIVE RESEARCH PROJECTS  
 1982-1985

PROJECT/INSTITUTIONS	PRINCIPAL INVESTIGATORS	RESEARCH ASSOCIATES
<b><u>PHILIPPINES</u></b>		
University of the Philippines in the Visayas	Dr. Jose A. Carreon	Dr. Romeo D. Fortes
University of Hawaii	Dr. Philip Helfrich Dr. Arlo Fast	Dr. James Woessner (1982-1985) Dr. Kent Carpenter (1985-present)
<b><u>RWANDA</u></b>		
National University of Rwanda	Dr. Valens Ndozeyaho	Mr. Felicien Rwangano
Oregon State University	Dr. Richard Tubb Mr. Wayne Seim (1985)	Dr. Boyd Hanson
<b><u>THAILAND</u></b>		
National Inland Fisheries Institute	Dr. Thiraphan Bhukaswan	Mr. Vijai Srisuwantach (1982-1984) Mr. Sompong Hiranqawat (1985) Mr. Somport Inkatawewat (1985)
University of Michigan	Dr. Karl Lagler (1982-1983) Dr. James Diana (1983-Present)	Dr. C. Kwei Lin

TABLE 6  
STATUS OF THE GLOBAL EXPERIMENT

PROJECT	<u>FIRST EXPERIMENTAL CYCLE</u>		<u>SECOND EXPERIMENTAL CYCLE</u>		<u>THIRD EXPERIMENTAL CYCLE</u>	
	dry season	wet season	dry season	wet season	dry season	wet season
<b>Honduras</b>	completed	completed	completed	in progress		
<b>Indonesia</b>	completed	completed	completed	in progress		
<b>Panama:</b>						
Brackish water	completed	completed	completed	completed	in progress	
Fresh water	completed	in progress				
<b>Phillipines</b>	completed	completed	completed	completed	in progress	
<b>Rwanda</b>	(To begin November 1985)					
<b>Thailand</b>	completed	completed	completed	in progress		

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improve the availability of fingerlings of these species for stocking in Honduras.

Indonesia - Improved Hatchery Management Techniques for *Clarias batrachus*. West Java has experienced a dramatic decline in the wild stocks of this species resulting in limited supply and escalating market prices. This project intends to develop improved hatchery technology to increase the availability of fingerlings of this species. Initially the project will emphasize improved broodstock management and increased hatchery survival through the fry-fingerling stages. In later stages the MSU/IPB team intends to investigate improved grow-out methods and genetic improvement through selective breeding.

Panama - Brackish Water Experiments. Frequent exchange of pond water to maintain water quality is a common practice in brackish water aquaculture. The daily cost of water exchange may be 20% or more of the total production cost in shrimp aquaculture. How water exchange influence the dynamic processes that regulate the productivity of brackish water ponds is poorly understood. This project is investigating how various rates of water exchange influences the dynamics of ponds relative to control ponds in which water is not exchanged.

Panama - Fresh Water Experiments. The soils of many tropical regions are highly acidic. The soils at the Gualaca Station are typical of highly acidic tropical soils. These acidic soils influence the chemical dynamics of the pond water. Acidic pond soils frequently result in phosphorous and carbon limitations in the pond water. Although the theoretical dynamics are understood, the translation of theory into practice has proven difficult because of the complexity of soil water interactions. This study is investigating the influence of limestone addition on soil and water pH and the chemistry of phosphorous and iron in the soil and water.

Philippines - The Relationship of Pond Depth to Water Quality. In the first cycle of CRSP experiments in the Philippines it was observed that average pond depth affected numerous variables of the pond environments including heat budget, chemical stratification and minimum oxygen concentration. In this investigation the effect of pond depth on water quality in replicated shrimp ponds with depths of less than one half meter, one meter and two meters is being compared.

Rwanda. This project has not initiated special topics research projects up to the present time. Because of the delays encountered in implementing the CRSP experiment, maximum effort is being devoted to getting this experiment on schedule. It is anticipated that the OSU/UNR team will initiate special research topics during the forthcoming year.

Thailand - Tilapia Reproduction. In recent years there has been increasing interest in the use of monosex cultures of Tilapia species as a means of controlling Tilapia reproduction, and consequently, produce fish of larger size. This project is investigating two aspects of monosex culture. Practical methods for producing all male Tilapia fingerlings through sex reversal using Testosterone is being investigated. Additionally, the performance of all female cultures of Tilapia nilotica are being compared to the all-male cultures used in the CRSP experiment.

In a second study the seasonal variation in spawning activity of Tilapia nilotica is being investigated. If seasonal variation in spawning performance can be correlated with water quality parameters that also vary seasonally, then manipulation of the spawning environment to extend the spawning season and thus increase fingerling production may be possible.

#### Special Topics Research Projects Completed

**Honduras** - Results from the first experimental cycle of the CRSP experiment indicated that clay turbidity limited fish production in the experimental ponds in Honduras. In this experiment the effects of organic fertilizer addition on levels of total suspended solids, total volatile solids and fish production were observed. It was found that the addition of cow manure resulted in greater secchi disc visibilities and amounts of volatile solids than other pond treatments. Total hardness and alkalinities were greater in the organic manure treatments while mean early morning dissolved oxygen levels and ammonia levels were higher in the other treatments. The results indicate that the application of organic manures is effective in reducing clay turbidity and that further research investigating the mechanisms is warranted.

**Indonesia** - Based upon results of the first cycle of CRSP experiments in Indonesia, it was hypothesized that the quality of the source water limited fish production in the experimental ponds. Thus a Special Topics Research Project was initiated that focused upon improving water quality through the use of a water conditioning system (WCS). The WCS consists of a series of three contiguous concrete lined cells. The first cell is filled with crushed limestone, the second cell with crushed limestone overlain with sand, and the third cell with charcoal. The source water for the WCS was drawn from the same irrigation canal that provides water for the CRSP ponds. It is diverted from the canal and passes serially through the three cells and may then be directed to the experimental ponds.

In this experiment four CRSP ponds were filled and maintained with water from the WCS and fertilized with locally available chicken manure as an organic nutrient source. Another set of four ponds was filled with unconditioned water and fertilized in the same way. A third set of four ponds received untreated source water and was fertilized with triple super phosphate and urea at levels that gave the same total nitrogen and total phosphorous loading as the ponds receiving organic fertilizer.

Results of this 150 day grow-out study showed that the ponds receiving conditioned water supported increased growth of adult fish and growth of fry. These ponds averaged 14% greater growth in adults and 135% increased fry production over the other treatments. Overall there was a 46% increase in fish harvest in the ponds receiving conditioned water. This treatment was effective in increasing alkalinity by 113%. The increased alkalinity was shown to stimulate primary production which in turn resulted in increased fish production.

**Panama** - The need to determine the most appropriate species or combination of species is an important aspect of shrimp culture in Panama. Penaeus vannamei and P. stylirostris are the species commonly cultured.

The advantages or disadvantages of each compared to a polyculture of both have not been established. In this experiment ponds stocked with varying proportions of the two species were compared to ponds stocked with 100% P. stylirostris or 100% P. vannamei.

The greatest production was obtained in the 100% P. vannamei treatment. The lowest yield was in the 25% P. vannamei, 75% P. stylirostris treatment. Survival was very low for P. stylirostris in all treatments, ranging from 15.6 to 29.7%. The survival of P. vannamei on the other hand was without exception greater, ranging from 66.7 to 88.0%.

**Thailand** - The sand goby Oxyeleotris marmoratus has been domesticated and cultured in Thailand and elsewhere in Southeast Asia. The high demand and limited supply has resulted in a high market value in recent years and in increasing interest in the culture of this species. Because the supply of fingerlings has traditionally come from natural reproduction, the limited availability of fingerlings imposes a severe bottleneck to goby production. To meet the demand for fingerlings, the Royal Thai Department of Fisheries initiated a seed propagation program at national fish hatcheries.

The objective of this study was to establish hatchery procedures for spawning, hatching and rearing sand goby fry and to produce microscopic and macroscopic live food organisms for use in hatchery production. Successful spawning was achieved and fertilized eggs were successfully hatched. Survival rates during the first 30 days of rearing were variable, ranging from 5 to 50%, but increased to over 80% in the interval from 30 to 60 days of rearing. In spite of the variable survival a large number of fingerlings resulted from this study because of the very high fecundity of sand gobys (ranging from 2,000 to 30,000 eggs per spawn). The production of approximately 100,000 fry represents the largest mass production ever of sand goby fry under hatchery conditions in Thailand.

Concurrent with the rearing trial, reliable methods for the production of rotifers and chironomid larvae were developed. These continuous mass culture methods provide a reliable source of food organisms not only for sand gobys but for other commercially important fishes of Thailand.

#### Other Activities

In addition to the research activities described above, the CRSP participants have made significant contributions in the areas of training, extension and institution building in all of the participating countries. In the interest of brevity these important contributions are not listed here. They have been described in some detail in the CRSP Annual Administrative Reports. Although the benefits are largely intangible, it is important to recognize these contributions because, consistent with the intent of Title XII, research capabilities have been substantially strengthened in every developing country in which the CRSP is active.

#### Data Management

A plan for CRSP data reporting was implemented in 1983. The plan was based upon a data base system in use at Auburn University. This system

employed a commercially available data base management program called "The General Manager" and APPLE IIe personal computers.

An explosion of personal computer technology has taken place since implementation of the CRSP, and more powerful and versatile software and hardware is now available. It became apparent by 1985 that continued use of "The General Manager" would limit opportunities to use these new tools for CRSP data analysis. Consequently, the decision was made to discontinue use of "The General Manager" before the CRSP Data Base became too large to change, and to shift to a more versatile and powerful system. The CRSP has now implemented a new data management system.

The new system provides for simplified data entry in the field using any one of three commercially available software packages. It provides numerous hardware options; the CRSP researchers are no longer limited to Apple computers. Field data files are forwarded on diskettes to the Program Management Office, where they are transmitted electronically into the centralized data base maintained on a mainframe computer at Oregon State University. Specific data sets may be retrieved from the mainframe files in virtually any format. Thus data analyses can be accomplished with nearly any existing or future hardware or software.

The present status of the system is:

- Development and testing of data entry procedures is completed. Data reporting instructions and templates are being prepared for distribution to the projects.
- The Program Management Office is in the process of entering all field data reported to date into the central data base. It is anticipated that data entry will be completed by January, 1986.
- The CRSP Data Synthesis Team is preparing to start statistical analyses of the CRSP data. A synthesis of these analyses will be presented to and discussed with CRSP participants at the next annual meeting in March, 1986.

#### Program Management and Technical Guidance

The Pond Dynamics/Aquaculture CRSP was envisioned as a cohesive program, consisting mainly of a series of parallel studies to be carried out in the participating host countries and basic research to be accomplished at U.S. institutions. Further, the CRSP was designed to be truly collaborative, with all participating institutions sharing in the direction of research efforts.

In accordance with these themes, activities during the first operational year of the CRSP focused on developing a spirit of teamwork while completing the practical requirements involved in getting CRSP research underway. CRSP research has been the dominant theme of the second and third years.

Technical, administrative and fiscal responsibility for the performance of the CRSP rests with the Management Entity. Oregon State

University created a Program Management Office for CRSP activities and designated a Fiscal Officer to provide program accounting and consolidation of fiscal reporting from institutions expending funds provided by the grant. A CRSP Executive Council was appointed. It selected a Program Manager with the approval of the Management Entity. The Executive Council and the Program Manager, with the support of a Technical Advisory Committee and a CRSP Research Team, have worked closely to guide the CRSP in areas of policy, budget management, and technical guidance.

The structure and composition of the program management and technical guidance agencies of the CRSP during the reporting period remained basically unchanged during the first three years of CRSP activities. One major addition was the formation of the CRSP External Evaluation Panel. This group, which will conduct periodic impartial reviews of the program, is an essential part of efforts to ensure that CRSP research remains carefully directed and cost effective.

The name of the Executive Council was recently changed to CRSP Board of Directors. This change was made to conform with the recently issued "Guidelines for the Collaborative Research Support Programs".

#### BOARD OF DIRECTORS

As the primary policy making body for the CRSP, the Board of Directors has taken an active role in guiding the program toward maturity. The members of the Council are:

- |                |   |
|----------------|---|
| (1982-Present) | Dr. Alfred M. Beeton<br>(Chairman of the Board)<br>Great Lakes & Marine Waters Center<br>University of Michigan |
| (1982-Present) | Dr. Wallis H. Clark, Jr.<br>University of California at Davis<br>Bodega Marine Laboratory                       |
| (1982-1985)    | Dr. E. W. Shell<br>Department of Fisheries and Allied Aquacultures<br>Auburn University                         |
| (1985-Present) | Dr. D. D. Moss<br>Department of Fisheries and Allied Aquacultures<br>Auburn University                          |

The Board has met frequently to provide guidance on policy, budgets, and technical performance. Board action has included:

- Advisement of the Management Entity on matters of CRSP policy.
- Confirmation of Dr. James Lannan of Oregon State University as the CRSP Program Manager.
- Appointment of the Co-Principal Investigators for the CRSP projects as standing members of the CRSP Research Team.

- Review of fiscal reports and advisement of the Management Entity regarding the apportionment of the limited funds available for program activities in the preparation of CRSP budgets.
- Guidance of efforts to strengthen CRSP projects by fostering special topic research at host country sites and at U.S. institutions.
- Selection of members of the External Evaluation Panel for the CRSP.
- Guidance in the development of a centralized CRSP data management system, including appointment of a Data Synthesis Team.
- Review of the performance of the Program Manager.
- Evaluation of the administrative and technical accomplishments of six CRSP project teams.
- Guidance of efforts to develop a U.S. research component of the CRSP, including identification of critical research needs and approval of proposals funded by the Management Entity.
- Participation in three CRSP annual meetings.
- Assistance in planning the CRSP Triennial Review and participation in overseas site visits as part of the review process.
- Review and acceptance of the External Evaluation Panel report.
- Approve changes in CRSP organization in response to recommendations of External Evaluation Panel and AID Management Review.

#### PROGRAM MANAGEMENT OFFICE

The Program Management Office (PMO), under the direction of the CRSP Director, provides executive linkage between the Management Entity and operations under the CRSP. The former title Program Manager was changed recently to CRSP Director to conform with Guidelines for the Collaborative Research Support Programs. During the first three years of CRSP activities, the PMO staff included:

- Director, Dr. James E. Lannan (1982-Present)
- Assistant Director, Ms. Michele Leslie (1983-1985)
- Assistant Director (Communication and Administration), Ms. Nancy A. Brown (1985-Present)
- Assistant Director (Data Management and Technical Affairs), Dr. Kevin Hopkins (1985-Present)
- Secretary, Ms. Carman McBride (1982-Present)
- Graduate Research Assistant (Data Management), Ms. Anne Kapuscinski (1983-1984)
- Graduate Research Assistant (Data Management), Mr. James Bowman

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The Fiscal Officer for the CRSP is:

Mr. William R. Millison  
Office of Business Affairs  
Oregon State University

During the reporting period, the Program Management Office continued to facilitate and coordinate interactions between collaborating institutions, monitor research activities and prepare summary and fiscal reports. Specific accomplishments include:

#### First Year

- Conclusion of Management funding agreements with U.S. institutions regarding the participation of individuals in research projects, the Executive Council and the Technical Advisory Committee.
- Direction of U.S. Principal Investigators in efforts to formalize administrative agreements with participating host country institutions based upon the provisional agreements concluded under the planning grant.
- Arrangement of and participation in meetings of the Executive Council and the Technical Advisory Committee.
- Assistance in obtaining host country clearances for U.S. personnel.
- Assistance in obtaining administrative approvals for equipment purchases for country projects.
- Initiation of a quarterly newsletter for the CRSP.
- Synthesis of the results of meetings and workshops including finalization of the CRSP work plan for a first experimental cycle.
- Strengthened the Management Office by recruiting an Assistant Program Manager.
- Organized an ad-hoc committee (approved by the Executive Council) to advise on development of a data base management system to CRSP research, and initiated development of the Data Base Management System.

#### Second Year

- Preparation of CRSP budgets and subcontract modifications extending funding and performance period.
- Attendance of AID Program Managers' Meetings, to voice the concerns and needs of CRSP participants and to stay informed of changes in AID policy.
- Facilitation of communication among CRSP participants, through development of an electronic mail system and publication of a quarterly newsletter.
- Arrangement of and participation in meetings of the Executive Council and the Technical Advisory Council.
- Synthesis of the results of meetings and workshops including finalization of the CRSP work plan for a second cycle of experiments.
- Assistance in obtaining travel clearances for CRSP personnel.
- Assistance in obtaining administrative approvals for the purchase of equipment for country projects.

- Development of a computerized data base management system, involving the use of a network of microcomputers to link Host Country project sites, participating U.S. institutions and the Program Management Office.

### Third Year

- Preparation of CRSP budgets and subcontract modifications extending funding and performance period.
- Continued assistance in processing travel clearances for CRSP personnel and approvals for purchases of "restricted goods" for country projects.
- Implementation of a technical information service for overseas research staff.
- Coordination of Triennial Review activities.
- Implementation of a U.S. Research Component.
- Concluded a new operating agreement between Institut Pertanian Bogor, Michigan State University, and USAID/Jakarta to redirect the CRSP Special Topics Research towards identified Indonesian priorities.
- Conducted a third annual CRSP research meeting, and produced a work plan for the third experimental cycle.
- Implemented development and utilization of an improved Data Base Management System which greatly expands CRSP capabilities for data analysis, synthesis, and modelling.
- Organized a CRSP Data Synthesis and Modeling Team and implemented analysis activities.

### CRSP Report and Documents

A number of reports and documents were prepared and disseminated by the PMO during the first three years of the CRSP. These include:

#### CRSP Work Plans

First Experimental Cycle (March 1983)  
Second Experimental Cycle (July 1984)  
Third Experimental Cycle (July 1985)

#### Annual Administrative Reports

First Annual Administrative Report (December 1983)  
Second Annual Administrative Report (December 1984)

#### CRSP Directory and Biodata of CRSP Participants

First Edition - May 1983  
First Revision - June 1984  
Second Revision - August 1985

#### Aquanews

The Quarterly Newsletter of the CRSP (eight editions to date).

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Pond Dynamics/Aquaculture

An informational brochure describing the CRSP.

Technical Report

Principles and Practices of Pond Aquaculture: A State-of-the-Art Review.

## TECHNICAL ADVISORY COMMITTEE

The Technical Advisory Committee advises the Executive Council and the Program Manager on technical aspects of CRSP planning and performance. Auburn University, CIFAD and the University of California at Davis each appointed one member to serve on the Committee. In addition to the CRSP Program Manager and the AID Project Manager who serve on the Committee in an ex-officio capacity, the members of the Technical Advisory Committee are:

Dr. Donald Garling  
Department of Fisheries & Wildlife  
Michigan State University

Dr. R. O. Smitherman  
Department of Fisheries & Allied Aquaculture  
Auburn University

Dr. George Tchobanoglous  
Department of Civil Engineering  
University of California at Davis

The Technical Advisory Committee has had a lead role in the development of the annual research plans for the first three years of CRSP activities. The Committee formulated a generalized research plan that was subsequently transformed into a more detailed work plan by the CRSP Research Team composed of Host Country and U.S. Principal Investigators.

## CRSP RESEARCH TEAM

The CRSP Research Team, a consolidation of Co-Principal Investigators and a standing body of a select group of other scientists to be appointed by the Executive Council, is responsible for establishing and maintaining standardized CRSP research practices. During the reporting period, the Executive Council confirmed the appointment of the Co-Principal Investigators to the Research Team but elected not to appoint additional scientists pending addition of the U.S. research component to the CRSP. Members of the Research Team, with support from a number of the CRSP Research Associates, transformed generalized work plans developed by the Technical Advisory Committee into detailed experimental protocols.

EXTERNAL EVALUATION PANEL

The External Evaluation Panel (EEP), referred to as the Program Review Panel in the CRSP grant document, is composed of impartial senior scientists selected on a world-wide basis by the Executive Council and approved by the Joint Committee on Agricultural Research and Development (JCARD) of the BIFAD. The Panel is responsible for carrying out periodic external reviews of program accomplishments, progress and prospects. During the reporting period, the following individuals served on the Panel:

Dr. James Avault, Jr.  
Professor of Fisheries  
School of Forestry and Wildlife Management  
Louisiana State University

Dr. Kenneth Chew  
Chairman, Division of Aquaculture and Invertebrate Fisheries  
School of Fisheries  
University of Washington

Dr. Richard A. Neal  
Director General, International Center for Living Aquatic  
Resources Management (ICLARM)  
Metro Manila, Philippines

Dr. Ziad Shehadeh  
Director of Fisheries  
Kuwait Institute for Scientific Research

Dr. Neal left the EEP in March, 1985, when he accepted a position with USAID. The CRSP Board of Directors is presently considering nominations for his replacement.

Since its appointment in 1984, the EEP has conducted one comprehensive program evaluation as part of the CRSP Triennial Review. The terms of reference, findings, and recommendations are presented in Part B of this report.

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## FINANCIAL SUMMARY

This section summarizes the expenditure of AID and non-federal funds for CRSP research projects and program management. This unaudited summary is intended to provide an overview of CRSP progress relative to budgeted amount indicated in the CRSP grant.

The AID funds expended relative to amounts budgeted for various program activities are presented in Columns A and B of Table 7. The data on expenditures for research projects were provided by the Principal Investigators of the several projects. The information on Management expenses was taken from monthly account status reports of the Program Management Office.

Because there is typically a time lag between the dates that expenses are incurred and posted, it is likely that the expenditures reported for the Collaborative Research Projects underestimate the true account status. Nonetheless, the projects have expended on the average 94 percent of AID funds obligated during the three year period. It is probable that the accounts are in fact fully expended.

Expenditures for Program Management exceeded the budget during the first three years. This resulted mainly from unbudgeted expenses incurred in conducting the Triennial Review. Guidelines for Triennial Review and responsibilities of External Evaluation Panels have undergone substantial evolution subsequent to the planning of this CRSP. Compliance with recent guidelines have understandably resulted in an increasing administrative and financial burden to the CRSP. The deficits will be absorbed in subsequent year's budgets.

The monthly rates of expenditure have increased throughout the life of the CRSP as the research effort has intensified and elements of the CRSP have become fully implemented. The monthly rate for the final six months of the third year is approximately \$115,000 per month, slightly exceeding the linear rate for a program that is projected to be level funded at \$1.3 million per year. Reducing and stabilizing the present rate will require reducing funding for some activities in subsequent years.

Cost sharing contributions from the U.S. institutions is presented in Column C of Table 7. These data reflect continuing institutional commitments to participation in the CRSP. It appears that the amounts reported meet or exceed the 25 percent cost sharing requirement. However, confirmation of this requires further accounting because the proportions of the amounts shown in Column B to be excluded in calculating the cost sharing requirements in accordance with the BIFAD. Guidelines must be determined after the fact.

Finally, host country contributions (in U.S. dollars) through the first two years of the CRSP are presented in Column E of Table 7. These are the amounts reported in the Second Annual Administrative Report. Additions for the third year were not received by the Management Office at the time of preparation of this summary, but will be reported in the Third Annual Administrative Report. The data presented in Column E were provided

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by the Principal Investigators of the several projects. Although host country cost sharing is not required, these data indicate a substantial commitment to participation in the CRSP, especially when the dollar amounts are related to local economies.

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TABLE 7  
SUMMARY OF AID FUNDS BUDGETED AND EXPENDED, AND U.S. AND HOST COUNTRY CONTRIBUTION

	<u>AID Contribution</u>		C U.S. Inst. Contribution	D Total Program Expenditures	E Host Country Contribution
	A Budgeted	B Expended			
<b><u>Collaborative Research Projects</u></b>					
Honduras - Auburn University	\$ 239,140	\$ 218,494	\$ 61,070	\$ 279,564	\$ 88,000
Indonesia - Michigan State University	383,296	374,719	108,386	483,105	58,740
Panama - Auburn University	330,048	310,892	80,830	391,722	149,000
Philippines - University of Hawaii	379,835	348,759	102,551	451,310	53,500
Rwanda - Oregon State University	334,426	301,058	49,004	350,062	170,000
Thailand - University of Michigan	<u>303,915</u>	<u>288,859</u>	<u>38,174</u>	<u>327,033</u>	<u>86,550</u>
sub totals	<b>\$1,970,660</b>	<b>\$1,842,781</b>	<b>\$ 440,015</b>	<b>\$2,282,796</b>	<b>\$605,790</b>
<b><u>Program Management</u></b>					
Management Office	389,873	395,873	N/A	395,873	
Executive Council, Technical Advisory Committee and External Evaluation Panel	<u>39,467</u>	<u>75,499</u>	N/A	<u>75,499</u>	
sub total	<b>\$ 429,340</b>	<b>\$ 471,372</b>	<b>N/A</b>	<b>\$ 471,372</b>	
<b>TOTALS</b>	<b>\$2,400,000</b>	<b>\$2,314,153</b>	<b>\$ 440,015</b>	<b>\$2,754,168</b>	

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PART B

EXTERNAL EVALUATION

Report of External Evaluation Panel  
Report of AID Management Review  
CRSP Response

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## EXTERNAL EVALUATION OF THE POND DYNAMICS/AQUACULTURE CRSP

Prepared by the

**CRSP EXTERNAL EVALUATION PANEL**

March 22, 1985

## EXECUTIVE SUMMARY

Efficient administrative and technical management is critical to the success of this geographically diffuse, multi-component Collaborative Research Support Program (CRSP). Clear and specific management guidelines; an efficient communication system among implementing institutions, management and field projects; short reaction time by management; and monitoring and amendment when necessary of management elements/criteria in the early phase of the program are particularly important in the management process.

Cognizant of the complexity of the management task, the External Evaluation Panel was, in general, very favorably impressed by performance to date. Both administrative and technical management are operating effectively and much has been accomplished by the program in a very short period because of this fact. Existing problems have been identified and are being addressed by management, subject to budgetary restrictions in some instances.

Despite the diversity of interests among participating U.S. and host country institutions and the occasional problems this can be expected to cause, a very good cooperative spirit is prevalent among participating institutions, administrative committees and the Program Manager/Management Entity.

Panel members especially commend the Program Manager and, to a large extent, attribute program accomplishments to his managerial capabilities, pleasant personality and flexibility - attributes that are recognized and appreciated by program participants at all levels.

With the completion of the first year of research activities, as can be expected, some technical and administrative problems and/or weaknesses have surfaced. The External Evaluation Panel is satisfied that management is aware of these problems and is considering appropriate corrective measures within the program's financial resources.

Most of these problems were under discussion by management during the March 1985 Annual Research Planning Meeting, which took place during the preparation of this report.

The External Evaluation Panel singled out the following key issues for consideration by management:

- a. Expansion of the Executive Council to allow representation from host developing countries.
- b. Strengthening of the Technical Advisory Committee and expansion of its terms of reference.

- c. Abbreviation of the management chain to permit more rapid reaction to the needs of field projects, particularly in connection with backstopping of base-line research projects.
- d. Amendment of research planning from an annual to a biennial exercise to allow thorough analysis of data before the planning of subsequent research.
- e. Full implementation of the Research Team.

## SYNOPSIS OF RECOMMENDATIONS

Administrative and Technical Management

It is recommended that:

- At least two members be added to the Executive Council from participating host country institutions.
- The Technical Advisory Committee be strengthened by adding two members with expertise in some of the following fields: data processing/management, pond ecosystems, brackish water ecosystems, shrimp pond aquaculture.
- The Research Team be formed as described in the proposal and that it be made a functional element of the program.
- The administrative chain be abbreviated and communications with field projects be improved to permit quicker technical back-stopping.
- The research planning schedule be amended from an annual to a biennial exercise to allow thorough analysis of results before planning subsequent research.

Overall Activities

It is further recommended that:

- Peripheral activities (extension, demonstration, training) be restricted and unauthorized deviations from core research plans be prevented to safeguard the central research objectives of the program.
- The central data management system be made operational, on an urgent basis, and the work on integration of data and development of theoretical models of pond productivity be initiated immediately.
- The Research Team reexamine and amend, where necessary, standard methods for (a) chlorophyll determination, (b) wind measurement and (c) analysis of organic manures.
- The Research Team specify standard methods for chemical analyses of brackish water and insure additional documentation of soil chemistry and benthic productivity in both freshwater and brackish water ponds.
- The Research Team insure uniformity of the test species (Tilapia nilotica) among projects by identifying a common source and verifying genetic make-up using standardized electrophoretic tests.

✓ (12)

- 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.
- The Management Entity initiate consultations with USAID (Washington, D.C.) and USAID Country Missions to encourage provision of additional logistic support to U.S. field staff and to insure continued commitment to ongoing projects by USAID Country Missions as mission staff personnel change.
- 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.
- Increased interaction among field projects be encouraged through site visits and/or joint workshops under the guidance of the Technical Advisory Committee.
- USAID consider a modest increase in budget to: (a) strengthen collaborative research at U.S. universities, (b) increase input by U.S. principal investigators in support of field projects, (c) hire laboratory technicians for chemical analyses, (d) strengthen the two apparently under-funded projects in Honduras and Panama, (e) fund interproject workshops and, (f) provide a technical information service.
- The Management Entity take necessary steps to see that field personnel are experienced, senior researchers who command the respect of their host country counterparts.

## I. INTRODUCTION AND TERMS OF REFERENCE

### A. Background

The Pond Dynamics/Aquaculture Collaborative Research Support Program (CRSP) was initiated in September 1982 to increase the availability of aquaculture-derived animal protein in selected developing countries through a specific coordinated research program. It is a comprehensive long-term collaborative research program which focuses the technical resources of the developing countries and U.S. 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 production of animal protein.

The administrative and technical tasks necessary 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. Research has been underway at most sites for a little over one year and results of initial experiments are in hand.

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

### B. The External Evaluation Panel: Duties and Membership

The External Evaluation Panel is composed of impartial senior scientists selected by the Executive Council and approved by the JCARD/BIFAD. Three scientists were appointed to the panel in May and a fourth in December 1984. Members participating in this evaluation are:

Dr. James Avault, Jr., Louisiana State University  
Dr. Kenneth Chew, University of Washington  
Dr. Richard Neal, International Center for Living Aquatic Resources  
Management  
Dr. Ziad H. Shehadeh, Kuwait Institute for Scientific Research

The panel reviews and assesses the merits of component projects and the technical and administrative accomplishments of the program as a whole. It provides written evaluation reports to the Management Entity, AID and JCARD/BIFAD.

This first program evaluation covers the period September 1982 through February 1985. It is based on review criteria formulated by the Executive Council, in collaboration with two panel members, during the Triennial Review Planning Meeting (October, 1984). The criteria are appended as Annex A. Information for the evaluation process was obtained from the following sources:

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1. The First and Second Annual Administrative Reports,
2. Site visits to all six field projects conducted by teams composed of one representative each from the External Evaluation Panel, the Executive Council and USAID, Washington,
3. Seminars presented by principal investigators and research associates during which research progress, accomplishments and problems were discussed fully (Annual Research Planning Meeting, March 1985),
4. Intensive interviews with project staff (Annual Research Planning Meeting, March 1985), and
5. Meetings with the Program Manager, Technical Advisory Committee and Executive Council (Annual Research Planning Meeting, March 1985).

The External Evaluation Panel did not have access to information regarding the decisions, program policy changes or research planning processes relating to the future of the program that resulted from the Annual Research Planning Meetings, the Executive Council Meetings or the Technical Advisory Committee Meetings of March, 1985.

## II. PROGRAM REVIEW

### A. Administrative and Technical Management

#### 1. Effectiveness of the Management Entity/Project Manager

The Management Entity and Program Manager have been very effective in planning, coordination, documentation, fiscal management and overall management of the program. A representative of the Management Entity attends planning and review meetings and the Program Manager is in close touch with management bodies, AID, field projects and participating institutions.

The program is most fortunate to have the services of the Program Manager and the panel attributes a major part of program progress to his competence, energy and pleasant manner. Both the Management Entity and Program Manager share excellent relationships with the Executive Committee, Technical Advisory Committee and the External Evaluation Panel.

The diffuse, multi-component nature of the CRSP calls for a certain level of administrative infrastructure to ensure adequate management and control. Under these circumstances, care should be exercised to maintain the minimum necessary infrastructure, to avoid high costs, and to ensure efficient backstopping of projects. The panel was therefore pleased to note that administrative cost was at the 15% level.

Management is encouraged to accelerate its efforts to reduce delays encountered in responding to technical queries from projects, in connection with standard procedures for base-line research. The panel specifically suggests exploring ways and means of abbreviating the administrative chain of these projects, and of strengthening the Technical Advisory Committee. Linking field projects where possible to an electronic mail system would also help accelerate communications.

#### 2. Effectiveness of the Executive Council

The Executive Council was organized according to the guidelines set forth in the program document with one administrative member each from Auburn University, CIFAD and the University of California at Davis. Despite conformity with approved program guidelines, the panel was concerned by the lack of any representation from participating developing countries and is of the opinion that such representation would facilitate communication with, and strengthen support of field projects by host countries. Accordingly, the panel recommends that the Executive Council membership be expanded to include at least two representatives from participating developing country institutions.

The Council has pursued its prescribed duties with competence and dedication. It has met about three times per year during the past two years, excluding numerous telephone conference calls. Contact has been maintained with field projects through site visits and good working relationships exist with the Technical Advisory Committee and the Program Manager/Management Entity.

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### 3. Effectiveness of the Technical Advisory Committee

The Technical Advisory Committee is composed of three members, one each from the three participating U.S. institutions, with the CRSP Program Manager and AID Project Manager as ex-officio members.

The committee has rendered valuable service, within its terms of reference, to the Executive Council, Program Manager and research projects. It has also carried out some of the duties of the CRSP Research Team which is still in the formative stage.

The Technical Advisory Committee has a very good working relationship with the Executive Council, the Program Manager and project staff. Its contact with the latter, however, is restricted to annual research planning meetings. The panel encourages management to arrange occasional visits to field projects by Technical Advisory Committee members, as funds permit, to acquaint them with field conditions and strengthen their ties with field staff and host institutions.

The committee comprises established technical competence in pond aquaculture, fish nutrition, water quality/waste management and statistical analysis. It lacks expertise, however, in some disciplines central to program objectives - data processing and management; pond productivity as a holistic interactive process, brackish water chemistry, ecology and aquaculture.

Field staff have complained about these deficiencies because of negative effects on the research planning advisory role and a related lag time in the management process. The External Evaluation Panel shares this concern and recommends that management quickly strengthen the Technical Advisory Committee by expanding membership. In case of budgetary restrictions, the required experts could be retained on an ad hoc basis.

The demand for additional technical advisory services in connection with base-line research projects has placed heavy pressure on the limited members of the Technical Advisory Committee and on the Program Manager. Concern was expressed regarding which entities have the responsibility for assimilation, synthesis and analysis of the information from the six field projects. In other words, what is the mechanism for integrating the six projects into a functional program? Although this responsibility is not clear in the program documents, the panel was informed that this is the responsibility of the Technical Advisory Committee. It was not apparent that the Technical Advisory Committee is playing this role; however, such integration and interpretation at the program level should be an ongoing part of the research planning process.

The purposes and value of the research experimentation in brackish water and with penaeid shrimp should be reexamined by the Technical Advisory Committee and the objectives and hypothesis tested related to these studies should be clearly stated so that interrelationships with the freshwater/tilapia experimentation is clear.

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#### 4. Effectiveness of the CRSP Research Team

The team is to be composed of the Co-Principal Investigators (U.S. and host country institutions) of CRSP projects and a standing body of 12-15 scientists with expertise in disciplines relevant to program objectives, selected by the Executive Council from participating institutions. Its purpose is to insure maximum participation from CRSP institutions and highest possible scientific competency in support of CRSP activities. Its function is to transform generalized work plans developed by the Technical Advisory Committee into standardized experimental protocols.

The team is in the formative stage and its function is being carried out at present by the Principal Investigators and Research Associates with assistance from the Technical Advisory Committee.

In the opinion of the External Evaluation Panel the Research Team should be made fully functional and should be given full authority to execute its responsibility as outlined in the program proposal. Failure to settle small but critical matters relating to standardization of procedures reflects the failure of the research team to function as planned. It is likely that this shortcoming will result in decisions to repeat some of the baseline experiments because of lack of comparability, an essential element in the core studies of this program.

The need to expedite preparation of standard research procedures, especially for brackish water aquaculture systems, and for chemical analysis of water and soil is so critical that an external consultant should be retained for this purpose if it cannot be accomplished within the program within the next few months. The effectiveness of any research protocol is dependent upon the extent to which researchers adhere to the procedures. Additional rigor may have to be exercised by the Program Manager to enforce the recommendations of the Research Team.

The research planning effort could be further improved by rescheduling of the exercise as a biennial rather than the current annual affair. This would insure time for thorough analysis and interpretation of research data before planning of subsequent research and would reduce the pressure on research staff to make plans before they have adequate feedback from the Technical Advisory Committee.

#### B. Evaluation of Progress

##### 1. Schedule

The Pond Dynamics/Aquaculture CRSP is a fairly new activity. The program was initiated in September 1982 and the first year was devoted to establishment of the administrative infrastructure, signing of agreements with the host countries, staff selection and preparation of field facilities. Research has been underway at most sites for a little over one year. Achievements of the program at this stage are generally above the expectations of the External Evaluation Panel and well within the work plan schedule with few exceptions.

Field conditions and the availability and/or quality of host country resources vary among project sites and this is reflected in asynchronous progress among projects. Slow start-ups have been directly related to (a) limited availability or non-availability of qualified host-country staff, especially technicians, (b) need to renovate existing facilities or await their completion, (c) geographic isolation which aggravates communications and the problem of host-country staff availability, (d) delays in customs clearance of goods entering the host country, or (e) poor research site selection. The Panel recognizes that these delays/problems are largely unavoidable in developing countries and are beyond the control of management.

The External Evaluation Panel is concerned, however, about the fact that USAID Country Missions which agreed to the execution of CRSP projects in particular countries have not always honored these agreements as changes in mission personnel have occurred. As a result, the entry of research associates has been blocked in two participating countries. The External Evaluation Panel urges management to resolve this problem in consultation with USAID (Washington, D.C.). Management should, concurrently, investigate the feasibility of formalizing an agreement with USAID so that U.S. field staff can take advantage of some logistic support from USAID Country Missions (health care, expediting visas, custom clearances, etc.). The Panel recognizes that the majority of host country USAID Missions have been very supportive in this regard.

## 2. Quality of Research and Data Analysis

As can be expected in a new program, some problems have arisen in connection with the application of standard methods and designs as well as with data analysis and management. There has been some delay in the resolution of these problems due to the fact that the CRSP Research Team, vested with the responsibility of research standardization, is not yet fully operative and due to problems encountered in the development or application of data management software. Although the External Evaluation Panel recognizes these as normal start-up problems, it is concerned by the apparent delay in resolving them. Problems with implementation of standard methods and standard research design, if not addressed quickly, might invalidate the utility of data from baseline research projects and delay the development of a predictive model of pond productivity.

The lag in the central compilation and synthesis of research results from the six project sites is serious. Central compilation, analysis and synthesis of data is critical to the planning and coordination of baseline research and to overall understanding of pond dynamics. (In some instances planning has preceded thorough interim interpretation of research results). Responsibility for these tasks is vested in the Technical Advisory Committee but a mechanism for their execution is not clearly established. In addition, methods for the integration of project data are not clearly explained and information on models to be tested is not yet available. No clear statement of general hypotheses being tested was available to the External Evaluation Panel. The External Evaluation Panel therefore urges management to accelerate the development of data management software and to complete the Central Data Management System on an emergency basis, with the assistance of ad hoc advisors. Management is also urged to complete and

activate the full CRSP Research Team and strengthen the Technical Advisory Committee to expedite resolution of problems of standardization of research methods and of data analysis and synthesis.

Research quality is good and the research proposal format in use (prepared by the Technical Advisory Committee) is excellent. In some instances, however, the interdisciplinary expertise necessary for the conduct of research is not evident in project staffing and some Research Associates working at the host country institutions are relatively inexperienced. A dichotomy in emphasis is surfacing as a result, with stress on either fish production or water chemistry, depending upon the experience and background of the Principal Investigators and Research Associates. Since the understanding of pond dynamics mandates an interdisciplinary approach, the External Evaluation Panel is gratified to note that progress is being made toward integration of these approaches as researchers meet and compare methods and results.

The Technical Advisory Committee and CRSP Research team should make a special effort to amend standard methods for: (a) chlorophyll determination, (b) determination of organic manure characteristics, (c) chemical analyses in brackish water, (d) wind measurement, (e) standardization of the test animal (Tilapia nilotica) and (f) documentation of soil chemistry and benthic productivity. It may be desirable, in addition, to repeat some experiments (if recommended by the Technical Advisory Committee and CRSP Research Team) in cases where excessive pond seepage, soil acidity, turbidity, or arbitrary changes in experimental guidelines have resulted in data of questionable comparability.

Water analysis is proving to be a problem in some projects where counterpart staff do not have the necessary expertise and local staff trained by research associates do not remain with the project. The panel recommends that under these circumstances (Rwanda, Thailand, Honduras, Panama) funds be allocated to the projects to pay for the services of permanent laboratory technicians.

The External Evaluation Panel is concerned that pressure to make CRSP research more immediately applicable to developing country needs may pose a danger of compromising progress toward the original pond dynamics research objectives. The Program Manager and Executive Council should take additional steps to ensure that original research objectives remain central to the research effort. Drifting of CRSP personnel activities into extension, demonstration and training should be limited to protect original research objectives. Representation of participating host country institutions in the Executive Council and more frequent contact between Principal Investigators (and/or Executive Council members) and participating host country officials and USAID missions would help reduce this pressure.

### 3. Communications and Dissemination of Information

Communications within the program are good. An excellent microcomputer network links participating American universities and the Management Entity at Oregon State, and an attempt is underway to extend the system to field projects. A broad need was identified for better

communication with USAID Country Missions and with various host country institutions, especially by the Principal Investigators, to strengthen understanding of and local support for the CRSP projects and the overall program.

There is also need to establish a technical information service in support of field projects to overcome isolation problems and keep field staff current on technical developments. The proposed service would provide current titles, abstracts, literature searches and copies of important papers to field personnel.

Interaction among staff of the six field projects is limited to annual planning meetings. The panel feels that more frequent communication would be very beneficial and recommends that an effort be made to improve this interaction.

Dissemination of technical information is in its preliminary stages due to the newness of the program. The Program Manager's office has done an excellent job in the dissemination of information. A brochure has been prepared and a document on standard research methods published. Two technical reports, on baseline physico-chemical properties of experimental ponds and the results of the first research cycle are under preparation. Annual administrative reports are issued regularly with two reports published to date. Procedures for publication of research results in refereed journals have also been worked out. Individual field projects maintain contact with other national projects and with related institutions, and field staff of some projects have contributed technical papers to national and international meetings.

#### 4. Funding

The Panel is of the opinion that the program is modestly underfunded. Some increases are desirable to improve research benefits to U.S. universities and host country institutions, and to ensure implementation of the External Evaluation Panel's recommendations. The Panel also recommends that financial support for the Panama and Honduras projects be reviewed and increased if necessary. The cost of these two projects appear to have been underestimated.

#### 5. Summary

In summary, it is the opinion of this panel that the program is a strong and viable one that merits continued support by USAID. The program is experiencing some "growing pains" as should be expected of a complex, international program of this type. The problems encountered by the program are being addressed by all participants in a cooperative manner that is encouraging and that demonstrates the capabilities of the participating groups to collaborate effectively. The program is designed to establish new information of a basic but essential nature for future research and for optimum management of production ponds in aquaculture. The technical opinion of this team is that the information being gathered is of importance and will represent a major contribution to the understanding of fish production pond dynamics. The probability of the program attaining its stated goals are excellent and the new information

resulting from this research will be valuable in furthering the science of controlled aquaculture in developing countries.

The panel was favorably impressed with the organization, research progress, host country collaboration and prospects for additional important contributions through the program.

## III. PROJECT REVIEWS

## A. Honduras - Directorate of Renewable Natural Resources/Auburn University

Site Visit: January 6-9, 1985 by Dr. James Avault, Jr., Mr. Kenneth Osborn, and Dr. Wallis Clark

## 1. Background

## a. Project personnel

Host Country Principal Investigator: Lic. Jonathan Espinoza  
Host Country Research Associate: Ing. Pes. Hermes Alvarenga  
U.S. Principal Investigator: Dr. Ronald Phelps  
U.S. Research Associate: Bart Green

Bart Green, who implements the research on a day to day basis, is doing an excellent job. He is very well qualified for this particular project, having had previous experience in pond dynamics. He speaks fluent Spanish and has an excellent rapport with his counterpart and the host country Principal Investigator.

## b. Logistics

The ponds are established and in overall good condition. Perhaps the only major problem is the high turbidity in ponds due to high winds. Ponds are part of the El Carao station established in 1978 partly with USAID funding, and dedicated in 1980. The project proposed never was established. With the initiation of this CRSP, new life was given to El Carao. Besides CRSP research, El Carao is used in producing fish seed for distribution to farmers.

Virtually all the necessary equipment is in place for water analysis with the exception of that required for Kheldahl nitrogen determinations. There is often a long lag time between requests for chemicals, such as sulfuric acid, and actual receipt of them. The station is very isolated and has no phone. It is sometimes difficult for the research associate to communicate with the U.S. Principal Investigator.

## 2. Baseline Research

## a. Schedule and Results

The baseline research is on schedule. The second cycle for the dry season is in progress, and ponds are to be drained and fish harvested in mid-June. The wet cycle study will begin in July, 1985. Overall fish yields in kg/ha were considerably lower than anticipated, probably due to high turbidity levels. This interfered with phytoplankton production - the first link in the grazing food chain.

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b. Quality of Research

Great care has been taken collecting and analyzing samples. Bart Green and his counterpart do the actual work, but they get assistance with certain tasks, such as water analysis. Students from the university are trained and very closely supervised. For example, standards are frequently run just to check out methodology. Perhaps the only analyses presenting difficulty is the chlorophyll a determination, because of unusual turbidity.

Aside from water analysis, good procedures are followed in the mundane activities of fertilization, weighing of tilapia, and other related tasks.

c. Analysis of Data

There is a long lag time between collecting of empirical data and synthesis of data. Auburn now is synthesizing data and Oregon State will later complete the analysis in a standardized manner. This long delay does not allow enough time for feedback to the Technical Advisory Committee in planning of future baseline research.

3. Site Specific Research

Research underway involves use of organic manures and feeding in polyculture. This is a sound experiment and is a direct spin-off from baseline research. First, organic manure may help to flocculate out clay particles. The feeding treatment bypasses, to a degree, the need for primary production, i.e., growth of phytoplankton; and research on polyculture is designed to explore the possibility of increased fish production by stocking fish with different feeding habits. Future site specific research calls for use of a control set of ponds comparable to the baseline research to serve as a uniform benchmark for each experiment. This is an indication of the research associate's understanding of pond dynamics research and proper experimental design.

4. Linkages

a. USAID Mission

There is excellent rapport between the project personnel and the AID Mission personnel. The CRSP has served as a catalyst to spark new aquaculture programs within the country. For example, the ongoing Natural Resources Management Project has added an aquacultural component, and Manuel Paz was hired specifically to organize this aquacultural component. The Agriculture Officer of USAID, John Warren, spent one full day with the External Evaluation Panel member to visit the El Garao Station.

b. Country Agencies

Close cooperation between the Ministry of Natural Resources and the project has already resulted in exploration of future pond sites in South Honduras. The University of Honduras has good linkage with the Ministry of Natural Resources which hires students as fishery workers.

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c. Technical Advisory Committee, Executive Council, Program Manager and Other CRSP Projects

Because of the infrastructure of the CRSP program, it is difficult to have meaningful dialogue between the on-site research associate and the Technical Advisory Committee except at regular structured meetings. The research associate must make his own best decisions concerning problems which may need quick answers. For example, the Technical Advisory Committee work plan calls for the installation of wind gauges, but the height and location were not standardized. After more than a year of discussion this issue has not been resolved. A close relationship between the Research Associate and U.S. Principal Investigator has been slow developing simply because the station has no phone. The relationship of the Research Associate with the Program Manager is not a major factor in day to day activities. If a major policy issue should arise the Research Associate confers with the Principal Investigator. Linkage with other CRSP projects at this point is limited to annual reports and meetings, although Honduras and Panama do confer because they are close geographically.

5. Summary and Conclusions

Overall the project is progressing very well and should accomplish program goals. The U.S. research associate is highly qualified. The baseline research and site specific research are being carried out on schedule and in a very professional manner. The rapport with the USAID Mission is excellent. Problems that do exist are mainly logistic, because of isolation, but they should ultimately be worked out. Financial support from the CRSP for this project should be re-examined. Some CRSP stations, e.g. those in the Philippines and Indonesia, have good backstopping help from in-country USAID Missions. However, the CRSP project in Honduras relies almost entirely on CRSP funding.

6. Contacts

Auburn University:

Mr. Bart Green, Research Associate

Directorate of Renewable Natural Resources:

Mr. Jonathan Espinoza, Principal Investigator

Ministry of Natural Resources:

Dr. Jesus Abastida

USAID:

Dr. John Warren, Agriculture Officer

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B. Indonesia - Institut Pertanian Bogor/Michigan State University

Site Visit: January 31-February 2, 1985 by Dr. Kenneth Chew,  
Mr. Kenneth Osborn, and Dr. E. W. Shell

1. Background

a. Project Personnel

Host Country Principal Investigators: Dr. Muhammad Eidman  
Host Country Research Associate: Mr. Odang Carmen and  
Mr. Komar Sumantadirata  
Host Country Research Assistant: Ms. Pipih Suptihay  
U.S. Principal Investigator: Dr. Clarence McNabb  
U.S. Research Associates: Dr. Betty Premo

Qualified personnel have available for this project located at Darmaga Field Station near Bogor, West Java. Drs. McNabb and Premo have strong backgrounds in limnological and water quality research. Dr. Eidman comes to the program with experience and training in fish culture and also acts as the host country principal investigator. Mr. Sumantodinata and Mr. Odang Carmen are fish culture specialists who have had their training at the Institut Pertanian Bogor and are very important to the day to day activities at the pond site, as well as Ms. Suptihay, who is responsible for the chemical analysis.

Dr. Premo left the CRSP site in mid-1984 to have her child in the U.S. She continued to work up the data through 1984 to at least complete the compilation and review for the first cycle of wet and dry season experiments on the project. A new research associate has been selected by Michigan State University to take her place in Bogor, but he is waiting clearance to come to Indonesia.

b. Logistics

The study site was selected after a special review team made its recommendation in 1982. The pond construction was basically completed during the later part of 1983, coupled with the construction of necessary docks, buildings, and other support facilities by the Institut Pertanian Bogor. All the equipment needs are in place at the present time and the program is moving on schedule.

2. Baseline Research

a. Schedule and Results

This program, which started in September 1983, has kept on schedule within the basic work plan. Wet and dry season data have been compiled and sent to the Program Management Office at Oregon State University. Project personnel have also completed a useful laboratory manual to be used by the Indonesian technicians who might be working in the future at the Darmaga Fisheries Station CRSP site. The manual includes methods for all analyses, example data sheets, and a schedule of required activities.

#### b. Quality of Research

During the first cycle of wet season studies, project staff did not have enough chemicals to follow through with some of the chemical analysis. This was not a problem for the second experiment (dry season) which was completed on November 14, 1984. The data appear to be sound, judging from the techniques used at the site. Water parameters such as dissolved oxygen, temperature, pH, alkalinity, hardness, nutrients, and chlorophyll a were taken at the site by well trained personnel. A question regarding stocking size of fish for testing was raised for the early experiments, but this should not be a future problem.

Problems related to pond seepage, evaporation, and turbidity are being addressed and taken care of.

#### c. Analysis of Data

All data have been entered in the prescribed "General Manager" system and the diskettes have been submitted to the Program Management Office. Some analysis of the data has taken place and has been shown to be helpful in the planning for studies beginning in 1985.

The CRSP-Indonesia project has been instrumental in developing standardized data sheets which have been adopted for use at all the CRSP aquaculture sites, as well as helping to develop the experimental protocol and methods for the second experimental cycle.

### 3. Site Specific Research

A site specific study was initiated to determine the effects of detergents and pesticides on fish production. This was proposed because the CRSP research site near Bogor may be affected by regional water quality problems mainly related to agricultural practices. Model charcoal and sand filter devices are being tested for removal of contaminants.

Also, in order to facilitate research activities and at the same time involve students in the CRSP program, a program was developed to allow top students to design studies using the project facilities. A rigorous evaluation is conducted by the faculty at the Insitut Pertanian Bogor of applicants before five senior level students are selected to participate in the program. This has already proven to be a very fruitful and well-recognized program in Indonesia.

### 4. Linkages

#### a. USAID Mission

The Chief of the Mission AID Office of Agriculture and Rural Development has stated they do not support the Pond Dynamics CRSP in Indonesia because it is considered irrelevant to the priorities for USAID assistance to Indonesia. He said this is a matter of budget, personnel and priorities, and emphasized that this is a new era with different emphasis under a period of budget constraints. The posture of the local USAID

Mission was an apparent turnaround, and will require resolution at the Executive Council level.

b. Country Agencies

Although fish culture has been a major activity in Indonesia for many years, little has been done to conduct systematic research to understand the specific requirements in pond dynamics to produce a good crop of fish. According to Dr. Eidman, Dean of the College of Fisheries, the fisheries faculty of the Institut Pertanian Bogor looks at this Pond Dynamics CRSP as one of the first basic research programs with which they have been involved. Information may appear to be meager now, but it should help in the future to understand basic requirements for improved fish culture.

c. Technical Advisory Committee, Executive Council, Program Manager and Other CRSP Projects

There was a question about information exchange, and it was noted a great lag time sometimes exists in getting pertinent information down to the host country from the Program Management Office.

It is suggested that the three people in the Executive Council are very busy. Will they have adequate time from their busy schedule to spend on the CRSP to ensure visibility and direction? Researchers had expected the Executive Council to be more communicative and also had looked forward to more review and interaction with the Technical Advisory Committee.

There is little contact with other country projects and this needs to be addressed. Better communication of information between country projects is desirable.

5. Summary and Conclusions

The operation in Indonesia is well coordinated between the U.S. lead institution, Michigan State University and the host country lead institution, Institut Pertanian Bogor. The collection of core baseline information as prescribed in the program plan is basically on schedule. The data base for the prescribed first cycle studies are in hand and filed in the Program Manager's Office with new studies already started for the second series of experiments beginning in 1985.

A major concern still exists because a new research associate from Michigan State University has not been brought on board at the time of this writing. This will need to be resolved as soon as possible.

Finally, the fact that the USAID Mission Indonesia Office of Agriculture and Rural Development does not support the Pond Dynamics CRSP may have impeded the normal progress of this project in Bogor. The Executive Council must take appropriate action to resolve these differences.

6. Contacts

Michigan State University:

Dr. Clarence McNabb, Principal Investigator  
Dr. Ted R. Batterson, Co-Principal Investigator

Institut Pertanian Bogor:

Dr. Muhammad Eidman, Dean, College of Fisheries, Principal Investigator  
Mr. Komar Sumantodinata, Research Associate  
Mr. Odang Carmen, Research Associate  
Ms. Pipih Suptihay, Research Assistant

USAID:

Mr. Kenneth Osborn, Project Manager, CRSP  
Dr. Richard A. Cobb, Chief Office of Agriculture and Rural Development  
Mr. Kevin Rushing, AID Mission Office

Executive Council - Pond Dynamics CRSP:

Dr. Wayne Shell, Auburn University

C. Panama - National Directorate of Aquaculture/Auburn University

Site Visit: January 9-12, 1985 by Dr. James Avault, Jr., Mr. Kenneth Osborn, and Dr. Wallis Clark

1. Background

a. Project Personnel

Host Country Principal Investigator: Dr. Richard Pretto M.  
U.S. Principal Investigator: Dr. Ronald Phelps  
U.S. Research Associates: Mr. David Hughes, Mr. David Teichert-Coddington

David Hughes, who implements the research on a day to day basis, is highly qualified and doing an excellent job. He speaks fluent Spanish and has had previous experience in pond dynamics. He has also helped to develop pond facilities. He has excellent rapport with his counterpart and the host country principal investigator. David Teichert-Coddington has only recently come on board as a second U.S. research associate for freshwater research with tilapia. David Hughes will concentrate on penaeid shrimp research in brackish water in the future.

b. Logistics

The brackish water station at Aguadulce is well established. It consists of 42 ponds each approximately 600 m<sup>2</sup> in size. Of these, 12 ponds are available for project use and an additional 10 ponds (totaling 10 ha) are to be constructed.

The freshwater station at Divisa was formerly chosen for CRSP research, but now the work will be conducted at the newly constructed station at Gualaca. The water supply at Gualaca is gravity flow but has a low total alkalinity and low total hardness. Soil/water pH is very low and turbidity is a problem. Currently the station has 16 concrete tanks, 33 ponds of 1000 m<sup>2</sup> each, and 10 ponds 300 m<sup>2</sup> in size.

The Divisa station is a well established national hatchery dedicated primarily to seed production. The hatchery has 51 ponds (totaling 6 ha). Site specific research will be done here.

Virtually all the necessary equipment is in place for water analysis except customs has held up the Kheldahl equipment. There is often a long lag time between requests for support and actual receipt of it.

2. Baseline Research

a. Schedule and Results

Brackish water ponds were in place and functioning well, so that when David Hughes came on board he could begin baseline research immediately. Brackish water research is on schedule. Production with fertilizers has been low. For example, in the first wet cycle 173 kg/ha were produced, and

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in the second dry cycle, production was 220 kg/ha. Nevertheless, good baseline data were obtained.

Because freshwater research was moved from Divisa to Gualaca, there has been a delay in conducting baseline research. Currently this research is in the middle of the first experiment of the first cycle.

b. Quality of Research

At the Aguadulce station, the quality of water analysis and related methodology is good. Fortunately an in-country chemical oceanographer has been conducting water analyses. This person recently left and now a pharmacologist trained in water analysis will assume the analytical responsibilities. Water analysis at Gualaca is done on an ad hoc basis, and it is too early to comment since this baseline research was just getting underway at the time of the site visit.

c. Analysis of Data

There is a long lag time between collecting of empirical data and synthesis of data. Auburn is now synthesizing data and Oregon State will complete the analysis in a standardized manner. This long delay does not allow enough time for feed-back to the Technical Advisory Committee in planning for future baseline research.

3. Site Specific Research

Research at the Aguadulce station involves the effect of silicates on fish productivity. Other experiments are planned as spin-off from baseline research. Baseline ponds are serving as controls for site specific research. At Gualaca, site specific research will concentrate on the problem of low primary production, mainly due to low total alkalinity. Seed production and use of feeds are also pertinent topics. A number of cooperative projects are being conducted at Divisa.

4. Linkages

a. USAID Mission

There is not a clear understanding of the goals of CRSP within the AID Mission, and some friction may exist. The Research Associate, David Hughes, is very resourceful and does receive some logistical assistance from the Mission.

b. Country Agencies

There is an excellent relationship between project personnel and the National Directorate of Aquaculture in the Ministry of Agriculture, and meetings which are relatively frequent result in a useful exchange of ideas. Personnel in the Ministry frequently interact with CRSP personnel. It helps that the host country principal investigator is an Auburn graduate and that Panama has a history of aquacultural programs.

c. Technical Advisory Committee, Executive Council, Program Manager and Other CRSP Projects

Because of the infrastructure of the CRSP program, it is difficult to have meaningful dialogue between the on-site research associate and the Technical Advisory Committee except at regular meetings (see also this section for Honduras).

5. Summary and Conclusions

Overall the brackish water component is progressing well, is on schedule, and should accomplish program goals. The baseline research and site specific research are being conducted in a professional manner. Scientific papers have been presented at an international symposium in Costa Rica, a shrimp conference in Mexico, and a national scientific symposium in Panama. A paper has also been submitted to the Journal of the World Mariculture Society.

The relationship and cooperation with the National Directorate of Aquaculture is excellent; relations with the AID Mission are only adequate.

The freshwater component is lagging behind schedule, but should catch up since ponds are available to conduct two sets of experiments simultaneously. Problems will arise because of the poor quality of source water, seepage, and acid soil conditions. This station will have ample site specific research projects to follow-up specific research projects related to these conditions. It is premature to draw further conclusions, but aside from problems mentioned above, the baseline research and site specific research should reach project goals.

6. Contacts

Auburn University:

Mr. David Hughes, Research Associate  
Mr. Nathan Stone, Student  
Dr. Carole Engle, Biologist

National Directorate of Aquaculture:

Dr. Hamed de Leon, Station Manager  
Mr. Azael Torres, Research Associate  
Ms. Graciela de Gomez, Water Chemist  
Mr. Ahmed Tunon, Biologist  
Mr. Dalys Lore, Biologist  
Mr. Juan Rodriguez, Biologist  
Mr. Ernesta Lasso de la Vega, Student  
Mr. Hipolito Chavez, Student  
Mr. Italo Quesada, Student  
Dr. Diomedes Garcia, Hatchery Manager  
Mr. Orlando Garcia, Biologist  
Mr. Jesus Moreno, Biologist  
Ms. Arcelia Kivers, Biologist  
Mr. Medando Peral, Station Manager

USAID:

Dr. Gayle Rozelle, Agriculture Officer  
Dr. Donald Drga, Assistant Agriculture Officer



D. Philippines - University of the Philippines in the Visayas/University of Hawaii

Site Visit: January 26-28, 1985 by Dr. Kenneth Chew and Mr. Kenneth Osborn.

1. BACKGROUND

a. Project Personnel

Host Country Principal Investigator: Dr. Jose Carreon  
 Host Country Research Associate: Dr. Romeo Fortes  
 U.S. Principal Investigators: Dr. Arlo Fast, Dr. Philip Helfrich  
 U.S. Research Associate: Dr. James Woessner

The on-site investigators in charge of the Pond Dynamics CRSP are Drs. Woessner and Fortes. Both are qualified researchers in water quality management and fish culture techniques. Dr. Woessner has spent several years in Japan studying fish culture practice. Dr. Fortes is trained in fisheries aquaculture and is well known for his research activities in the Philippines. Dr. Fortes is presently the Director of the Brackishwater Aquaculture Center near the city of Iloilo, where the CRSP project is carried out.

b. Logistics

The Brackishwater Aquaculture Center includes eight buildings with three chemical laboratories, one wet laboratory, one feed processing laboratory, one hatchery laboratory, and 217 units of earthen brackishwater ponds. Eighteen units of 1,000 m<sup>2</sup> ponds are devoted to the CRSP studies, with additional smaller ponds made available to the project by the Brackishwater Aquaculture Center for both baseline and special topic research. The laboratories are now equipped with most of the basic instruments and equipment for water and chemical analysis.

Aside from Drs. Woessner and Fortes, several faculty of the University of the Philippines and research staff at the Brackishwater Aquaculture Center participate directly or indirectly with the CRSP studies. This has helped in expanding the scope of CRSP activities at the Brackishwater Aquaculture Center.

2. Baseline Research

a. Schedule and Results

Basically the research is on schedule with the first wet cycle experiment conducted between June and December 1983, and the dry cycle studies completed early in 1984. After the first series of tests, the investigators felt another season or series may be required for substantiation of results. However, the first series of baseline data have been submitted to the Program Management Office with results statistically analyzed and graphed as appropriate.

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The results of the first wet season testing did provide an aid to the following dry season testing and sampling. Data on baseline studies are being generated on schedule. However, as in other country projects, some modification has taken place in design and execution of core baseline experiments. This may be difficult to control as specific site needs sometimes influence the change. Nevertheless, changes in the experimental design of baseline studies do reduce the value and comparability of results, negating, in part the purposes of baseline studies at six sites.

#### b. Quality of Research

The quality of data relates to the adequacy of research and laboratory techniques used by trained personnel. The quality of data can be difficult to judge, but direct questions to technicians and researchers indicate they are knowledgeable of what measurements they have to take for water quality. Even students who were present at the site doing their own research studies, ancillary to CRSP studies, had been thoroughly instructed by the staff in sampling and chemical analyses.

#### c. Analyses of Data

Although the data are adequately collected, the entry of this information into an acceptable format for computer use is a separate data management function as prescribed by the Program Management Office. The Philippine project has been entering their data on "DBase II", which they feel is best suited for their needs. However, since the "General Manager" system was prescribed by the Program Management Office, this discrepancy needs to be resolved soon. All projects should have the same programs to handle the data, so that data can be easily compared with other country projects. The data are being collected on time and some analysis has already taken place to assist in the planning for successive experimentation.

### 3. Site Specific Research

One of the site specific efforts is to study the effects of pond depth on water quality in shrimp ponds. Average depth could effect the chemical stratification, oxygen heat budget and other parameters in pond dynamics. They also have initiated another site specific study comparing the interaction of available "lablab" with "lumut" with respect to fish growth. Both studies have been conducted scientifically by the site staff and should be of value to understanding pond dynamics for the area.

There are some related student projects that will be of value to the overall CRSP program. These are reviewed carefully by the staff before they are started.

It was noticed in the presentation of site specific studies to the external evaluator who visited the site that a good exchange of questions among the researchers took place; they quizzed each other very specifically on statistics and interpretation of results. This is a good sign as it will lead to better research studies related to the project.

#### 4. Linkages

##### a. USAID Mission

Although frequent visits have been made by project investigators to the Mission AID office, interaction is passive at best. There is an indication that the AID Mission was basically interested only at the beginning stages of the CRSP to see how it was tied into the basic Philippine government needs. It was pointed out the Pond Dynamics CRSP falls into one of the government's high priority areas (especially in the area of Tilapia culture), so the AID Mission Office in Manila recognizes the role of the program.

##### b. Country Agencies

The fish farmers are coming to the Brackishwater Aquaculture Center to share what they feel are their priority research needs in their culture operations. This helps the researchers to consider site specific studies that will address some of the farmers' needs. Visits with some fish farmers indicate the staff at the Brackishwater Aquaculture Center are most helpful, including the personnel involved with the CRSP. The local community and farmers support the activities of the CRSP at the Brackishwater Aquaculture Center due to the excellent interaction the staff has with the local fishermen and appointed political leaders of the community.

##### c. Technical Advisory Committee, Executive Council, Program Manager and Other CRSP Participants

The question of information exchange was one of the biggest issues. Communications from the Program Manager's office and between projects in different countries has to be improved. The Program Manager's Office should see how this can be accomplished. There is a feeling of no direct interaction with the Technical Advisory Committee. Advice is only provided at the beginning and little thereafter. It may be advisable to increase the size of the Technical Advisory Committee.

#### 5. Summary and Conclusions

The project at the Philippines site has provided good baseline information for the CRSP studies. The staff involved with the project is technically trained to handle the design of experiments, sampling, and analytical requirements, as well as to assist students in discrete studies helpful to the Pond Dynamics CRSP.

#### 6. Contacts

University of Hawaii:

Dr. James Woessner, Research Associate  
Mr. Steven S. Katase, Student

University of the Philippines of Visayas:

Chancellor Dionosa Rola  
Vice-Chancellor Roger Juliano  
Vice-Chancellor Arce Comacho  
Dr. Jose Carreon, Dean, College of Fisheries  
Dr. Virgil Dureza, Associate Dean, College of Fisheries  
Dr. Romeo Fortes, Director, Brackishwater Aquaculture  
Center, Research Associate  
Professor Varleriano L. Corre, Jr., Biologist  
Dr. Yvonne Chiu, Biologist  
Ms. Carmen Gempio, Research Assistant,

USAID:

Mr. Kenneth Osborn, Project Manager  
Mr. Douglas Clark, Chief, Office of Rural and Agriculture  
Development  
Mr. Noel Ruiz, Fisheries Specialist

ICLARM:

Dr. Richard Neal, Director General, International Center for  
Living Aquatic Resources Management

E. Rwanda - National University of Rwanda/Oregon State University

Site Visit: February 18-22, 1985 by Dr. Richard Neal, Mr. Kenneth Osborn, and Dr. E.W. Shell

1. Background

a. Project Personnel

Host Country Principal Investigator: Dr. Valens Ndoreyaho  
Host Country Research Associate: Not yet selected  
U.S. Principal Investigator: Dr. Richard Tubb  
U.S. Research Associate: Dr. Boyd Hanson

Dr. Hanson is well qualified to study the basic ecology and dynamics of pond systems and his experience in water chemistry will be valuable for completion of the project research activities.

b. Logistics

Initial plans to conduct research at an existing aquacultural development facility were abandoned at the recommendation of the National University for a variety of political and site related reasons. In the opinion of the review team this was an appropriate decision. Since no alternative facility was available, project work was diverted to construction of a suitable facility with funds available from the European Economic Community. Auburn University personnel stationed in Rwanda on an aquacultural development project provided technical assistance to the project staff on pond construction methodology. The construction involved renovation of an abandoned fish culture station with major reconstruction and earth moving using hand labor. Construction work is nearing completion and the site and required fish seed will be available October 1, 1985 for initiation of the research. Research ponds constructed for this research are of excellent quality and many problems encountered at other sites with imperfect ponds will be avoided. Dr. Hanson, with the assistance of the National University and with funding for construction from the European Economic Community, has done an excellent job of renovating and reconstructing a facility that was previously useless.

A new field laboratory for analytical work was also constructed on the site. Equipment and supplies are in place to conduct the research.

2. Baseline Research

a. Schedule and Results

The research is far behind schedule as a result of the decision discussed above. As 20 research ponds will be available, plans are being made to conduct two cycles simultaneously, thereby reducing the overall time required to complete research by one-half. This plan will quickly bring the project in line with the schedule of the other projects.

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b. Quality of Research

No baseline research has been conducted. Technicians are being trained in analytical methods so should be prepared to conduct analyses correctly.

c. Analysis of Data

No data have been collected.

3. Site Specific Research

Some preliminary production/demonstration experimentation has been initiated in available ponds but major site specific research has not been initiated.

4. Linkages

a. USAID Mission

An excellent working relationship exists with the Kigali USAID personnel. The Mission has been helpful and supportive in numerous ways and views the CRSP as a worthwhile and politically important project.

b. Country Agencies

A high level of interest and support exists in the National University as reflected during meetings with the University President and with the Dean of Agricultural Sciences. National interest is reflected by three visits to the site by the President of Rwanda. Cooperative relationships exist with several other agencies in Rwanda.

c. Technical Advisory Committee, Executive Council, Program Manager and Other CRSP Projects

Field personnel feel isolated and would appreciate strengthened lines of communication. Better communication of actions and recommendations of the Technical Advisory Committee, Executive Council and Program Manager are desirable and should be accomplished through greater involvement by the Oregon State Principal Investigator. The Principal Investigator should visit the research site to become fully aware of project activities, problems and opportunities and to strengthen communication links with university staff.

5. Summary and Conclusions

Irregardless of delays caused by changing research sites, the External Evaluation Panel supports the decision made and believes the course of action taken was the most appropriate of alternatives available. The construction work completed is of excellent quality and a fine facility is now available for the research. The construction of this new facility has strengthened the support for the project in Rwanda and has been beneficial from a political as well as from a research standpoint.

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Since an unusually large number of research ponds (20) are now available for the research, the project can quickly catch up with other projects. Personnel should be complimented for their excellent work and for taking positive steps that (with support from the European Economic Community and the Auburn in-country project) have saved the project from failure. External Evaluation Panel members believe the project is now in a position to add significantly to the program and that scheduled baseline research will now be conducted in a technically sound and highly acceptable fashion. This is a good project in spite of its slow start.

#### 6. Contacts

##### Oregon State University:

Dr. Boyd Hanson

##### National University of Rwanda:

Dr. Valens Ndoreyaho, Professor  
Dr. Abdul Kamamzi, Dean, Faculty of Agriculture  
Rector of the University  
Vice-Rector of the University

##### USAID:

Mr. Eugene Chiavaroli, Director  
Mr. Michael Fuchs-Carsch  
Ms. Rosemary Depp

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F. Thailand - Department of Fisheries/University of Michigan

Site Visit: February 4-7, 1985 by Dr. Richard Neal, Mr. Kenneth Osborn, and Dr. E. W. Shell

1. Background

a. Project Personnel

Host Country Principal Investigator: Dr. Thiraphan Bhukaswan

Host Country Research Associate: Mr. Vijai Srisuwantach

U.S. Principal Investigator: Dr. James Diana

U.S. Research Associate: Dr. C. Kwei Lin

Dr. Lin is well qualified for the field research and draws upon research experience in limnology, water chemistry, and biology. He is respected by Thai researchers, many of whom have Ph.D's in fisheries, and has an excellent working relationship with counterparts and colleagues. Cooperation of Thai biologists and research station staff is very good and is essential to the successful execution of the research. Turnover of Thai counterpart staff has been high and has necessitated retraining of new assistants.

b. Logistics

Selection of the initial experimental site (Nong Sua), an area subject to flooding and with a severe acid-sulfate soil problem, was an error that has delayed research. A new site has been selected (Bang Sai) where project personnel have resumed experimentation in an effective and highly satisfactory fashion. Minor problems with water supply and seepage from some ponds are being addressed. The facilities and equipment available to the project are judged to be adequate for successful continuation of the research.

2. Baseline Research

a. Schedule and Results

Progress of the research is slightly behind schedule due to the change in research sites and need to repeat some experiments. This does not pose a serious problem and the project will soon be roughly even with other projects in terms of the research schedule. Research is being conducted on baseline activities closely following the research design.

b. Quality of Research

Chemical analyses, measurements and research techniques reflect a high level of accuracy and analytical expertise. Only a few measurements (e.g. wind speed and total nitrogen) require additional standardization or equipment to ensure comparability with data collected at other CRSP sites.



### c. Analysis of Data

Some preliminary analysis of data in the field and at the University of Michigan is underway. Procedures for collective analysis of data for all projects at Oregon State University are inadequate and behind schedule. It is expected that this shortcoming may soon limit the ability of the Department of Fisheries/University of Michigan team to plan and coordinate research fitting well as part of the program.

### 3. Site Specific Research

Pertinent special experiments underway include examination of the role of nesting in water turbidity and rearing of sand goby with emphasis on nutritional aspects of larval culture. Site specific research will focus on the relative roles of autotrophic and heterotrophic organisms in the food chain of fertilized ponds. It may be necessary to work more closely with Department of Fisheries personnel in the future to ensure that their interests are addressed in the site specific aspects of the research.

### 4. Linkages

#### a. USAID Mission Bangkok

An excellent working relationship exists with USAID and Mission personnel have been helpful and supportive of the project in a number of ways. Good opportunities exist for interaction and cooperation with related fisheries research and development activities.

#### b. Country Agencies

The only serious issue identified during the site visit is the communication between Department of Fisheries and CRSP personnel. Although the objectives and approach to research on pond dynamics were carefully explained to Thai fisheries personnel and a memo of understanding was signed before the project was signed, Department of Fisheries personnel have changed and some high level individuals would prefer to have the research more closely oriented toward immediate Thai interests. Additional communication is required by high-ranking Michigan personnel with high-ranking Fisheries personnel to further communicate:

- The purposes and value of the CRSP,
- the applicability of site specific research to Thai problems,
- the opportunities Thai Fisheries people have had and continue to have to influence the research being done, and
- the willingness and interest of the CRSP team to address specific Thai problems related to pond dynamics as part of the site specific research.

The overall relationship with the Department of Fisheries is a good one in spite of this communication gap. Better communication between the U.S. and Thai principal investigator is needed.

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- c. Technical Advisory Committee Executive Council, Program Manager and other CRSP Project.

These linkages appear adequate and are developing as the program matures. The research associates expressed some frustration concerning delays in communication and their isolation from planning processes.

## 5. Summary and Conclusions

Overall the project is a sound one and is moving forward, on course, in an effective, technically correct fashion. The decision to change sites was the correct one. Project personnel should be commended for the level of local cooperation generated, for their adherence to research plans and for their careful and thorough collection of data.

The contracting agency may have slightly underestimated the cost of project execution and a slight increase in funding would be useful in ensuring the benefits to both U.S. and Thai institutions, the full and thorough execution of the research and the execution of strong site specific research of interest to the Department of Fisheries and the USAID Mission.

Additional efforts to improve communication are required.

Project research matches planning and design criteria and is being carried out properly.

## 6. Contacts

### University of Michigan:

Dr. C. Kwei Lin, Research Associate

### National Inland Fisheries Institute:

Dr. Thiraphan Bhukaswan, Director  
Mr. Vijai Srisuwantach, Research Associate

### Department of Fisheries:


Dr. Vanich Varikal, Director General  
Dr. Plodprosop, Deputy Director  
Dr. Bang Orn, Deputy Director  
Mr. Robert Ralston, Advisor  
Dr. Alex Federak, Advisor

### USAID:

Dr. John Foti, Agriculture Officer  
Dr. Robert Ressig

## ANNEX A

## CRITERIA FOR PROJECT REVIEWS

- A. What is the present status of the project with respect to:
1. Accomplishment of the baseline research plan
    - staying on schedule
    - quality of research techniques (e.g., sampling and analysis) and consistency with work plan specifications
    - data management (i.e., record keeping and data analysis)
  2. Accomplishment of site specific research objectives
    - schedule
    - quality of research techniques
    - data management
  3. Reporting and dissemination of information
  4. Relationship between U.S. Principal Investigator/Contracting Institution and field personnel
  5. Relationship between U.S. and Host Country participants (e.g., training and institution building activities)
  6. Relationship between CRSP participants (U.S. and Host Country) and U.S. AID Mission staff; CRSP participants and representatives of other in-country programs and projects
  7. Relationship between project personnel and program management (i.e., the Program Management Office, Executive Council, Technical Advisory Committee)
  8. Benefits to the U.S. Institution
  9. Contribution to program goals
- B. What is the potential for project achievement relative to the above nine points?
- 

CRITERIA FOR PROGRAM REVIEW

1. Is the program attaining its goals?
2. Is the organization and management serving program needs:
  - a. Is the Management Entity effective?
  - b. Is the Executive Council effective?
  - c. Is the Technical Advisory Council effective?
  - d. Is the AID Project Manager effective?
3. Is the technical program functioning as described in the program proposal with respect to:
  - a. Work plan
  - b. Data management
  - c. Information dissemination
  - d. Interaction among program participants

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## ANNEX B

## CRSP CONFERENCE PARTICIPANTS

March 18-22, 1985

James Avault	Louisiana State University
Ted Batterson	Michigan State University
Alfred Beeton	University of Michigan
Nancy Brown	Oregon State University
Thiraphan Bhukaswan	Thailand, National Inland Fisheries Institute
Jose Carreon	University of Philippines
Kenneth Chew	University of Washington
Wallis Clark	University of California, Davis
Hamet DeLeon	Panama Research Representative
James Diana	University of Michigan
Muhammed Eidman	Indonesia, Bogor Agricultural University
Jonathan Espinoza	Honduras, Directorate of Renewable Natural Resources
Arlo Fast	University of Hawaii
Donald Garling	Michigan State University
Tejpal Gill	USAID, Washington, D.C.
Bart Greene	Auburn University
Boyd Hanson	Oregon State University
Philip Helfrich	University of Hawaii
David Hughes	Auburn University
William Fred Johnson	USAID, Washington, D.C.
James Lannan	Oregon State University
C. Kwei Lin	University of Michigan
Clarence McNabb	Michigan State University
Valens Ndoreyaho	Oregon State University
Richard Neal	International Center for Living Aquatic Resources Management
Kenneth Osborn	USAID, Washington, D.C.
Ronald Phelps	Auburn University
Ziad Shehadeh	Kuwait Institute for Scientific Research
E. W. Shell	Auburn University
R. O. Smitherman	Auburn University
George Tchobanoglous	University of California, Davis
David Teichert-Coddington	Auburn University
Richard Tubb	Oregon State University
James Woessner	University of Hawaii

**ADMINISTRATIVE MANAGEMENT REVIEW**  
of the  
Pond Dynamics/Aquaculture CRSP

by

Tejpal Gill, S&T/AGR  
and  
William F. Johnson, BIFAD/S

March 18-21, 1985  
Honolulu, Hawaii

I. THE SCOPE OF THE REVIEW

The review was a limited one, confined to interviews and discussions with principals involved in the CRSP and attending the planning sessions of the CRSP organizations. These included: U.S. and host country Principal Investigators; Research Associates from all six country projects; members of the Executive Council; the External Evaluation Panel; the Program Management Office; and the AID and BIFAD representatives; altogether 35 people attended.

It was not considered necessary or cost-effective to make an extensive review to include visits to participating institutions and interviews with administrative officials of these institutions. This course was taken because of satisfactory progress made by the CRSP, which indicated no serious administrative/management problems.

II. OBSERVATIONS AND SUGGESTIONS

The criteria used for any suggested changes were those contained in the amended CRSP Guidelines, published on June 21, 1985. The Management Entity had already noted most of those differences in structure and mode of operations from those prescribed in the Guidelines that are identified in this review. In fact, action has already been taken by the Management Entity to bring most of these differences into conformity with the Guidelines.

A Board of Directors Vice The Executive Council

The functions of the Council are those laid down in the Guidelines for the Board of Directors. The reviewers are pleased to note that the Management Entity and the Council have already decided to change this body to the Board of Directors and expand its membership.

The reviewers suggest that further modifications be taken to conform more fully with the Guidelines as follows:

- that the five principal participating U.S. institutions be represented on the Board of Directors; that membership be rotated periodically (one to two years) among institutions, excepting Oregon

State University, the Management Entity, when there are more than five participating U.S. institutions;

- that Oregon State University, because of its program responsibility and accountability to AID, be allowed a permanent seat on the Board. Elevation of the status of Oregon State's Principal Investigator would eliminate one of the anomalies that exist there.
- that the functions of the Board be confined principally to policy-making and guiding preparation for a reviewing annual budgets and annual plans developed by the Technical Committee, and that the Board not be engaged in operational details.
- that an additional Board member be selected from an institution not participating in the CRSP in any way in order to inject more objective thinking (a recommendation that will be considered by BIFAD for all CRSPs).
- that the Board may consider creating an Executive Committee to handle interim matters not warranting the convening of a plenary session of the Board.

#### A Technical Committee Vice The Technical Advisory Committee

The reviewers are also pleased to note that the Management Entity and Council have decided to create a Technical Committee composed of Principal Investigators of participating institutions with functions prescribed in the CRSP Guidelines to replace the Technical Advisory Committee.

It is believed that replacement of the top-down planning, necessary in initial stages, with planning by those engaged in the research will solve one of the elements of discord noted. This will require a closer liaison between the Principal Investigators and project Research Associates than appears to have existed in some instances in the past.

The principal functions of the Technical Committee should be to develop a draft of an integrated global research plan and budget annually with five-year roll-forward projections. The origin of the integrated plan and budget would be with each project (composed of a Principal Investigator of the U.S. and host country institution and the Research Associates) and adjusted integrated by the Technical Committee. Such annual plans and budgets would be submitted to the Management Entity and Board for review and approval. The operations of the Technical Committee could be facilitated by subcommittees. The annual budget and plan would be developed by the Technical Committee from overall guidelines passed to it by the Management Entity and the Board according to financial allocations and instructions provided by AID.

It should be the function of the Technical Committee to reconcile differences among projects based on the needs of an integrated global plan. This should be done without competitive bidding among projects of countries and institutions on submitted research proposals.

The Technical Committee should be permitted to use consultants as needed to fill gaps in disciplines on special tasks.

### The Principal Investigators

Principal Investigators are considered to be those principal scientists at the U.S. and host country institutions who devote a significant amount of their time in participating in the CRSP in actual research, in planning research, in supervising, guiding, assisting, and counselling the Research Associates operating in the field.

There were indications of weaknesses in the link among some U.S. Principal Investigators and institutions in this respect. These weaknesses appear to be derived from overloading of some Principal Investigators by the institutions.

It would be helpful to the projects for the Principal Investigator and Research Associate to develop an annual work plan and calendar of events and meetings so that each would know the appropriate timing for exchanges of visits and submissions to reduce delays.

### The Management Entity in the Chain of Communications

The Management Entity in the chain of communications could be greatly improved by the addition of a full-time professional in the office with the authority to act in the absence of the Director. Since the Director's job is only part-time, the full-time employee could be a deputy. While the person accepting this position need not be a full-fledged fisheries scientist, some experience or knowledge in this field would be appropriate to facilitate communications.

### The Global Objective of the CRSP

There is need for a clearer statement of the goal of this CRSP. Its goal and purpose are not well understood within AID and, in fact, within the CRSP itself. The general misunderstanding is that its sole purpose is to increase fish production in pond culture. It is suggested that another effort be made to articulate the goal clearly and concisely, drawing on the explanation contained in the recent Aquaculture Newsletter (Vol. 3, No. 1 dated Spring 1985).

### The Matching Budget

The allocations of matching resources among U.S. institutions need to be more precisely identified as to source and use. The practice among other CRSPs is to identify the individuals and their time and portion of salary which are being counted for matching purposes, as for example 15% of the time of "x" Principal Investigator, equivalent to \$6,000 per year. If the match is for overhead, or whatever, this should be identified and described in the budget.

The reviewers could make no judgement of how much time is FTE's equivalent of Principal Investigator's time that is being devoted to the

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CRSP activity. More careful budgeting detail could clarify exactly what is being counted as match.

Research Component in the United States

The reviewers note the continued lack of an adequate research component in the United States, although some progress appears to have been made in planning a global data analysis component. Implementation of this appears to be hung up on who is to do this, and how it is to be done.

It is suggested that the Technical Committee resolve this question with guidance from the Management Entity and with the help of consultants, if needed.

A biological and/or physical research component might be considered when needed to back up the research being conducted in developing countries.

**CRSP RESPONSE TO RECOMMENDATIONS OF THE EXTERNAL EVALUATION PANEL  
REPORT AND AID MANAGEMENT REVIEW**

The consensus among CRSP participants is that the External Evaluation and the AID Management Review have been a worthwhile exercise. The reviews were very positive and resulted in constructive recommendations that can strengthen the CRSP. The purpose of this section is to describe the action taken or anticipated by the CRSP in response to the recommendations of the External Evaluation Panel (EEP) and AID Management Review.

Although the External Evaluation Panel Report and the AID Management Review address the performance of the CRSP organization, it is implicit throughout both that the CRSP is in fact a partnership between AID, U.S. universities and institutions in developing countries. The responses described in this section are ones that the CRSP can address unilaterally. However, both documents contain recommendations that transcend the CRSP organization and must also be addressed by AID.

Response to the Recommendations of the External Evaluation Panel

A synopsis of recommendations of the External Evaluation Panel may be found on page B-7 of the External Evaluation Panel Report. The recommendations are repeated below along with the action taken or intended by the CRSP in response to each recommendation.

**RECOMMENDATION:**

*At least two members be added to the Executive Council from participating Host Country Institutions.*

**CRSP RESPONSE:**

After lengthy discussion of the implications of various options to reorganizing the CRSP Board of Directors (formerly Executive Council), the Board has elected not to modify its structure.

The primary reason underlying the Board's decision goes back to the earliest stage of CRSP development. The three entities participating in the CRSP, Auburn University, the University of California, Davis, and CIFAD were among a large number of institutions competing for the designation as CRSP Management Entity. AID had narrowed its selection to these three finalists but was deadlocked on the final selection of a contractor. AID subsequently called representatives of the three finalists to a meeting in Washington, D.C. and asked them to break the deadlock. The three parties acting, on their own initiative, agreed to organize a tripartite council of qualified institutions into an informal consortium through a Memorandum of Understanding between Auburn University, the University of California, Davis and CIFAD. Oregon State University was elected to serve as Management Entity for the CRSP.

This Memorandum has served as the policy statement for administration of the CRSP for nearly six years. Although the approach was somewhat unorthodox, it has worked. Each institution has honored its commitments under the Memorandum of Understanding and each institution has made substantial compromises to insure satisfactory performance of the CRSP.

The Board has concluded that in view of the history of the CRSP and the nature of the agreement under which the institutions have cooperated, it would be contradictory to the spirit of the Memorandum of Understanding to change the structure of the Board of Directors.

Although the Board showed sensitivity towards the suggestion to add host country representation to the Board, the financial and logistic implications of this change would result in a significant change in the close working relationship that the Board has established with the Management Entity. The Board presently meets frequently to act on policy and funding matters and consequently is well advised and deeply involved in matters of CRSP management. The addition of host country membership would, of necessity, greatly reduce the frequency of Board Meetings, probably to no more than one per year, and thus result in a titular Board of Directors.

The Board considered a compromise structure that would involve the three present members plus two appointed from host country institutions. It would then create a standing Executive Committee composed of the three U.S. members who could meet frequently to continue interaction as in the past. The full Board would meet once annually. This alternative was rejected because it would be insulting to host country participants. The newly organized Technical Committee (see below), will provide broad voting representation for host country participants. This is a fairer and more intellectually honest alternative to equitable representation of all parties and captures the intent of the External Evaluation Panel recommendation.

#### RECOMMENDATION:

*The Technical Advisory Committee be strengthened by adding two members with expertise in some of the following fields: data processing/management, pond ecosystems, brackish water ecosystems, shrimp pond aquaculture.*

#### CRSP RESPONSE:

The CRSP intends to replace the existing Technical Advisory Committee with a newly organized body to be called the Technical Committee. The Committee will be composed of all U.S. and host country Principal Investigators of funded CRSP activities, at-large members appointed by the Board of Directors to broaden the base of expertise. Initially the three members of the former Technical Advisory Committee will be designated at-large members of the Technical Committee.

There will be four standing subcommittees organized from among the Technical Committee membership. These are: Workplans, Technical Progress, Budgets and Materials and Methods. The standing committees will prepare

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materials for consideration by the fully assembled Technical Committee at its annual meeting. The Committee will make recommendations to the Board on virtually all aspects of CRSP technical activities.

RECOMMENDATION:

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

CRSP RESPONSE:

The Research Team composed of the Principal Investigators (host country and U.S. institution) was formed upon implementation of the CRSP. The Research Team has met once during each year of CRSP operations and prepared workplans as described in the proposal. It is assumed that the recommendation of the External Evaluation Panel refers to the appointment of a standing body of 12 to 15 scientists to provide additional expertise. This body has not been appointed to date because of funding constraints. However, the Research Team as it has existed brings a very broad range of technical expertise to the process of CRSP workplan development. The newly organized Technical Committee combines the best attributes of the former Technical Advisory Committee and Research Team and should greatly streamline CRSP technical administration without increasing costs. It is noted that this change is consistent with the guidelines for CRSPs.

RECOMMENDATION:

*The administrative chain be abbreviated and communications with field projects be improved to permit quicker technical backstopping.*

CRSP RESPONSE:

The CRSP has implemented a new policy whereby communications from the Program Management Office to the technical participants will be made to all participants concurrently. This policy replaces the former one of communication with principal investigators who then disseminated information to their project staff. This change of policy will expedite the dissemination of information, with only modest additional workload and cost burden on the Management Office.

RECOMMENDATION:

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

CRSP RESPONSE:

The CRSP agrees with this recommendation and had already intended to shift to a biennial research planning schedule. The CRSP Technical Committee will continue to meet annually. However, workplans will only be finalized in alternate years. During the intermediate years the standing committees of the Technical Committee as well as the CRSP Data Synthesis Team will have additional time to analyze results and draft materials for consideration in developing subsequent workplans.

RECOMMENDATION:

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

CRSP RESPONSE:

As noted in the Triennial Summary (see Host Country Special Topics Research projects), service to AID Missions and Host Country Institutions is to some degree a cost of doing business in the various countries. The needs of each country differ and the needs within a country change from time to time, especially as personnel rotate through the AID Missions. The CRSP has and will continue to place the highest priority on the global research objectives but recognizes that compromises will be necessary to continue the CRSP experiment in some countries. The ultimate solution to this problem would be an AID policy clarifying the role of Missions in determining CRSP objectives.

RECOMMENDATION:

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

CRSP RESPONSE:

The Central Data Management System is now operational. The Program Management Office has added a data base management specialist to its staff and the CRSP has designated a Data Synthesis and Modelling Team. Funding for the Team is in place and the activity is underway. The Team will present a quantitative synthesis of CRSP data to the participants during the next annual meeting in March of 1986.

RECOMMENDATION:

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

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## CRSP RESPONSE:

The recently issued third workplan addresses these and other methods. More importantly the newly appointed Materials and Methods Subcommittee of the Technical Committee provides the CRSP with a permanent mechanism to continuously review and, where appropriate, improve analytical methods employed in CRSP research.

## RECOMMENDATION:

*The Research Team specify standard methods for chemical analyses of brackish water and insure additional documentation of soil chemistry and benthic productivity in both fresh water and brackish water ponds.*

## CRSP RESPONSE:

Analytical methods for brackish water have been included in the recently issued third workplan. The need for additional documentation of soil chemistry and benthic productivity will be identified in the course of the quantitative data synthesis now underway. Again, the standing subcommittees of the newly organized Technical Committee will provide a mechanism for determining these and other needed documentation on a continuing basis.

## RECOMMENDATION:

*The Research Team insure uniformity of the test species Tilapia nilotica among projects by identifying a common source and verifying genetic makeup using standardized electrophoretic tests.*

## CRSP RESPONSE:

The CRSP intends to initiate a project surveying the genetic diversity among Tilapia nilotica stocks used in CRSP research. This project will be a part of the U.S. Research Component. Proposals received in response to an earlier Request for Proposals are presently in the process of peer review. The CRSP intends to select a contractor for this activity during January 1986. The contractor will attend the Annual CRSP Meeting in March and will coordinate logistics and sampling procedures with representatives of each of the CRSP projects at that time. The electrophoretic analysis will commence upon receipt of samples from the various project locations.

## 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.*

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CRSP RESPONSE:

This has only been a problem in one country (Panama) and has not been a major deterrent to technical progress. Each project must deal with staffing needs on an individual basis. However, the CRSP workplans provide alternative approaches for soil and water analysis by sending samples to approved U.S.D.A. testing laboratories in cases where specific countries may not have these capabilities.

RECOMMENDATION:

*The Management Entity initiate consultations with USAID (Washington, D.C.) and USAID Country Missions to encourage provision of additional logistic support to U.S. field staff and to insure continued commitment to ongoing projects by USAID Missions as Mission staff personnel change.*

CRSP RESPONSE:

The Management Entity has and will endeavor to maintain the strongest possible working relationships with AID Washington through its Office of Agriculture, Bureau for Science and Technology, and with regional bureaus and missions. The Management Entity notes that missions typically do not provide logistic support to CRSP projects. However, the CRSP projects have enjoyed excellent cooperation from most missions. In the absence of an agency policy regarding CRSP mission interactions, the best a Management Entity can do is to pledge to continue to work closely with the Agency to prevent problems from arising, and to work diligently to resolve problems that do arise.

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.*

CRSP RESPONSE:

The Program Management Office has implemented a Technical Information Service. The Assistant Program Manager provides bibliographies and title pages of appropriate journals directly to field staff on a monthly basis. The field staff forward their requests for articles of interest to their U.S. Principal Investigator, who is responsible for initiating requisition of the materials for his or her project.

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## RECOMMENDATION:

*Increased interaction among field projects be encouraged through site visits and/or joint workshops under the guidance of the Technical Advisory Committee.*

## CRSP RESPONSE:

The CRSP participants heartily endorse this recommendation. However, the reality of CRSP funding is such that even one meeting annually, as is presently practiced, severely taxes the CRSP budget. It is anticipated that the new organization of the Technical Committee will facilitate greater interaction by providing a higher degree of organization of data and planning materials to be discussed at each annual meeting (Workshop).

## RECOMMENDATION:

*USAID consider a modest increase in budget to; a) strengthen collaborative research at U.S. universities, b) increase input by U.S. Principal Investigators 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.*

*So, what's new in this matter?*

## CRSP RESPONSE:

This recommendation is clearly directed to USAID rather than the CRSP. The CRSP certainly concurs with the recommendation noting that the Honduras and Panama projects are not the only underfunded projects. Funding is absolutely minimal for all of the CRSP activities, especially in view of the level of effort being undertaken.

*Really.*

## RECOMMENDATION:

*The Management Entity take necessary steps to see that field personnel are experienced senior researchers who command the respect of their host country counterparts.*

## CRSP RESPONSE:

This is a curious recommendation in that it would seem to imply that CRSP Research Associates employed up to this point do not satisfy these criteria. This is certainly not the case. The CRSP Research Associates, both the U.S. and Host Country, are highly qualified professionals.

A Management Entity is limited in determining who participating institutions should assign to the field projects. Each institution has its

*of*



own personnel and affirmative action policies. Each institution has different goals and purposes relating to its participation in the CRSP.

Although personnel assignments to date have been highly satisfactory in terms of technical competency, The CRSP Management will continue to encourage contractors to address the preparation of U.S. personnel for overseas service. The CRSP Board of Directors has recently implemented a policy stipulating that personnel selected for overseas assignment who do not have previous experience working for an international development agency at an overseas location, should attend the AID orientation course before undertaking overseas service.

#### CRSP Response to AID Management Review

The AID Administrative Management Review does not provide concise recommendations analogous to those provided by the External Evaluation Panel. This section describes the CRSP action taken or anticipated in response to the comments in the Management Review regarding various CRSP activities.

The concerns of the Management Review Team relating to the Board of Directors and Technical Advisory Committee parallel the recommendations of the External Evaluation Panel and have been addressed in the CRSP response to External Evaluation Panel recommendations. The remaining concerns are addressed below.

#### The Principal Investigators

The CRSP shares the concerns of the reviewers regarding Principal Investigator's participation in some projects, and will continue to encourage more active participation in cases where weaknesses exist. It is noteworthy that an additional U.S. Co-Principal Investigator has been assigned to the Rwanda project.

The suggestion that Principal Investigators and Research Associates develop annual workplans and calendars is an excellent one and will be implemented.

#### The Management Entity and the Chain of Communications

The problem referred to by the reviewers was a temporary one. The CRSP Management Office has routinely employed an Assistant Program Director. Unfortunately, one of the persons occupying this position resigned to accept another position in February of 1985. Selection and training of a replacement required several months. Unfortunately, the External Evaluation, including the Administrative and Management Review, was accomplished during this interval. The Program Management Office staff now includes, in addition to the Program Director, an Assistant Director (Communications and Administration), and an Assistant Director (Data Base Management and Technical Affairs).

### The Global Objective of the CRSP

This is a very difficult concern to address as it does not state by whom a clearer statement of goals is needed. The CRSP will continue to attempt to clarify its goals, objectives and operations for Agency personnel not knowledgeable about Fisheries and Aquaculture. It is hoped that in addition to articles appearing in the CRSP newsletter, the description of the CRSP experiment appearing in the Triennial Summary will be of further assistance.

### The Matching Budget

The CRSP Management Office does not presently maintain detailed accounting on cost sharing as suggested in this report. The reason it has not is because such accounting is not specified in the CRSP grant. The Management Office would be happy to comply with this request if the Agency wishes to increase funding allocations accordingly. Ha, Ha!

Oregon State University as Management Entity for the CRSP does provide reports of cost sharing to the Federal Government in accordance with the provisions of the Grant and the Federal Reserve Letter of Credit.

### Research Component in the United States

The CRSP has implemented a U.S. Research Component. At the present time four projects have been funded and two additional projects are under review (see Triennial Summary). It is anticipated that they will be funded early in calendar year 1986. The CRSP would be pleased to implement a U.S. Research Component of broader scope if additional AID funding is available for these activities. The CRSP feels that these six projects, together with the participation of U.S. Universities in the Global Experiment and cooperation in the Host Country Special Research projects satisfies the mutual beneficial intent of Title XII. Ha Ha!

PART C

CONTINUATION PROPOSAL

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## INTRODUCTION

This document describes a five year forward-rolling program plan for continuation of the CRSP. It includes plans for the CRSP research program, CRSP organization and management, a work schedule, and a financial plan.

### PLANNING GUIDELINES

In developing the continuation proposal, the CRSP organization has critically evaluated its technical goals and objectives as well as its organizational and management structure. This evaluation was based upon experience gained during the first three years of CRSP activities, including, 1) the experiences of CRSP participants, 2) external evaluations of the CRSP, and 3) the experiences of other CRSPs.

#### Experiences of CRSP Participants

The CRSP organization has been together for over five years. It has functioned very well through the planning stages and into the implementation of research activities. In the course of this experience the CRSP participants have put forth a number of very constructive suggestions for improving both the research program and the efficiency of CRSP management. The proposal detailed below incorporates many of these suggestions.

#### External Evaluation

The Triennial Review was conducted in a very positive manner and resulted in a number of very constructive recommendations and most of these have been incorporated in the continuation proposal.

#### Experiences of other CRSPs

The Board for International Food and Agricultural Development recently issued revised Guidelines for the Collaborative Research Support Programs. These guidelines are based upon experience gained in administering a number of CRSPs over a relatively long period of time. In so far as is practicable, the continuation proposal intends to bring the Pond Dynamics/Aquaculture CRSP into consistency with the Guidelines. It is noteworthy that the revised CRSP organization and management fits neatly into the organizational scheme illustrated on page 5 of the Guidelines.

#### Development of the Continuation Proposal

The approach taken to developing this proposal has been to draw upon the experiences described above to identify existing strengths of the CRSP on the one hand, and areas that can be strengthened on the other. This information was then used to develop a five year plan that builds upon existing, demonstrated strengths while incorporating appropriate revisions intended to take advantage of the opportunities to improve overall program performance.

## RESEARCH PROGRAM

The CRSP research program proposed for the fourth through eighth year is a continuation of the global experiment reinforced with host country and U.S. Special Topics Research Projects. These components and their purposes are described in Part A: Triennial Summary of CRSP activities.

### THE CRSP GLOBAL EXPERIMENT

The rationale underlying the global CRSP experiment is to compile a detailed physical, chemical and biological baseline on a variety of pond environments and then proceed to observe the responses to various manipulations of these environments. Synthesis of the resulting data is directed towards quantitative descriptions of the pond environments. These quantitative descriptions will then be translated into management models on the one hand and production functions on the other. Parts A and B of this Triennial Summary indicate that the CRSP has made excellent progress in implementing the global experiment.

The proposed continuation of the CRSP global experiment builds upon the progress achieved during the first three years. The objectives and research plan are summarized. This plan represents a logical progression toward achievement of the longer range experimental objectives and goals.

For descriptive purposes it is convenient to consider two major elements of the global experiment; the field experiments conducted in the several host countries and the data analysis, synthesis and modelling activities.

#### Field Experiments

As noted in Part A, the CRSP developed work plans for three experimental cycles during the first three years. The experiments are presently in progress at seven locations in six countries.

Research Locations - The CRSP intends to continue operation of the present field projects through completion of the third experimental cycle. The research locations will be reconsidered during development of the fourth work plan (during the fifth year) and annually thereafter. The number and location of field experiments may be revised if necessary.

There are two important reasons for annual reconsideration. First, as the CRSP data base becomes more comprehensive it is possible that the need to conduct the experiments in additional environments will become apparent. Second, the CRSP is confronted with level funding and annually increasing project costs. Because the several projects are presently minimally funded and because the CRSP intends to place increasing emphasis on the data synthesis and modelling activities, funding constraints may require terminating one or more projects during the next five years.

The existing research locations, the collaborating institutions, and the Principal Investigators and Research Associates are summarized in Table 5 of Part A.

Work Plans - As noted above, the CRSP has developed work plans for three experimental cycles to date. Work plans were developed annually during the first three years. In response to recommendations of the External Evaluation Panel, the CRSP will implement the policy of developing biennial work plans commencing with the plan for the fourth experimental cycle.

The technical objectives of the first three work plans are as follows:

First Experimental Cycle

1. To compile a quantitative baseline of chemical physical and biological parameters for each work location.
2. To observe quantitative physical, chemical and biological responses to various levels of inorganic fertilizer application to pond culture systems and test for significant correlations with and between work locations.
3. To observe and document technical constraints limiting fry availability in each participating host country.
4. To compile a baseline of information on locally available nutrient inputs and local geography hydrology and water quality in each participating country utilizing available host country resources.

Second Experimental Cycle (Fresh Water Experiments)

1. To compare physical, chemical and biological responses between ponds treated with organic and inorganic fertilizers.

Second Experimental Cycle (Brackish Water/Marine Experiments)

1. To compare physical, chemical and biological responses between ponds treated with manure, manure plus inorganic fertilizer, manure plus feed and manure plus fertilizer plus feed.

Third Experimental Cycle (Freshwater Experiments)

1. To compare physical, chemical and biological responses between ponds treated with organic fertilizers at the rates of 125, 250, 500 and 1000 kg/hectare/week.

Third Experimental Cycle (Brackish Water/Marine Experiments)

1. To observe differences in physical, chemical and biological responses to ponds stocked with shrimp, shrimp and bivalves and shrimp, bivalves and fish.

2. To observe physical, chemical and biological responses to nutrient pretreatment.
3. To compare physical, chemical and biological responses to ponds subjected to varying rates of water exchange.

The pond variables observed, frequency of observation, materials and methods, and standardized reporting units for these experiments are presented in Table 1-4 of Part A.

Fourth Experimental Cycle - Initiation of planning for the fourth experimental cycle will commence during the fourth year of the CRSP and be completed at the annual meeting in March of 1987. The focus of this work plan will be to test statistical hypotheses about sources of variances, interactions, and correlation among and between physical, chemical and biological variables. Because the hypotheses to be tested will be formulated from the analysis and synthesis of results from the first three experimental cycles, the articulation of specific objectives must necessarily be deferred. However, the general objective for the fourth experimental cycle becomes;

1. To test statistical hypotheses relating to variances and interactions of physical, chemical and biological pond variables.

Fifth Experimental Cycle - The work plan for the fifth experimental cycle will emphasize field testing of pond management models. Planning for this work plan will be initiated in the sixth year of the CRSP and will be completed at the annual meeting of the Technical Committee in March of 1988.

#### Data Analysis, Synthesis and Modelling

The CRSP data base becomes increasingly comprehensive as data collection progresses in accordance with existing work plans. The CRSP will place increasing emphasis on the analysis and synthesis of these data, and to the development of predictive models of the processes occurring in pond culture systems. These models will become increasingly comprehensive with each experimental cycle. The models will be used to, 1) provide guidance for ongoing and future research, 2) predict the performance of existing and proposed pond systems subject to specific inputs and constraints, and 3) to improve the operation and efficiency of pond culture systems. Accordingly, the objectives of this activity for the next five years are:

1. To statistically analyze data from the first, second and third cycle of field experiments.
2. To synthesize these data into testable statistical null hypotheses about how physical, chemical and biological processes regulate the productivity of pond culture systems.
3. Analyze the data resulting from the fourth cycle of CRSP experiments in terms of statistical tests of the hypotheses resulting from the satisfaction of Objective 3.



4. Develop conceptual frameworks for one or more pond management models.
5. Develop management models consistent with each conceptual framework.
6. Calibrate and verify the models and develop economic production functions consistent with the most appropriate models.

#### SPECIAL TOPICS RESEARCH PROJECTS

In addition to the global CRSP experiment, the CRSP will continue to operate special topics research projects in the U.S. and host countries.

##### Host Country Special Topics

Host country special research topics will be decided upon collaboratively by the host country and U.S. Principal Investigators who will submit an annual proposed work plan to the CRSP Board of Directors for review. The Board will review proposals for consistency with CRSP goals and objectives. The proposals will not be subjected to peer review. However, the Principal Investigators are required to discuss their proposals with their appropriate AID Mission officers and mission concurrence must accompany the proposals submitted to the Board of Directors for annual review.

##### U.S. Special Topics

The U.S. Research Component will consist of several (typically five to seven) special topics research projects accomplished at the participating U.S. universities. The Management Entity, with concurrence of the Board of Directors, will from time to time issue requests for proposals relating to topics that have been identified as needed to reinforce other aspects of the CRSP research program. The Board will also consider unsolicited proposals from the participating institutions. Proposals received by the Management Entity will be subjected to critical peer review by outside reviewers not associated with any of the institutions participating in the CRSP. Peer review will emphasize the technical merit of the proposals and their relevance to the development of pond aquaculture. The Management Entity will submit all such proposals along with peer reviews of each proposal to the Board of Directors for consideration for inclusion in the U.S. Research Component. Selected projects will normally be funded for a period of one year although longer durations would be considered if appropriate.

#### DISSEMINATION OF RESULTS

The results of the CRSP global experiments will be published in a series of CRSP technical reports. At least one technical report corresponding to each CRSP experimental cycle is anticipated. The reports will summarize the analysis and synthesis of data from each experiment.

Additionally, special reports may be issued from time to time. Principal investigators of the Collaborative Research projects are expected to publish their results from time to time. These reports, to be published in appropriate refereed journals, may report on local aspects of the global experiment as well as host country and U.S. Special Topics Research Projects.

#### RESEARCH SCHEDULE

The proposed schedule for completion of the research program plan for the next five years is presented in Table 8.

TABLE 8.  
RESEARCH SCHEDULE

TASK	Year 4 9/85-8/86	Year 5 9/86-8/87	Year 6 9/87-8/88	Year 7 9/88-8/89	Year 8 9/89-8/90
Complete Field Experiments Experimental Cycles 1, 2 and 3	→				
Complete Data Analysis - Experimental Cycles 1 and 2 (Except Rwanda)	→				
Complete Data Analysis Experimental Cycle 3 and Experimental Cycle 1 (Rwanda)		←→			
Develop Descriptive Models			←→		
Research Planning: Experimental Cycle 4	←→				
Triennial Review			←→		
Complete Field Experiment Experimental Cycle 4		←→			
Research Planning Experimental Cycle 5			←→		
Develop Management Models			←→		
Complete Field Experiments Experimental Cycle 5				←→	

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## PROGRAM ORGANIZATION AND MANAGEMENT

This section describes the organization and management of the CRSP. The description includes several changes in organization and management relative to the original CRSP proposal. These changes are intended to strengthen the CRSP and are based upon a variety of experiences and recommendations, including 1) recommendations of CRSP participants based upon three years experience in operation of the CRSP, 2) recommendations from the External Evaluation Panel and AID Management Review, and 3) the revised BIFAD Guidelines.

### MEMORANDA OF AGREEMENT: FOUNDATION OF THE CRSP

In February 1980, the Joint Research Committee designated Auburn University, the University of California, Davis and the Consortium for International Fisheries and Aquaculture Development (CIFAD) as the participants in this CRSP. The participants subsequently elected Oregon State University to be the Management Entity for the CRSP. As Management Entity, Oregon State University negotiated Memoranda of Agreement with the participating U.S. institutions. The participants have in turn negotiated appropriate Memoranda of Agreements with host country agencies or institutions for the various collaborative research activities. These agreements have been revised from time to time as required, and continue to serve as the foundation for CRSP organization and management.

### MANAGEMENT ENTITY

The Collaborative Research Support Grant for this CRSP has been awarded to Oregon State University as the Management Entity. In this capacity, Oregon State University disperses funds to other participating institutions and serves as the legal and fiscal agent in the receipt and disbursement of CRSP funds, and is responsible to AID for performance of the CRSP. Additional responsibilities of the Management Entity are:

1. Coordinating the implementation and operation of individual projects comprising the CRSP.
2. Implementing the financial plan.
3. Fiscal and technical reporting to AID.

### Program Management Office

Within Oregon State University the CRSP is administered by a Program Management Office (PMO). Contracting and fiscal accounting and reporting is provided by the OSU Office of Business Affairs. At the present time the staff of the PMO includes:

- CRSP Director - Dr. James E. Lannan
- Assistant Director (Communications and Administration) - Ms. Nancy Brown

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- Assistant Director (Data Management and Technical Affairs) - Dr. Kevin Hopkins
- Secretary - Miss Carman McBride
- Bookkeeper - Mrs. Cecil Mary Petrie
- Graduate Research Assistant - Mr. James Bowman

The Program Director provides executive linkage between the Management Entity and operations under this CRSP. The Memorandum of Understanding between the participating institutions provides for selection, terms of employment, and service of the Director. The Director serves as ex-officio member of the Board of Directors and Technical Committee.

#### BOARD OF DIRECTORS

The primary policy making body for this CRSP is a Board of Directors comprised of one administrative member each from Auburn University, CIFAD and the University of California, Davis. This body was formerly known as the CRSP Executive Council. The name has been changed to be consistent with the Guidelines for Collaborative Research Support Programs. Council organization and operating procedures are prescribed in the Memorandum of Understanding between the participating institutions.

Among other functions, the Board of Directors; 1) advises the Management Entity on matters of CRSP policy; 2) selects the CRSP Director; 3) reviews annual summaries and fiscal reports; 4) approves formation of ad hoc committees; 5) appoints at-large members of the Technical Committee as described in a later section; 6) appoints review panels; 7) reviews the performance of the CRSP Director; and 8) reviews planned research activities for consistency with CRSP policy before submission to the Management Entity for funding.

#### TECHNICAL COMMITTEE

The former Technical Advisory Committee and Research Team described in the original CRSP proposal have been incorporated into a new body called the CRSP Technical Committee. The Technical Committee is composed of the Principal Investigators (host country and U.S. institutions) of the Collaborative Research Projects and members at-large as designated by the Board of Directors. The CRSP Director and AID Program Manager serve as ex-officio members of the Committee. The Technical Committee will; 1) develop biennial workplans and submit them to the Board of Directors through the CRSP Director for approval and implementation; 2) prepare annual budget recommendations for CRSP research activities and submit them to the Board of Directors through the Program Director for consideration in development of the annual CRSP budget; 3) review the technical progress of the CRSP or components thereof and propose appropriate modifications of the technical plan to the CRSP Board of Directors; and 4) continuously review materials and methods utilized in CRSP research and recommend appropriate modifications to the CRSP Board through the Management Entity. The Technical Committee shall meet at least once annually and report its findings in writing to the CRSP Board of Directors through the Management Entity.

There will be four standing subcommittees of the Technical Committee: Work Plans, Budgets, Materials and Methods and Technical Progress. The present members of the Technical Committee and the assignments to the standing subcommittees are summarized in Table 9. The responsibilities of the standing subcommittees are:

#### Work Plan Subcommittee

This Subcommittee will prepare a working draft of all subsequent work plans. The working draft will be submitted to the Management Entity on or before December 31st of even numbered years. The Management Entity, through the Program Management Office, will distribute the working draft to the Technical Committee for consideration at its Annual Meeting. The Work Plan Subcommittee will moderate discussions about the work plan at the Annual Meeting and prepare a final draft of the work plan immediately following the meeting. This draft will be forwarded to the Board of Directors through the Program Management Office.

#### Materials and Methods Subcommittee

This Subcommittee will determine standard materials and methods to be incorporated in the work plans for the Global CRSP Experiments. The Committee will also recommend revised or alternate materials and methods where necessary.

#### Technical Progress Subcommittee

This Subcommittee will continuously review work plans, materials and methods and data resulting from the various CRSP research activities. It will prepare an annual report addressing problems that might impede CRSP technical progress and recommend corrective action. This report will be distributed to the Technical Committee prior to its annual meeting. The Technical Progress Committee will moderate discussions about technical progress at the Annual Meeting and present a written report of its findings to the CRSP Board of Directors immediately following the Annual Meeting.

#### Budget Subcommittee

This Subcommittee will prepare annual budget recommendations for CRSP research activities in accordance with guidelines from the Board of Directors regarding the allocation of CRSP funds between research activities and program management. The Budget Subcommittee will moderate discussions about the proposed research budget at the Annual Meeting of the Technical Committee and present its recommendations in writing to the Board of Directors and the Management Entity at the close of the Annual Meeting.

#### EXTERNAL EVALUATION PANEL

The conduct of this CRSP is subject to annual external reviews accomplished by an External Evaluation Panel (EEP). The present members of

TABLE 9  
THE CRSP TECHNICAL COMMITTEE

NAME	INSTITUTION	SUBCOMMITTEE*
<b><u>Members-at-Large</u></b>		
Dr. Donald Garling (Chairman, 1985-86)	Michigan State University	W
Dr. William Chang	University of Michigan	T
Dr. Raul Piedrahita	University of California	W
Dr. R. O. Smitherman	Auburn University	T**
Dr. George Tchobanoglous	University of California	T
<b><u>Principal Investigators</u></b>		
Dr. Ted Batterson	Michigan State University	M**
Dr. Thiraphan Bhukaswan	National Inland Fisheries Institute, Thailand	B
Dr. Jose Carreon	University of the Philippines in the Visayas	M
Dr. James Diana	University of Michigan	W**
Dr. Muhammed Eidman	Institute Pertanian Bogor, Indonesia	T
Dr. Jonathan Espinoza O.	Directorate of Renewable Natural Resources, Honduras	B
Dr. Arlo Fast	University of Hawaii	W
Dr. Philip Helfrich	University of Hawaii	B
Dr. C. D. McNabb	Michigan State University	B
Dr. Valens Ndoreyaho	National University of Rwanda	T
Dr. Ronald P. Phelps	Auburn University	M
Dr. Richard Pretto M.	National Directorate of Aquaculture, Panama	W
Mr. Wayne Seim	Oregon State University	M
Dr. Richard Tubb	Oregon State University	B**

\* W = Work Plans; B = Budgets; T = Technical Progress; M = Materials and Methods.

\*\*Denotes subcommittee Rapporteur

this Panel, all senior scientists recognized by their peers and selected for their in-depth knowledge of aquaculture, are:

- Dr. James Avault - Louisiana State University
- Dr. Kenneth Chew - University of Washington
- Dr. Ziad Shehadeh - Kuwait Institute for Scientific Research

There is presently one vacancy on the External Evaluation Panel resulting from the employment of Dr. Richard Neal, former Director General of ICLARM, by USAID. The CRSP is presently considering nominations for a replacement for Dr. Neal.

To keep the External Evaluation Panel advised of CRSP activities, the Management Entity provides the Panel with copies of all significant CRSP documents. The Panel Members also attend the Annual CRSP Meeting. Attendance at the meeting provides the EEP with the opportunity to discuss progress with the various CRSP participants and to observe the various CRSP planning activities. Additionally, the EEP visits overseas research sites in years coinciding with AID's Triennial Review. At the conclusion of the Annual Meeting, the EEP submits a written report of its findings to the Management Entity, Board of Directors and AID Program Manager with copies to BIFAD.

The External Evaluation Panel serves without compensation but receives reimbursement for all travel expenses. Additionally, the External Evaluation Panel members receive an honorarium during Triennial Review years.

#### PEER REVIEW

Research proposals submitted for inclusion in the U.S. Research Component receive critical peer review before they are presented to the Board of Directors. The Program Management Office maintains a roster of qualified scientists who serve as reviewers and who are not affiliated with institutions participating in the CRSP. This Panel has as its sole purpose impartial critical review of research proposals and has no further responsibilities under the CRSP. To insure objective reviews, the names of reviewers are not identified when the reviews are returned to their authors. However, the reviewers are identified for the Board of Directors to insure the credibility of the review process.



## FINANCIAL PLAN

This section presents a CRSP financial plan with a "five year forward horizon". The plan assumes that the CRSP will be level funded, with obligations of AID funds totalling \$1.3 million per year.

The proposed summary budget for the next five years is presented in Table 10. Included in this Table are the distributions of AID funds for research and Program Management, and estimated U.S. and host Country institutional contributions.

The expected distribution of AID funds among the research activities for each of the next five years are presented in Tables 11-15. In presenting these Tables, it is assumed that the CRSP will continue the existing six Collaborative Research Projects for the next five years. However, it has been noted in an earlier section that the number and location of Collaborative Research Projects will be reconsidered annually and modified if appropriate. Therefore, the distribution shown in Table 11 may be considered firm, and those in the remaining Tables are tentative.

The estimated U.S. institutional cost sharing presented in Tables 11-15 assumes that 50 percent of the AID funds expended will be exempted from the 25 percent cost sharing requirement in accordance with BIFAD Guidelines. As noted in Part A, the actual cost sharing requirement can only be determined after the fact.

The host country contributions, although not a requirement for participation, are taken as evidence of the country's commitment to the program. The amounts reflected in Table 10 are estimated on the basis of contributions during the first two years of the CRSP.

Line item budgets for the several CRSP activities are developed and approved by the Board of Directors on an annual basis as described in earlier sections. The approved budgets are forwarded to the AID Grant Officer for attachment to the CRSP Grant. This mechanism provides the flexibility to make appropriate adjustments for CRSP activities. It has worked well in years past and will be continued.

The line item budget for year four is presented in Table 16.

TABLE 11  
RESEARCH PROGRAM BUDGET BY PROJECT

PROJECT	Year 4 9/1/85 to 8/31/86
<b><u>1. AID Program Contribution</u></b>	
HONDURAS (Auburn University)	\$ 110,000
INDONESIA (Michigan State)	165,000
PANAMA (Auburn University)	165,955
PHILIPPINES (University of Hawaii)	159,885
RWANDA (Oregon State)	160,000
THAILAND (University of Michigan)	159,000
U.S. RESEARCH COMPONENT	<u>179,993</u>
<b>TOTAL AID PROGRAM CONTRIBUTION</b>	<b>\$1,099,833</b>
<b><u>2. Estimated Total Non-Federal Contribution</u></b>	
HONDURAS (Auburn University)	\$ 22,000
INDONESIA (Michigan State)	33,000
PANAMA (Auburn University)	31,191
PHILIPPINES (University of Hawaii)	31,977
RWANDA (Oregon State)	32,000
THAILAND (University of Michigan)	31,800
U.S. RESEARCH COMPONENT	<u>59,998</u>
<b>TOTAL NON-FEDERAL CONTRIBUTION</b>	<b>\$ 241,966</b>

TABLE 12  
RESEARCH PROGRAM BUDGET BY PROJECT

PROJECT	Year 5 9/1/86 to 8/31/87
<b><u>1. AID Program Contribution</u></b>	
HONDURAS (Auburn University)	\$ 110,000
INDONESIA (Michigan State)	145,000
PANAMA (Auburn University)	160,000
PHILIPPINES (University of Hawaii)	145,000
RWANDA (Oregon State)	145,000
THAILAND (University of Michigan)	145,000
U.S. RESEARCH COMPONENT	<u>250,000</u>
<b>TOTAL AID PROGRAM CONTRIBUTION</b>	<b>\$1,100,000</b>
<b><u>2. Estimated Total Non-Federal Contribution</u></b>	
HONDURAS (Auburn University)	\$ 17,188
INDONESIA (Michigan State)	22,656
PANAMA (Auburn University)	25,000
PHILIPPINES (University of Hawaii)	22,656
RWANDA (Oregon State)	22,656
THAILAND (University of Michigan)	22,656
U.S. RESEARCH COMPONENT	<u>78,125</u>
<b>TOTAL NON-FEDERAL CONTRIBUTION</b>	<b>\$ 210,937</b>

TABLE 12  
RESEARCH PROGRAM BUDGET BY PROJECT

PROJECT	Year 5 9/1/86 to 8/31/87
<b><u>1. AID Program Contribution</u></b>	
HONDURAS (Auburn University)	\$ 110,000
INDONESIA (Michigan State)	145,000
PANAMA (Auburn University)	160,000
PHILIPPINES (University of Hawaii)	145,000
RWANDA (Oregon State)	145,000
THAILAND (University of Michigan)	145,000
U.S. RESEARCH COMPONENT	<u>250,000</u>
<b>TOTAL AID PROGRAM CONTRIBUTION</b>	<b>\$1,100,000</b>
<b><u>2. Estimated Total Non-Federal Contribution</u></b>	
HONDURAS (Auburn University)	\$ 17,188
INDONESIA (Michigan State)	22,656
PANAMA (Auburn University)	25,000
PHILIPPINES (University of Hawaii)	22,656
RWANDA (Oregon State)	22,656
THAILAND (University of Michigan)	22,656
U.S. RESEARCH COMPONENT	<u>78,125</u>
<b>TOTAL NON-FEDERAL CONTRIBUTION</b>	<b>\$ 210,937</b>

TABLE 13  
RESEARCH PROGRAM BUDGET BY PROJECT

PROJECT	Year 6 9/1/87 to 8/31/88
<b><u>1. AID Program Contribution</u></b>	
HONDURAS (Auburn University)	\$ 105,000
INDONESIA (Michigan State)	130,000
PANAMA (Auburn University)	150,000
PHILIPPINES (University of Hawaii)	130,000
RWANDA (Oregon State)	130,000
THAILAND (University of Michigan)	130,000
U.S. RESEARCH COMPONENT	<u>225,000</u>
<b>TOTAL AID PROGRAM CONTRIBUTION</b>	<b>\$1,000,000</b>
<b><u>2. Estimated Total Non-Federal Contribution</u></b>	
HONDURAS (Auburn University)	\$ 16,406
INDONESIA (Michigan State)	20,313
PANAMA (Auburn University)	23,438
PHILIPPINES (University of Hawaii)	20,313
RWANDA (Oregon State)	20,313
THAILAND (University of Michigan)	20,313
U.S. RESEARCH COMPONENT	<u>70,313</u>
<b>TOTAL NON-FEDERAL CONTRIBUTION</b>	<b>\$ 191,409</b>

TABLE 14  
RESEARCH PROGRAM BUDGET BY PROJECT

PROJECT	Year 7 9/1/88 to 8/31/89
<b><u>1. AID Program Contribution</u></b>	
HONDURAS (Auburn University)	\$ 110,000
INDONESIA (Michigan State)	145,000
PANAMA (Auburn University)	160,000
PHILIPPINES (University of Hawaii)	145,000
RWANDA (Oregon State)	145,000
THAILAND (University of Michigan)	145,000
U.S. RESEARCH COMPONENT	<u>250,000</u>
<b>TOTAL AID PROGRAM CONTRIBUTION</b>	<b>\$1,100,000</b>
<b><u>2. Estimated Total Non-Federal Contribution</u></b>	
HONDURAS (Auburn University)	\$ 17,188
INDONESIA (Michigan State)	22,656
PANAMA (Auburn University)	25,000
PHILIPPINES (University of Hawaii)	22,656
RWANDA (Oregon State)	22,656
THAILAND (University of Michigan)	22,656
U.S. RESEARCH COMPONENT	<u>78,125</u>
<b>TOTAL NON-FEDERAL CONTRIBUTION</b>	<b>\$ 210,937</b>

TABLE 15  
RESEARCH PROGRAM BUDGET BY PROJECT

PROJECT	Year 8 9/1/89 to 8/31/90
<b><u>1. AID Program Contribution</u></b>	
HONDURAS (Auburn University)	\$ 110,000
INDONESIA (Michigan State)	145,000
PANAMA (Auburn University)	160,000
PHILIPPINES (University of Hawaii)	145,000
RWANDA (Oregon State)	145,000
THAILAND (University of Michigan)	145,000
U.S. RESEARCH COMPONENT	<u>250,000</u>
<b>TOTAL AID PROGRAM CONTRIBUTION</b>	<b>\$1,100,000</b>
<b><u>2. Estimated Total Non-Federal Contribution</u></b>	
HONDURAS (Auburn University)	\$ 17,188
INDONESIA (Michigan State)	22,656
PANAMA (Auburn University)	25,000
PHILIPPINES (University of Hawaii)	22,656
RWANDA (Oregon State)	22,656
THAILAND (University of Michigan)	22,656
U.S. RESEARCH COMPONENT	<u>78,125</u>
<b>TOTAL NON-FEDERAL CONTRIBUTION</b>	<b>\$ 210,937</b>

TABLE 16  
AID LINE ITEM BUDGET FOR YEAR FOUR

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**Research Program (AID Funds)**

Personnel	\$ 511,315
Equipment	86,250
Services and Supplies	79,670
Travel	115,750
Other Direct Costs	31,890
Indirect Costs	<u>274,958</u>

**Total Program (AID Funds) (a)      \$1,099,833**

**Management Entity (ME) (AID Funds)**

Personnel	\$ 101,500
Equipment	4,000
Services and Supplies	20,000
Travel	17,000
Other Direct Costs	9,744
Indirect Costs	<u>47,923</u>

**Total Management Entity (b)      \$ 200,167**

**Total AID Contribution (a) + (b)      \$1,300,000**

As reasonably necessary amounts may be switched among line items within the Program budget, and within the Management Entity Budget.