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A Review of the Aquaculture Production Project and Recommendations for Improving the Effectiveness of Research-Extension Linkages

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A Committee[1/] Report
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INTRODUCTION

Fish plays a vital role in the lives of Filipinos. As a source of animal protein and total protein, fish ranks first and second, respectively, in the diet. Fish production in the Republic of the Philippines (RP) during 1975 was 1.3 million metric tons - an insufficient amount to meet national needs. Protein consumption by Filipinos is estimated to be 7% below United Nations Required Daily Allowance (UNRDA). The nation's demand for fish in the year 2000 is estimated to be 4 million tons or almost four times current production. Therefore, there is an essential need to increase fisheries production by all available means.

Cost restricts the importation of fisheries products. The catch from marine fisheries is already approaching maximum sustainable yield and the costs of increasing the units of effort required to catch more fish from the sea are becoming prohibitive due to rising costs of energy and fishing equipment.

Aquaculture production in the RP is about 106 thousand metric tons/year; however, technology is already available that could more than double production within 5 years if effectively used (See Table 1, Appendix A). The long term potential for aquaculture is much higher.

In order to help achieve national goals for increasing aquaculture production, the Government of the Philippines (GOP) with assistance from the United States Agency for International Development (USAID) began the Aquaculture Production Project (APP) in 1974. The APP focuses on: (1) the establishment of a phased aquaculture extension program in the Bureau of Fisheries and Aquatic Resources (BFAR), (2) continued development of the Brackishwater Aquaculture Center (BAC) and the Freshwater Aquaculture Center (FAC) and (3) intensified research activities linked to and coordinated with the extension program (See Appendix B for background information)..

The purpose of this paper is to examine the status of the research-extension linkage component of the APP, identify constraints to progress, and recommend remedial measures to increase future effectiveness of the program. The ad hoc Research-Extension Linkage Committee (REL Committee) was formed and assigned this task by a joint GOP/USAID panel during an evaluation of the APP in May-June 1977.

1/ The ad hoc Research-Extension Committee. Members - Dr. Arsenio S. Camacho, Project Leader, BAC; Dr. Catalino R. dela Cruz, Project Leader, FAC; Mr. Abraham Gaduang, Chief Extension Division, BFAR; Dr. Daniel Leary, Research Advisor, USAID, and Mr. Johnie H. Crance, Extension Advisor, USAID, Committee Chairman.

IMPORTANCE OF RESEARCH-EXTENSION LINKAGES

The rationale for establishment of the APP emphasizes that the GOP must provide four essential services to the aquaculture industry if the gap between fish production and demand is closed. These services: (1) research to generate new knowledge, (2) extension to advise and assist fish farmers in putting new knowledge into practice, (3) education to provide extension workers, researchers, administrators and other trained personnel to the private and public sectors, and (4) administrative support to provide adequate budgets, clear administrative guidelines, organization structures and qualified personnel to implement and sustain programs aimed at aquaculture development.

Linkages and two-way communication between research and extension agencies are key factors to the successful development of technology and its transfer to fish farmers for adoption. A fish farmer needs advice and instructions on improved management practices if he is to do a better job. An extension service must provide this service if it is to function for long. A research program will be most effective when it develops know-how in response to the need of the user. Effective inter-agency communication, cooperation and coordination will speed up the processes of identifying existing technology, developing technology packages, transferring technology to users, and planning and conducting research to provide new technology needed by the fish farmer.

CONSTRAINTS AND RECOMMENDATION

General Constraint. The committee believes that the fundamental constraint to development of aquaculture in general is inadequate commitment to the project on the part of the GOP. After examining the directives and planning documents of the GOP relative to aquaculture development, the committee concluded that the concept and essential machinery for the program are already in existence. Nonetheless, it is not progressing satisfactorily. An ingredient is missing, the force necessary to energize the plans and convert them to action. We believe that only adequate GOP commitment can make this ingredient available.

A more positive and agressive attitude by the government toward aquaculture development can and should occur. The President and his advisers at one point concluded that the potential of aquaculture warranted development. PD 704 makes this clear as do the Integrated Fisheries Development Plan, the Aquaculture Production Project, and a number of other sub-parts of the over-all program. But the issuing of directives alone has not produced significant progress. The highest levels of GOP leadership need to re-examine the matter of aquaculture development, determine what would be required to make it go, and decide whether the benefits are worth the cost. The committee believes that total commitment of necessary resources to achievement of the goal, such as in the "Masagana 99" program, is essential if aquaculture is to be developed effectively.

Without the impetus such commitment would provide, aquaculture development will continue to languish because implementing agencies already are occupied fully with their present programs and are not motivated to take on additional responsibilities, if the government does not require compliance with directives regarding the program. GOP commitment to the program also is necessary to make funds available for hiring additional personnel and expanding the budgets of implementing agencies as necessary to carry out the project.

Recommendations. The committee recognizes that even if the government adopts a more positive and aggressive attitude toward developing aquaculture, the resultant chain of events necessary before such a change would influence activity will not occur overnight. In the meanwhile, there are specific actions that could be taken in the short term to expedite progress of the APP.

Substantial progress has been made in accomplishing the goals of the APP with regard to establishment of research facilities, training programs, and extension capabilities; however, the linkage of research with extension has lagged. The principal reason for this shortcoming was stated above; namely, neither the research nor extension agencies have the funds or personnel available to effect this linkage in addition to other commitments.

Therefore the committee recommends that four new positions be established within the agencies involved in the APP. These positions are:

1. Extension Coordinator, BAC

2. Extension Coordinator, FAC

3. Research Coordinator, BFAR Region V

4. Research Coordinator, BFAR Region VI

The nucleus group later could recommend what additional personnel and resources would be needed to expand the functions of the group as necessary to accomplish effective research-extension linkage. These four positions should be filled by qualified personnel on a full time, permanent basis and supported by adequate budgets. A job description for each position which reflects the duties and responsibilities of the incumbents and the importance of the positions should be developed by the employing agencies.

In general the functions of the Coordinators would be essentially the same whether they represented research or extension, i.e., coordination of research and extension activities between their respective agencies. Specifically these responsibilities should include cooperative efforts to achieve the following:

a. identify needs of fish farmers and establish research priorities responsive to these needs,

b. identify existing technology for extending to fish farmers,

c. conduct aquaculture field trials and demonstrations of new technology before disseminating it to users,

d. develop extension literature to disseminate tested technology,

e. identify training needs of extension workers, design workshops and short courses in response to these needs, and conduct training activities for extension workers and fish farmers (actual instruction would be the responsibility of the research agency primarily),

f. develop and implement a system for two-way exchange of progress reports and other data between extension and research units, and

g. coordinate other research-extension activities as required.

The Committee feels that if BAC, FAC and BFAR make sufficient commitments to establish and fill the positions as recommended, effective linkage of research and extension activities will result, and problems associated with ineffective coordination will be minimized.

The Committee recognizes that considerable costs are associated with staffing four new positions but is convinced that the pay-off would justify the costs. The availability of qualified people to fill the positions also may be a problem. Participants who receive an advanced degree under the APP should be good candidates for the positions.

The Committee also understands that some actions already have been taken by BFAR, BAC and FAC to establish research-extension linkages and coordination between these agencies. However, commitments of additional funds and manpower to strengthen the research-extension linkage and coordination are needed to achieve aquaculture production goals.

Other Constraints. The Committee identified other constraints that are not directly related to APP research-extension linkages but that have indirect influence on the success of the APP and national aquaculture programs. These constraints are:

1. Representatives of several national and international agencies have expressed concern over the need for a National Aquaculture Coordination-Advisory Council. More effective coordination of the efforts of all agencies and a National Aquaculture Program of the intensity of the Masagana 99 Program may be needed to develop the full potential of aquaculture. The Committee feels that the potential for aquaculture in the RP warrants such a national effort.

2. Reliable and timely aquaculture statistics are invaluable to good management of aquaculture programs. The existing system for gathering and reporting aquaculture statistics needs improvement.

3. The establishment of a good, all-weather access road to BAC is a GOP commitment that has not been fulfilled. The road is barely passable during rains and its condition hinders easy access to the research center. The investments made at BAC, the Center's role in aquaculture research, and the need for ready access by employees and others justify high priority commitment of funds to the completion of a good, all-weather access road to BAC.

APPENDIX A

BACKGROUND INFORMATION ON THE POTENTIAL AND RATIONAL FOR EXPANDING AQUACULTURE PRODUCTION

Importance of Fisheries

Fish is an important staple in the diet of Filipinos. The state of nutrition of Filipinos is below desirable standards. Protein consumption is estimated to be 7% below UNRDA. Fish ranks second as a source of total protein, after rice, for Filipinos. For low income groups, fish is the least expensive and the single most important source of animal protein, providing 20% of total protein intake and up to 61% of their animal protein intake. It ranks ahead of pork, beef, poultry and eggs. Fish in general provide more nutrition per unit of weight than red meats. It is clearly evident that an increase in fish in the diet of the average Filipino is highly desirable. However, national production does not meet current demand and high costs prohibit sufficient quantities from being imported.

A survey conducted by the U.N. in 1975, revealed that the RP ranked 12th among the fishing nations in total fish catch. The world fish catch in 1975 was 69.7 million metric tons. Fish production in the RP in 1975 was 1,336,803 metric tons from the following sectors (BFAR, 1975-Fisheries Statistics of the Philippines).

Sector	Metric Tons	Per cent
Municipal Fisheries	731,725	54.7
Commercial Fishing	498,617	37.3
Fish ponds	106,461	8.0
TOTAL	1,336,803	100.00

The BFAR has projected the annual demand for fish by the year 2000 to be 4 million metric tons or about 300% above current domestic production. There is growing concern among fishery scientists about marine fisheries (municipal and commercial sectors) not being capable of producing sustained yields significantly above current production levels. Even if marine fisheries are biologically capable of producing significant increases in sustained yields, the catch per unit of effort required to harvest additional fish has become very costly due to increases in the cost of energy (oil) and fishing equipment.

Potential for Aquaculture

The potential for increasing aquaculture production in the RP is substantial. Aquaculture has been practiced in the country through the ages. There are over 176,000 hectares of brackishwater in production and up to 400,000 hectares available for development (BFAR, 1975 Fisheries Statistics of the Philippines). Average annual production of brackishwater ponds in the RP is only 600 kg/ha. This compares to 2000 kg/ha/yr in Taiwan where supplemental feed is used but the growing season is shorter than in the RP. A few progressive milkfish farmers in the Philippines produce in excess of 2000 kg/ha/yr.

Technology exists that if effectively utilized could increase the average production of brackishwater fishponds in the RP to 2000 kg/ha/yr. If production of existing brackishwater ponds was increased to only 75% of attainable level (from 600 kg/ha/yr to 1500 kg/ha/yr), annual production from this sector would be increased by 158,000 metric tons (from 106,000 metric tons to 264,000 metric tons). Furthermore, the development of only 10% of the avaialble brackishwater swampland into fishponds that produced 1500 kg/ha/yr would increase brackishwater fishpond production by 60,000 metric tons/yr.

Additional aquaculture production could be realized by development of a freshwater fishpond industry, including rice/fish farming. Technology exists to produce up to 3000 kg/ha/yr in freshwater fishponds utilizing species of Tilapia or carp. It has been estimated that over 125,000 hectares of suitable freshwater fishpond sites exist in the Philippines (BFAR, 1975 Fisheries Statistics of the Philippines). These areas are not generally suitable for agriculture crops. If only 20% or 25,000 ha of the available land area, was developed into ponds that produced 2000 kg/ha/yr (67% potential) it would result in an increase of 50,000 metric tons/yr of fish.

The potential of fish culture in paddies with rice can now be developed with the advent of new technology for applying chemicals and the availability of insect resistant varieties of rice. Rice/fish technology is available to produce more than 200 kg/ha/yr of fish in two crops with rice without lowering rice production. The number of paddies utilized for rice/fish production now is minimal. However, it is estimated that over 1.3 million hectares of irrigated paddies exists that could be adapted to this practice. If only 25% of the existing irrigated rice paddies were utilized for rice/fish and they produced 150 kg/ha/yr (75% of potential), aquaculture production could be increased by 49,000 metric tons/yr.

The potential increase in aquaculture production from brackishwater ponds, rice/fish paddies and freshwater fishponds is summarized in Table 1. Table 1 shows that if only a moderate increase in present aquaculture production was achieved within the next 5 years, annual production would be increased from 106,000 tons to 265,000 tons, a significant and realistically achievable goal.

Table 1. Existing and Potential (at two assumed levels) Aquaculture Production in Brackishwater and Freshwater Fishponds and in Rice/Fish Paddies - Philippines

Production Sector	Production (1975)	Technologically Achievable	Moderate increase Achievable within 5 years
Brackishwater Fishponds			
Area utilized	176,000 has.	400,890 has.1/	40,000 has.
Production/unit/year	600 kg/ha	2,000 kg/ha	1,500 kg/ha
Total production/year	106,000 tons	802,000 tons	60,000 tons
Freshwater Fishponds			
Area utilized	2/	126,253 1/	25,000 has.
Production/unit/year		3,000 kg/ha	2,000 kg/ha
Total production/year		375,000 tons	50,000 tons
Rice/Fish Paddies			
Area utilized	2/	1,300,000 has.3/	325,000 has.3/
Production/unit/year		200 kg/ha	150 kg/ha
Total Production/year		260,000 tons	49,000 tons
Total production/year 3 sectors	106,000 tons	1,437,000 tons	159,000 tons

1/ Hectares available for development (1975 Fisheries Statistics of the Philippines, BFAR).
2/ Area and production uncertain but relatively insignificant as of 1977.
3/ Irrigated rice land.

National Programs and Rationale

Around 1970, the Philippine Government intensified a broad program to improve nutrition for its population. Projects designed to increase fish production from all sectors - commercial fishing, municipal fisheries, and fishfarming (aquaculture), were implemented as part of the national goal of improved nutrition. The need and potential for increased aquaculture production is clearly indicated in the following documents: the Integrated Fisheries Development Plan (DNR, 1976); the National Plan for Development of Aquaculture in the Philippines (UNDP/FAO Report ADCP/REP/76/2); the Fish Production Program (BFAR, FY 1974-1975); the International Bank for Reconstruction Development (IBRD) Sector Survey (May 2, 1973); and the APP PROP (FY 1975-78). These documents and other data provide ample justification for investments that have been made in aquaculture research and extension. The rationale for intensifying efforts to develop and expand aquaculture production in the RP includes but is not limited to the following:

1) Production of marine fisheries resources (commercial and municipality), from which 90% of the nation's fish are produced, is already at or near maximum sustainable yield.

2) Aquaculture, an age-old practice, has not been intensified for maximum production in the country. There are over 175,000 hectares of fishponds (mostly milkfish) that produce an average of only 600 kg/ha/yr or a total of 106,000 tons annually. Technology exists, and additional fishpond sites are available for development, that would allow production in brackishwater and freshwater fishponds and rice/fish paddies to be increased 1,000,000 tons annually.

3) Competition for land between aquaculture and agriculture is minimal because most brackishwater and freshwater fishponds are constructed on sites that are unsuitable for agriculture.

4) Fish are more efficient in converting feed to flesh than land-based cultured animals, primarily because fish are cold-blooded and do not require energy to maintain body temperature, and because fish require very little energy to support themselves against gravity.

5) New varieties of insect-resistant rice and specialized techniques of applying insecticides to rice paddies make possible the growing of fish in combination with rice in irrigated paddies. This practice will increase available protein and supplement the income for a large number of low-income farmers.

6) Aquaculture, when practiced on the farm or in backyards and utilized in the diets of the producer requires very little, if any, additional infrastructures.

7) It is labour-intensive and therefore complements the government economic development policies. Especially in small-scale operations, manual labor is preferred to mechanization.

APPENDIX B

BACKGROUND INFORMATION ON THE AQUACULTURE PRODUCTION PROJECT

Introduction

The Aquaculture Production Project (APP)was undertaken by the Government of the Philippines (GOP) with assistance provided by the United States Agency for International Development (USAID). It was initiated July 1, 1974 and will end September 30, 1978. The APP is a follow-on of the Inland Fisheries Project (IFP), also a joint GOP-USAID Project, that started in 1971 and ended in 1974. Each project was designed to increase aquaculture production by strengthening aquaculture research and extension capabilities so that more fish protein would be available to improve nutrition of the Filipino consumer. The IFP focused on the establishment of two aquaculture research centers, the Freshwater Aquaculture Center (FAC) at Central Luzon State University (CLSU) and the Brackishwater Aquaculture Center (BAC) in Iloilo. The APP focuses on the establishment of a phased aquaculture extension program in the Bureau of Fisheries and Aquatic Resources (BFAR), continued development of BAC and FAC, and intensified research activities linked to and coordinated with the extension program.

The Freshwater Aquaculture Center

The FAC, a sister aquaculture research center to the BAC and a major component of the former IFP and the current APP, is located adjacent to the Central Luzon State University, Munoz, Nueva Ecija. Major construction of the FAC was initiated in 1972. The Center become operational in 1973. Construction of major facilities is essentially complete.

(Purpose) The FAC has been designated by the Philippine Council for Agriculture and Resources Research (PCARR) to be the National Center for Freshwater Aquaculture Research. The center was established under the administration of the UPCF as part of the IFP and the APP. A memorandum of agreement was developed in June, 1977, between the UP, CLSU and NSDB relegating administration of the FAC from UPCF to CLSU. Funding for the FAC is provided by the GOP through NSDB, CLSU, UPCF and PCARR. External assistance is provided by USAID. The total budget for FAC during FY-1977 is ₱577,000.

(Staff) The FAC staff consisted of a total of 33 personnel as of July, 1977. There are 7 senior and 5 junior technical staff and 21 support staff. Three of the 12 technical staff possess a Ph.D. degree, 3 a MS degree and 6 a BS degree. A USAID advisor served as a senior staff member at the center from 1972-1976. Six of the senior staff members have received a graduate degree at Auburn University. One PCV, who possesses a MS degree, is assigned to the center and serves as a senior staff member. Two staff members are currently on study leave enrolled in the fisheries graduate degree training program at Auburn University and one is pursuing her Ph.D. at UPCF. Two BFAR extension workers from the BFAR Region III office are assigned to FAC to carry out freshwater aquaculture extension activities in the area.

(Facilities) The physical plant of FAC consists of 74 research ponds (total of 7.76 hectares of water) placed in replicated series, allowing for statistical analysis of research data. A 1.1 ha pond with concrete rip rap serves as a water supply reservoir. Water is supplied from wells and a irrigation canal. The first series of 60 ponds was completed and utilized for research in 1973. A rice-fish culture experimental area of about 2.5 ha was developed in 1975 adjacent to the pond system.

The building complex at FAC is adjacent to the research ponds and consists of a laboratory/administration building (372 m^2), a shop(165 m^2) for carpentry and vehicle repair, three senior staff cottages on the main campus and a pond supervisor's residence (each 113 m^2), a research laboratory (390 m^2), a wet laboratory (372 m^2) and a 10-room (4 to a room) unit dormitory (707 m^2). The ponds, laboratory/administration building and shop were completed in 1975. Construction of the other buildings and an elevated water tank of 20 m^3 capacity was initiated subsequently and completed in 1977. A fisheries building with 1070 m^2 of classroom and laboratory space was completed on the main campus of CLSU in June, 1977.

(Research) Major research thrusts planned at the FAC for the 5 years are as follows:

I. Improved fish pond management

   A. Fertilization
   B. Stock manipulation
   C. Mono-polyculture
   D. Supplemental feeding
   E. Predator, pest, parasites and disease control
   F. Soil and water management
   G. Harvesting techniques

II. Development of techniques for massive production of Tilapia and carp fingerlings

III. Agro-fishery systems

IV. Nutrition and feed development

   A. Nutrition requirements
   B. Screening of feedstuffs
   C. Evaluation of rations for different life stages and culture systems

V. Culture of invertebrates

VI. Culture of other fish species

VII. Other studies

   A. Pollution
   B. Engineering

(Teaching) Parallel to the activities of the BAC, the FAC is also deeply involved in teaching and manpower training. As a result of the APP and the FAC, a College of Inland Fisheries offering a BS degree in Inland Fisheries was begun at CLSU in 1976. Currently there are 112 students enrolled in the College of Inland Fisheries. The first class will graduate in 1979.

(Extension) The extension role of the BAC is still in the formative stage. The FAC staff conducts two or three workshops per year for teaching fish farmers and extension workers advance freshwater aquaculture technology. The staff of FAC also assists the BFAR extension workers assigned to the center in conducting field trials. Primary emphasis is now place on rice/fish culture and on pond culture of Tilapia. A memorandum of agreement between the Department of Natural Resources (DNR), Department of Agriculture, CLSU and UP has been developed to cooperatively field test rice/fish culture. A proposal to field test Tilapia Nilotica in BFAR demonstration farms has been developed by FAC.

The Brackishwater Aquaculture Center

The BAC, a major element of the former IFP and the current APP, is located near the town of Leganes, Iloilo, Panay Island. Major construction of the Center was initiated in 1972. It became operational in 1974.

(Purpose) The Center has been designated by PCARR to be the National Center for Brackishwater Aquaculture Research. It is currently the major, if not the only, national research facility conducting research in brackishwater aquaculture. The BAC is part of the University of the Philippines, College of Fisheries (UPCF). It is jointly funded by the Philippine Government through the National Science Development Board (NSDB) and the UPCF with external assistance from the Agency for International Development (USAID). The total budget for Fiscal Year 1977 was about ₱800,000, exclusive of a ₱1.2 million contribution from the Southeast Asian Fisheries Development Center (SEAFDEC) for operation of the joint UPCF-SEAFDEC graduate program.

(Staff) The BAC staff consists of a total complement of 55 personnel in July, 1977. Currently there are 20 senior and junior technical staff and 35 support staff. Of the six senior staff, including the AID advisor, two have a Ph.D. degree; three have a M.S. degree, and one has a B.S. degree. All of the graduate degrees except one were awarded by Auburn University. Also included in the category of senior staff are two Peace Corps Volunteers (PCV) both of whom have a B.S. degree. The junior staff consists of 14 research assistants and biologists, all of whom have a B.S. degree from Philippine universities. The remaining staff is made up of administrative personnel, skilled laborers, and laborers. Three staff members are currently enrolled in fisheries graduate degree programs at universities in the U.S.

(Facilities) The BAC physical plant consists of 76 ponds (8.5 hectares of water) ranging in size from 500 m^2 to 2 hectares. The ponds are in replicated series which allows for statistical analysis of data. Ten additional hectares of ponds (1 ha and 2 ha) are under construction. All ponds are filled and drained by taking advantage of tidal fluctuation.

A laboratory/administration building (625 m^2) contains chemistry, nutrition, soils and plankton laboratories, and office space for the senior staff. A shop (346 m^2) for vehicle repair and carpentry is adjacent to the laboratory/administration building. Under construction are two new buildings. One (1168 m^2) will contain research and teaching laboratories, classrooms, office space, and a library. The other building (660 m^2) will have a dormitory for 20 students and a cafeteria. The two new buildings being constructed plus site development will cost a total of about ₱4.3 million. Construction is expected to be completed in November 1977.

(Research) The research program at the BAC is focused on four general areas which are:

I. Evaluation and improvement of lab-lab and plankton culture systems in fishponds.

   A. Development of sampling techniques for soil and water variables, and pond biota.

   B. Development of methods for quantitative and qualitative evaluation of the lab-lab community.

   C. Development of more effective fertilization practices.

   D. Development of improved pond management practices.

II. Investigation of acid sulfate soils as they relate to fish production in brackishwater fishponds.

   A. Determination of how acid sulfate soils affect pond production by the study of: chemical changes in soil on flooding and drying, availability of macro and micro nutrients, levels of possible inhibitory substances, e.g., aluminum, iron, manganese.

   B. Development of practical and economical procedures to minimize adverse effects of acid sulfate soils on pond productivity; e.g., liming, alternate flushing and drying, replacement of pond bottoms with a more favorable substrate.

III. Improved survival of milkfish fry and fingerlings

   A. Identification of causes of mortality at all stages in the collection, holding, and stocking process.

   B. Improvement of pond management practices to increase survival.

IV. Utilization of agricultural by-products and wastes in fish feeding

   A. Test of single agricultural by-products as supplemental feeds.

   B. Test of combinations of agricultural by-products as supplemental feeds.

C. Tests of pelleted feeds formulated from combinations of agricultural by-products with other feedstuffs.

D. Determination of feed effects on water quality.

A major portion of staff effort at the BAC is devoted to improving technology for fishpond production through field and laboratory experiments. Most experiments are in the category of applied research. Research at the BAC has been hampered by acid sulfate soils which are prevalent at the center. Acid soils were not known to be a severe problem in brackishwater aquaculture until identified by research at the BAC.

(Teaching) The BAC is also deeply involved in manpower training. The BAC staff conducts the UPCF-SEAFDEC graduate program (MS level), the only institution in the Philippines offering a graduate degree in aquaculture. The program is funded by SEAFDEC which is a consortium of six member nations (The Aquaculture Department of the organization is located in Iloilo). SEAFDEC provides all of the funds and most of the classroom and laboratory facilities, while the BAC provides most of the teaching and administrative staff. Since the beginning of the graduate program 3 years ago, it has expanded from an enrollment of two students to 37 at present. Continued expansion is planned to accommodate not only Philippine nationals but those of other Southeast Asian nations.

BAC staff members also teach undergraduate fisheries courses at the UP Iloilo (UPI) campus. At present, there are approximately 60 students at UPI enrolled in the fisheries curriculum leading to a BS degree. This program was started in 1976 and has expanded rapidly.

(Extension) The extension role of the BAC is in an early stage of development. A pilot project is underway on the island of Panay to establish an effective force of extension workers under the BFAR. Linkages between the BAC and the BFAR extension teams have been formed and the cooperative effort between the two agencies is expected to become active in the near future.

The BFAR Aquaculture Extension Program

The third major component of the APP is the aquaculture program of the BFAR. This component was programmed to be developed after the research components (FAC and BAC) and is therefore the youngest. Manpower training under the project began in 1975.

(Purpose) The BFAR has the responsibility to conduct a National Fisheries Extension Program by virtue of PD 704. The Extension Division of the BFAR was formally established under this PD and became operational effectively in 1976. An Aquaculture Extension Section, one of four sections of the Division has responsibilities exclusive for inland aquaculture extension. The Extension Division assists the Director of BFAR on matters pertaining to fisheries extension and monitors and evaluates the BFAR's Fisheries Extension Program.

Specific objectives of the Extension Division are:

1. to increase fish yields of existing fishponds, sea farms and inland bodies of water; and

2. to develop additional areas for fish farms for socio-economic consideration through the development of fishpond estate.

(Staff) The BFAR Inland Fisheries Extension staff consists of 185 personnel. Out of this total number 50 are assigned to nine provinces of the pilot Regions V and VI, 4 are assigned to the Central Office and the remaining 40 provinces in other regions. The Extension Division staff is augmented by 18 U.S. Peace Corp Volunteers. Administration of extension workers in a region is under the BFAR Regional Director who is the implementor of the extension program in the field. The Chief of the Extension Division, Manila, coordinates with the field extension force.

Of the 50 extension workers in the nine targeted provinces, 21 have a BS degree in fisheries and related fields, 23 have a 2½ year Associate in fisheries with a number of years experience in extension work, 2 undergraduates with experience in extension services and 4 have received specialized aquaculture training in the U.S. Two staff members are on educational leave at Auburn University working for a MS degree in Aquaculture.

(Extension Activities) The BFAR inland fisheries extension program focuses on administration and organization at the central and regional levels. Program planning, personnel training, logistics and extension literature development and distribution services are provided to the regional extension offices by the Central Office. APP field programs have been concentrated in five provinces (Camarines Norte, Camarines Sur, Catanduanes, Masbate and Sorsogon) of Region V and in four provinces (Iloilo, Capiz, Aklan and Antique) of Region VI. Planned programs of work have been implemented in these nine provinces where two extension workers comprise an extension team. Extension activities are implemented following a sequence of activities listed below:

1. Data gathering - Extension workers gather baseline data on number, location and size of fish farms, production inputs and outputs, services available from financial institutions, location of fertilizer and pesticide dealers, bangus fry sources, etc..

2. Training and orientation - Extension workers are first teamed then given orientation before they are deployed in the field.

3. Actual field implementation of program - Extension workers conduct meetings with fish farmers and others to introduce them to the possible advantages of using advanced aquaculture technology; set up field demonstration/trials, provide assistance to fish farmers; and follow-up on the progress of fish farmers to determine success and provide additional information if necessary.

4. Evaluation - Extension workers use results of actual performance of fish farmers and results of field trials conducted at demonstration farms to compare with benchmark data and give evaluation reports.

(Specific Projects) The BFAR aquaculture extension programs is aimed primarily at:

I. Dissemination of information on technologies pertaining to:

A. Fishfarm management - The BFAR extension workers deployed in the targeted provinces will assist the fishpond operators in improving the yield of their fish farms by advising them in the technical and economic aspects of farm management.

B. Development of new fish farms - The extension workers will guide new operators in fish farm planning and construction.

C. Sea farming - Sea farming has been given an impetus by President Ferdinand E. Marcos. It involves the utilization of nutrient-rich shallow protected coastal waters, e.g. bays and coves, for the production of shellfish, fish and crustacean animals.

D. Rice-Fish culture - Production of fish in combination with rice becomes once more viable with the advent of pest-resistant rice varieties. BFAR extension workers will render technical assistance pertaining to fish culture.

E. Stocking of inland bodies of water - Fingerlings shall primarily be stocked in communal bodies of water to enhance productivity and/or replenish depleted areas. Request for fingerlings from private operators shall likewise be entertained.

II. Advisory services (rendered only upon request).

A. Assistance to individuals/organizations requesting for advice on subjects pertaining to inland fishery and aquaculture.

B. Assistance in the preparation of aquaculture project feasibility studies and its implementation thereof.

III. Conducting lectures, seminars and workshops on the technologies pertaining to inland fishery and aquaculture to inform a greater mass of our clientele.

IV. The RP-USAID and RP-UNDP aquaculture projects

A component of the Inland Fisheries and Aquaculture Extension Project is the RP-USAID Aquaculture Production Project (APP) and the RP-UNDP Brackishwater Aquaculture Development and Training Project.

The long-range objective of these projects is to assist in increasing fish farm production through strengthening of the government aquaculture extension service system.