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END-OF-PROJECT EVALUATION
OF THE
AQUACULTURE PRODUCTION PROJECT

USAID No. 492-11-180-266

by

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I. SUMMARY

The Aquaculture Production Project (APP) was undertaken by the Government of the Philippines (GRP) with assistance from the United States Agency for International Development (USAID). It was initiated July 1, 1974, and terminated September 30, 1978. The APP was a follow-up to the Inland Fisheries Project (IFP) that started in 1971 and ended in 1974. All told, a total of 27 participants received training (see Appendix B). When the project is considered in whole from 1971 to 1978, and when all factors are considered, the project was highly successful, and the GRP and USAID should be commended.

The physical plants of both the Freshwater Aquaculture Center (FAC) and Brackish Water Aquaculture Center (BAC) are excellent. Major problems at the BAC such as a poor access road and bridge, lack of potable water, and the necessity to generate electricity at the station are in the past. A considerable amount of effort was needed in developing both facilities, and progress in research was somewhat curtailed initially. With facilities at both FAC and BAC now virtually finished research should progress as planned.

The personnel at both FAC and BAC are very capable, highly motivated, and are doing a commendable job in research. Their salaries are still low but are now competitive with their peers in certain other organizations. A major concern is that staff at both FAC and BAC are overloaded and that they are spreading themselves too thin. Additional staff should gradually be added.

It should be emphasized that research should be continued to meet the needs of the fish farmer and increase the nutrition of the poor. There may at times be a tendency for research to follow the interests of an individual. For the most part, however, research is definitely on target. Examples are rice/fish and survival of milkfish fry. Publications and extension bulletins have been produced that are filling a real need; the importance of publication, especially extension bulletins, cannot be overemphasized. Important data must continue to be published and not be lost in annual reports. ✓

Funding of both FAC and BAC is on solid ground. Both Centers, because of their good reputations, are attracting grant funds from other organizations such as PCARR, ICLARM and SEAFDEC. The BAC has a semi-autonomous budget from the University of the Philippines (UP). Support of the FAC by Central Luzon State University (CLSU) is good. The NSDB, which has given grant funds to FAC and BAC, is now also giving institutional (block) funding.

Graduate training has been a very productive spin-off from the APP. The CLSU College of Inland Fisheries was founded in 1976. FAC staff teach the courses. It offers graduate training in fisheries/aquaculture. The UPCF instituted a graduate program in November 1974 with BAC/SEAFDEC staff as teachers.

Training sessions held by FAC, BAC, and BFAR have been frequent, varied in subject matter, and have served the needs of a wide range of people, particularly farmers.

Extension has progressed in Regions V and VI. Extension workers are motivated and have good rapport with cooperators and farmers. Fish farmers interviewed spoke very highly of the extension workers and were most happy with results in their ponds. A major problem listed by farmers is a lack of fingerlings for stocking. Other problems are shortages of fertilizer and financing. Extension workers list lack of adequate transportation as their major problem. BFAR plans to assist extension workers to obtain motor bikes. There are good research/extension linkages at the regional level but stronger and formal linkages are needed at the national level.

The educational background of extension workers varies considerably. Extension workers are not always well qualified and have received their training from various places. They do, however, take refresher courses as new technology develops. The Freshwater Fisheries Development Project, which has training as a major element, should help greatly to upgrade competence.

The BFAR plans to use the model of extension in Regions V and VI for expansion of its extension program of the other eleven regions. It is suggested that extension be expanded to one region at a time rather than all regions at once because of the high cost and shortages of resources. Extension programs now exist in the regions but at a low level.

Project Accomplishments

According to the logical framework in the APP project paper the project accomplished only part of its stated goals. There are two reasons for this. First, current data were not available on which to make an adequate judgment. In some cases 1976 data were the latest available. Therefore, it is suggested that final analysis of the log frame with future projects be postponed until data are available. Since the log frame is objective in nature, final evaluation of it could be made by USAID personnel. Second, it is assumed that new technology would move quickly to the farmer level. This did not occur because much of the new technology was generated only two years ago. This period of time is not long enough for new technology to move from researcher to farmer. In future studies it is suggested that evaluation of new technology be made at the cooperator level. Such evaluation should be a good indicator of the acceptance of new technology and whether or not it is successful. In our evaluation of the APP, we relied on interviews with a few cooperators to make an assessment.

While the goal and purpose were difficult to assess in the log frame, outputs and inputs were not. Generally, they were met as outlined in the log frame.

Transferability of techniques and procedures from the APP is possible to other developing countries. However, the sequence of the project components and the intensity of each effort must be studied carefully for each country. For example, if available technology exceeds application, then the extension component might be given first priority or vice versa.

The GRP through BFAR should continue to play the leadership role in administration of fisheries. Extension techniques learned from the pilot studies in Regions V and VI are programmed by BFAR in the other regions. It is

suggested that other regions receive strengthened extension services one at a time to have the most impact. It is doubtful that BFAR has the funds and extension workers to begin full-fledged extension programs in the other eleven regions at once.

BFAR should make every effort to improve research/extension linkage at the national level. This linkage seems adequate at the regional level.

USAID correctly assessed that lack of fry and extension workers trained in hatchery management are major limiting factors in rice/fish culture and aquaculture in general. The Fisheries Sector Study for the Philippines (1977) documents this in detail. The Freshwater Fisheries Development Project is most timely and its implementation is highly recommended.

USAID's involvement in an artisan fisheries (municipal fisheries), with elements of mariculture, is also recommended. The GRP has emphasized time and time again its desire to help the artisan fisherman.

II. INTRODUCTION

The Aquaculture Production Project (APP) was undertaken by the Government of the Philippines (GRP) 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-up of the Inland Fisheries Project (IFP), also a joint GRP-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 the 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 Brackish-water Aquaculture Center (BAC) in Iloilo. The APP focused on the establishment of a pilot 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.

AID provided advisory services in developing the general layout of the two research centers and in planning and organization of the extension division within BFAR. Through contract with Auburn University, AID provided assistance in design and execution of research programs and in participant training of the FAC and BAC research staff and the BFAR extension staff. Commodities from AID included second-hand jeeps and equipment which were used in BFAR's extension work and at the BAC and FAC.

This report is an end-of-project review to evaluate project accomplishments and failures relative to stated goal, purpose, and expected outputs of the project as per the project design summary (logical framework). In addition, suggestions are made regarding methods for evaluating USAID projects. Finally, suggestions are made for USAID support of future aquaculture projects in the Philippines.

III. PROJECT REVIEW

A. Research

1. FAC. The FAC, a major component of the former IFP and the APP, is located adjacent to CLSU, Munoz, Nueva Ecija. Major construction of the FAC was initiated in 1972. The Center became operational in 1973. Construction of major facilities was completed in 1977.
 - a) 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 signed in June 1977 between the UP, CLSU and NSDB relegating administration of the FAC from UPCF to CLSU.
 - b) Physical Plant.--The physical plant of FAC consists of 74 research ponds (total of 7.76 ha 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 an 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 ponds. Land is available for expansion of facilities if needed.

The building complex at FAC is adjacent to the research ponds and consists of a laboratory/administration building (372 m²), a shop (165 m²) for carpentry and vehicle repair, three senior staff cottages on the main campus and a pond supervisor's residence (each 113 m²), a research laboratory (390 m²), a wet laboratory (372 m²) and a 10-room (4 to a room) unit dormitory (707 m²). The ponds, laboratory/administration building and shop were completed in 1975. Construction of the other buildings and an elevated water tank of 20 m³ capacity was initiated subsequently and completed in 1977. A fisheries building with 1070 m² of classroom and laboratory space was completed on the main campus of CLSU in June 1977.

Research labs are well equipped and contain basic equipment such as microscopes, scales, balances, autoclave, spectrophotometer, and chemicals and equipment for water chemistry. Necessary equipment is available for making and analyzing experimental feeds. The last lab to be made functional is a pathology lab. Construction is complete; all that remains is to equip it.

In general, the physical plant is excellent. Laboratories and ponds will allow for comprehensive aquaculture research.

- c) Personnel.--The FAC staff consists of a total of 40 personnel. There are 7 senior and 5 junior technical staff and 27 support staff. Three of the 12 technical staff possess a Ph.D. degree, 3 a M.S. degree and 6 a B.S. degree. A resident 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 U.S. Peace Corps Volunteer was assigned to the center for 18 months and served as a senior staff member. Two staff members are currently on study leave and are enrolled in the fisheries graduate degree training program at Auburn University and

another is pursuing a Ph.D. degree at UPCF. They will return to CLSU in October 1978.

In addition to the above staff, ICLARM has provided a postgraduate staff member and supports one junior staff member for water quality.

Overall, the FAC technical staff is well qualified to carry out integrated aquaculture research.

- d) Projects.--During 1977 to the present the FAC conducted meaningful research. Two promising technologies developed at the FAC are being field tested. They are rice/fish culture and tilapia culture. Below is a list of experiments completed during the reporting period above:
- 1) Effect of different stocking weights on the culture of Tilapia nilotica in paddy fields.
 - 2) Effect of Furadan placement on T. nilotica and Cyprinus carpio survival in paddy fields.
 - 3) Effect of varying ratios of T. nilotica and Cyprinus carpio survival under paddy field condition.
 - 4) Experiment on developing a fish paddy facility for rotational rice and fish cropping.
 - 5) Screening of materials as feed supplement in a polyculture system using Nile tilapia and common carp. Feeding of copra meal at varying rates.
 - 6) Screening of feedstuffs as ingredients in the ration of freshwater fishes. Utilization of fish meal, rice bran, soybean meal, binlid, sorghum and copra meal in the ration of Nile tilapia.
 - 7) Screening of materials as feed supplement for milkfish in freshwater ponds. Use of fine rice bran and copra meal.
 - 8) Fingerling production in rice/fish culture of T. nilotica. Stocking of breeders at varying densities with and without supplemental feeding.
 - 9) Polyculture of male T. nilotica, male T. mossambica and carp with supplemental feeding in fertilized ponds.
 - 10) Polyculture of Tilapia nilotica and Anodonta woodiana in fertilized ponds.
 - 11) Pond evaluation of Macrobrachium idella.
 - 12) Pond production of Tilapia nilotica fingerlings with three stocking ratios.

Following is a list of on-going projects:

- 1) Effect of different insecticides on the survival of T. nilotica in rice paddy fields.
- 2) Fingerling production in rice/fish culture of T. nilotica. Stocking of breeders at varying densities with and without supplemental feeding.
- 3) Effect of different stocking weights on the culture of T. nilotica in paddy fields.

- 4) Experiment on developing a fish paddy facility for rotational rice and fish cropping.
- 5) Effect of Furadan placement on the survival of Tilapia spp. under paddy field condition.
- 6) Screening of feedstuffs in a polyculture system using Nile tilapia and common carp. Supplemental feeding of leaf meals with rice bran.
- 7) Studies on supplemental feeding of fish cages for T. nilotica and for T. mossambica. PCARR assisted project.
- 8) CLSU/ICLARM Cooperative research program on integrated animal-fish farms.
- 9) Studies on the substitution of fish meal with other feedstuffs.
- 10) Fingerling production of carp (Cyprinus carpio) in ponds.
- 11) Pond evaluation of Tilapia aeneus.
- 12) Hybridization of Tilapia species.
- 13) Culture of Macrobrachium idella in fertilized ponds.

In general, the research is on target as to the needs and interests of freshwater fish farmers, and the staff is responsive to suggestions from BFAR's extension workers. To give one example, research was conducted to produce mono sex (all males) by feeding tilapia methyltestosterone. Male tilapia grow faster and there is not excessive fish reproduction in rice/fish fields. However, this technology would be difficult to pass on to the farmers. Instead FAC stocked both sexes of Tilapia nilotica into rice/fish fields. This species will not spawn until 3 or 4 months old. Thus, the original fish stocked grow to a harvestable size of 80 grams or more before they are overcrowded with their own offspring. Some spawning does occur, and the young then can be used in other rice/fish fields.

- e) Publication.--Staff members of the FAC have a good publication record. Further, FAC staff are well known for their research and have presented papers at national and international meetings. As one example, research findings of the FAC were presented at the FAO United Nations Conference in Kyoto, Japan, in 1976. Below is a list of recent publications:

Cruz, E. M., and I. L. Laudencia. 1977. Protein requirements of Tilapia mossambica fingerlings, Kalikasan. Phil. J. Biol. 6(2):177-182.

Cruz, E. M., and I. L. Laudencia. 1977. Preliminary study on the protein requirements of Clarias batrachua. Fish. Res. J. Phil. 1(2):43-45.

Heinrichs, E. A., G. B. Aquino, J. A. McMennamy, H. Arboleda, N. N. Navasero, and R. C. Arce. Increasing insecticide efficiency in lowland rice. Agricultural Mechanization in Asia. 1977. Farm Machinery Industrial Research Corp. Vol. VIII, No. 3, pp. 41-47.

Guerrero, R. D. 1977. Cage culture of Tilapia. FAO Aqua. Bull. 8(2):8.

Guerrero, R. D., and T. A. Abella. 1976. Induced sex reversal of Tilapia nilotica with methyltestosterone. Fish. Res. J. Phil. 1(2):46-49.

Guerrero, R. D., and L. A. Guerrero. 1976. Culture of Tilapia nilotica and Macrobrachium species separately and in combination in fertilized freshwater fishponds. Phil. J. Fish. 14(2):232-235.

Guerrero, R. D., R. M. Magana, and U. U. Cargado. 1977. Production of tilapia fry in floating net enclosures. FAO Aqua. Bull. 8(3-4):4.

Guerrero, R. D., and T. A. Abella. 1978. Culture of Tilapia nilotica (male) X T. mossambica (female) hybrid in fertilized ponds at two densities (in press).

Guerrero, R. D., and E. P. Villanueva. 1978. Notes on the pond culture of Macrobrachium idella (in press).

- f) Funding.--Funding for the FAC was initially provided by the GRP through NSDB, CLSU, UPCF and PCARR. External assistance was provided by USAID. The recent budget breakdown is as follows:

Period Covered	CLSU	NSDB	ICLARM	IFS
July 1976 to June 30, 1977	₱183,060	₱370,000	--	--
July 1977 to Dec. 31, 1977	₱273,585	₱185,000	--	--
Jan. 1978 to Dec. 1978	₱310,033	₱230,000	₱400,000	₱41,000

USAID had continued to contribute in the form of equipment within the periods indicated above.

To generalize, the FAC has a budget that will provide a firm basis for continuing operations. Several things should be noted: Because of its good reputation, FAC is beginning to attract new funds. ICLARM and IFS, for example, are providing funds for research. NSDB has been providing project support from the outset. It is now beginning to award funds for institutional funding. The FAC is seeking a grant from the Japanese government for equipment.

2. BAC. The BAC, a second major facility, is located near the town of Leganes, Iloilo, Panay Island. Major construction of the Center was initiated in 1972. It became operational in 1974.

- a) Purpose.--The Center has been designated by PCARR as the National Center for Brackishwater Aquaculture Research. It is currently the major national 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 GRP through the National Science Development Board (NSDB) and the UPCF with external assistance from 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.

b) **Physical Plant.**--The BAC physical plant consists of 199 ponds ranging in size from 40 m² to 2 hectares, giving a total of 18.5 ha of water. Ten ha of this total consists of two 2-ha ponds and six 1-ha ponds. These ponds near completion will be used as demonstration ponds. Fish produced will be sold and the funds will be used for assistance of BAC activities. The experimental ponds are in replicated series which allows for statistical analysis of data. All ponds are filled and drained by taking advantage of tidal fluctuation. A freshwater supply system is under construction to provide water to ponds. This will allow researchers to adjust salinity.

A laboratory/administration building (625 m²) contains chemistry, nutrition, soils and plankton laboratories, plus office space for senior staff.

A shop (346 m²) for vehicle repair and carpentry is adjacent to the laboratory/administration building. Recently completed are two new buildings. One (1168 m²) contains research and teaching laboratories, classrooms, office space, and a library. The other building (600 m²) has a dormitory for 20 students and a cafeteria. The two new buildings plus site development cost a total of about ₱4.3 million. Labs are in general well equipped.

Overall, the general physical plant of BAC has undergone a dramatic improvement since 1976 (see evaluation of APP by LeBeau, Avault and Bravo). The facilities including buildings, ponds and accessories are excellent. Since 1976, the road leading to the BAC has been greatly improved as has the bridge. Freshwater, for domestic purposes, is now on the station. Electricity has also been brought in through public utility lines and generators no longer have to be operated at the station.

In general, the BAC station can rank as one of the best brackish-water research centers anywhere.

c) **Personnel.**--The BAC staff consists of a total complement of 57 personnel. Currently there are 20 senior and junior technical staff and 37 support staff. Of the seven senior staff, one has 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. The junior staff consists of 13 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 recently completed graduate degree programs at universities in the U.S. and are awaiting transfer to the BAC. The BAC is also seeking a Peace Corps Volunteer. A soils and water specialist, formerly with the International Rice Research Institute (IRRI), will join the BAC in October 1978 to work on acid soils research. His assignment will be a temporary appointment, and he will train one of the BAC staff to replace him when he leaves.

The Director of the BAC has identified the need for other staff in the future--to include a fish pathology specialist, a plankton specialist, and a soils/water specialist.

In summary, the BAC staff members are well qualified to conduct meaningful aquaculture research. In 1976 there was a major morale problem

with the staff as pointed out by LeBeau et al. (1976). Salaries were low; facilities were far from completed because of many problems such as a poor access road, no bridge, etc. Things looked dim, but the BAC weathered the storm because of the leadership of its director and the support of the staff. SEAFDEC gives BAC staff members an honorarium. This plus their salary from UPCF makes them among the top paid fisheries staff when compared to other fisheries scientists and faculty in the Philippines.

d) Projects.--During 1977 to present, the BAC conducted meaningful research in tune with the needs of fish farmers. Below is a list of experiments completed:

- 1) An evaluation on the effect of fertilizer on water and soil-water systems.
- 2) Mass culture of fishpond organisms using various enrichment media. Effect of different N-P-K ratios.
- 3) A comparison of isonitrogenous applications of urea and ammonium fertilizers in brackishwater ponds.
- 4) Residual effects of heavy doses of organic fertilizers in brackishwater fishponds.
- 5) Phosphorus dynamics in brackishwater ponds.
- 6) Investigation of different artificial substrates for analyzing lab lab community.
- 7) Diurnal oxygen levels as a measure of community metabolism.
- 8) The culture of Tilapia in brackishwater ponds using tarpon as a biological control for Tilapia reproduction.
- 9) Polyculture of milkfish and Tilapia in brackishwater ponds with tarpon to control Tilapia reproduction.
- 10) Effect of varying salinities and hormone levels on the growth, survival and sex reversal of Tilapia mossambica.
- 11) Production response of milkfish to added substrates as surface attachment for fishpond organisms in brackishwater ponds.
- 12) Study on the use of rice straw as additional substrate for fishfood organisms.
- 13) Preliminary investigations into methods for determining suitability of soils for fishpond development. Evaluation of techniques for determining potential acidity.
- 14) Effects of varying combinations of chicken manure and lime on the production of milkfish in brackishwater ponds affected by acid-sulphate soils.
- 15) Establishment of ground cover vegetation to minimize dike erosion.
- 16) Survival and growth response of milkfish grown from fry to fingerlings in brackishwater ponds with added substrates.
- 17) Intensive feeding of milkfish fry in net enclosures using complete and incomplete diets at various protein levels.

- 18) Use of piggery wastes in brackishwater ponds.
- 19) Feeding trial using ipil-ipil leaf meal in pelletized feeds for T. mossambica.
- 20) Studies on the relative response of T. mossambica to some agricultural by-products.

Following is a list of on-going projects:

- 1) Evaluation of five commercial fertilizers for brackishwater fishponds.
- 2) Culture potential of mullet. Stocking density.
- 3) Mass production of T. mossambica fry in brackishwater. Influence of selected factors.
- 4) The effect of liming rates on ponds affected by acid-sulphate soils.
- 5) Development of improved methods of collecting, sorting and holding milkfish fry. Survey of existing techniques.
- 6) Development of artificial feeds for intensive milkfish fingerling production. Response of milkfish fry to standard test diets.
- 7) Use of agricultural wastes for fish production. Combined ingredient feeds.
- 8) The effect on fish production of rearing pigs over brackishwater ponds.

In general, the research at the BAC is on target. For example, a BFAR extension administrator was asked what are some major areas where research should be conducted. He replied, "survival of the milkfish fry." Later, the Director of BAC was asked the same question. He said survival of milkfish fry was a priority research project.

e) Publications

- Camacho, A. S. 1977. Implications of acid sulfate soils in tropical fish culture. In South China Sea Fisheries Development and Coordinating Programme Work Plan implementation SEAFDEC, Tigbauan, Iloilo, Philippines, pp. 97-102.
- Potter, Thomas. 1976. Some characteristics of mangrove soils which influence their quality for use in fishponds. Presented at the PCARR Fisheries Forum in honor Fish Conservation Week, October 20, 1976. 6 pp. (mimeographed)
- Potter, Thomas. 1976. The problems to fish culture associated with acid sulfate soils and methods for improvement. Presented at the 12th Annual National Conference of the Philippine Federation of Fishfarm Producers, August 26-28, 1976, Iloilo City. 9 pp. (mimeographed).

Research Results Selected for Publication (in preparation)

- Camacho, A. S. Use of agricultural by-products as feeds for tilapia in brackishwater fishponds.
- Leary, D. F., and C. C. Baylon. A successful method for establishing grasses (Cynodon spp.) on acidic soils to minimize erosion.

Fritz, L. M., and H. J. Gonzales. Primary productivity and fish yield in brackishwater fishponds.

Other Research Results Targeted for Publication

Fortes, R. D. Mixed culture of milkfish and Tilapia in brackishwater ponds with tarpon as biological control for Tilapia reproduction.

Camacho, A. S., and L. A. Dureza. Feeding trial using ipil-ipil leaf meal in pelletized feeds for Tilapia mossambica.

Cholik, F., and R. D. Fortes. The effect of the different densities of artificial shelters on the growth and survival of Penaeus monodon raised from fry to juveniles.

Dureza, V. A., and C. L. Gempis. Production response of milkfish in brackishwater ponds with added substrates.

Fortes, N. R., and C. A. Saclauso. An evaluation of the effect of fertilizer on water and soil-water system.

The BAC has a publication committee and its staff is serious about publishing meaningful research findings. However, a considerable amount of time has been devoted to the development of the overall facilities up until now. It is felt that publications will follow now that the facilities are basically complete.

f) Funding.--Funding for the BAC for 1977 was as follows:

A. Personal Services

1. Salaries:

a. For personnel under the

regular UP payroll -----		₱148,164.00
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1) Coll of fish -----	₱ 79,896.00	
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2) IFDR -----	68,268.00	
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b. For NSDB paid contractual personnel -----		175,245.34
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2. Wages, NSDB contractual manual labor -----		74,852.69
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3. Living Allowances (regularly paid

UP personnel) -----		34,800.00
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Total for Personal Services		₱433,062.02
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B. Special Purpose (Staff Honoraria from NSDB) -----		23,576.60
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C. Maintenance and Operation

1. Travel -----	₱ 9,168.70	
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2. Sundries -----	29,000.35	
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3. Supplies & Materials -----	141,679.35	179,848.40
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D. Equipment Outlay -----		686.15
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Total Disbursement		₱637,173.18
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The BAC has a solid framework for continued activity. The NSDB plans to give the BAC institutional (block) funding in addition to project support. The BAC now has a semi-autonomous budget with UPCP and the Director of BAC serving as the budget director, thus putting the BAC on a continuing sound budget. SEAFDEC provides an honorarium to augment salaries of technical staff for their linkage in the graduate training program.

B. Training

1. Participants

a) **FAC.**--The FAC conducted a number of workshops for various groups during 1977:

<u>Date</u>	<u>Clientele</u>	<u>No. of Participants/Observer</u>	<u>Subject</u>
June 27-28	Private group from Fort Magsaysay, N.E.	9	<u>Tilapia</u> cage culture
Aug. 15-16	BFAR Reg. I and Fish Farmers	25	<u>Tilapia</u> cage culture
Aug. 27-31	Sab-a Basin Settlers, Leyte	9	<u>Tilapia</u> production and rice/fish cultures
Sept. 5-10	BFAR, BAex, BPI Technician	38	Field testing of rice/fish culture
Nov. 25	N.E. Fish Farmers	22	<u>Tilapia</u> hatchery and culture
March 29	N.E. Fish Farmers	36	<u>Tilapia</u> hatchery and culture
	Total	<u>139</u>	

Personnel of FAC have also had linkage with extension agencies:

1) Nationwide:

- a)) Second time field testing of rice/fish culture technology in cooperation with NFAC, MA and MAR in the 12 regions of the country.
- b)) Continued supporting the APP in cooperation with BFAR and USAID with Regions V and VI as initial target areas.

2) Province-wide:

- a)) Extension of tilapia hatchery and culture technology to fish farmers of Nueva Ecija--joint project of CIF and FAC funded by the Asia Foundation.
- b)) Actual visitation of fishponds (joint effort of FAC and BFAR personnel assigned at the center).

Resource Persons/Lecturer/Participant/Workshop Chairman:

The staff of the FAC has served as:

- 1) Trainors in tilapia cage culture attended by seven participants and two observers from Fort Magsaysay N.E. on June 27-28, 1977.
- 2) Lecturer in rice/fish culture of FAC to LEDA farmers on July 13, 1977.
- 3) Participants and workshop group chairman in the National Mangrove Symposium held at El Grande, Paranaque, Rizal on July 28-30, 1977.
- 4) Lecturers on tilapia and rice/fish cultures given to the research staff of SEAFDEC Freshwater Aquaculture Station, Binangunan, Rizal on August 2 and March 8, 1978.

- 5) Participants in the International Workshop on Hilly Land Development, sponsored by PCARR in cooperation with several other agencies, held at Imperial Hotel, Legaspi City on August 3-6, 1977.
- 6) Speakers on prospects and potentials of freshwater fisheries in the Nueva Ecija before the Rotary Club of Cabanatuan City on August 4.
- 7) Trainors of tilapia cage culture and rice/fish culture given to 25 BFAR fish farmers and extension workers from Regions I and III on August 15-16.
- 8) Observers in the CLARC Media Extension Conference held at CLSU on August 22, 1977.
- 9) Lecturer on tilapia culture given to 15 PCV at PRRM San Leonardo, Nueva Ecija on August 23.
- 10) On-the-job trainors on August 27-31 for nine Basin Project settlers.
- 11) Guests for nationwide broadcast of Mr. Jojo Taduran of the Voice of the Philippines (VOP) "Pulong Pulong sa Kaunlaran" Program. The interview covered the objectives, research and extension activities and linkages of the center.
- 12) Representative of CLSU in meeting with NEDA and BFAR in connection with the Freshwater Fisheries Development Project being proposed by BFAR/USAID. It will consist of a fish hatchery-extension training center located at CLSU. Construction cost is approximately ₱5 million.
- 13) Trainors of 40 BPI, BAex and BFAR Technicians, rice/fish training program, September 5-10, 1978.
- 14) Participant and chairman of the Aquatic Food Commodity Group in the Effective Research Utilization System Seminar-Workshop held at Coverlandia, Cavite, September 28-October 1, 1977.
- 15) Resource speaker at the National Fish Farmers Federation Convention held at Manila Peninsula Hotel, Makati, September 30-October 1, 1977.
- 16) Lecturer in fishpond engineering training in SEAFDEC, Tigbauan, Iloilo, October 3-4, 1977.
- 17) Extended technical assistance to VISCA technician on October 10-11, 1977.
- 18) Resource speaker on a Symposium on Inland Fisheries at the BFAR Regional Office III in San Fernando, Pampanga on October 17, 1977.
- 19) Participant in the Institutional Planning Workshop-Seminar at Angeles University, October 28-30, 1977.
- 20) Participant in the conference on economics of fisheries held at SEAFDEC, November 2-7, 1977.
- 21) Participant in the 2nd National Agriculture and Resources System Research Congress sponsored by PCARR, November 10-13, 1977, at UPL3.
- 22) Participants in the International Mangrove Symposium and Workshop at the Manila Hotel, November 14-19, 1977.
- 23) Participant in a seminar on Freshwater Fish Marketing, November 18, 1977.

- 24) Trainers of Nueva Ecija fish farmers and BFAR technician in tilapia hatchery extension program on November 25, 1977, and March 29, 1978.
 - 25) Lecturer on T. nilotica to Central Luzon Fish Farmers in Orani, Bataan, December 10, 1977.
 - 26) Participant in the International Seminar on Fisheries Research Management held at Terraces Plaza, Baguio City, December 11-17, 1977.
 - 27) Resource person in the farmers training at Maddela, Quirino, January 9, 1978.
 - 28) Resource speakers at the U.S. Peace Corps Training at SEAFDEC, Iloilo, January 10-11, 1978.
 - 29) Participants in the PCARR Directors and team leaders conference with NEDA Regional Executive Director and other Bureau Directors in Cebu City from February 27-March 2, 1978.
 - 30) Participants in the NEDA Team Leaders Conference with NEDA Regional Executive Directors and other Bureau Directors for Regions VI, VII and VIII, April 28-30, 1978, at Iloilo City.
 - 31) Participants in the PCARR Team Leaders Conference with NEDA Regional Executive Directors and other Bureau Directors for Regions IX, X, XI and XII in Zamboanga City, May 2-6, 1978.
 - 32) Resource speaker in the Corporate Farmers and Agriculturist Seminar in Davao City, May 5-6, 1978.
- b) BAC.--The BAC staff participated in a number of training activities during 1977. Major activities are listed below:
- 1) UPCF Planning and Budget Workshop (Jan. 15), Diliman.
 - 2) Examination of UP Tacloban curriculum in Fisheries (Feb. 10), Tacloban, Leyte.
 - 3) Rural Agenda Research Conference (April 18-20), ORC-sponsored, Luzon Province.
 - 4) Seminar on Aquaculture Economics (March 16-17), UPCI, Iloilo City.
 - 5) Review of Aquaculture Production Project (APP) as a member of the ad-hoc Research and Extension Linkage committee (May 17-20), Manila, Nueva Ecija and Iloilo.
 - 6) Project Evaluation Conference (June 29), Diliman, Quezon City.
 - 7) Conference on the Establishment of the Asia Institute of Fisheries (Oct. 8-11), Manila.
 - 8) Regional Workshop in Aquaculture Engineering (Nov. 27-Dec. 3), Tigbauan, Iloilo.
 - 9) Symposium on Aquaculture, sponsored by PCARR (April 25), Paulino Garcia Hall, Manila.
 - 10) Seminar on Fisheries Extension, Region VI (July 1).
 - 11) PCARR "Bangus Recommends" panel meeting (July 14), UPLB, Laguna.

2. College level in-country

- a) CLSU, CF-FAC.--The CLSU College of Inland Fisheries (CLSU CIF) was founded in 1976 to fill the need for trained manpower. The College offers the B.S. in Inland Fisheries program with specialization in aquaculture and inland fisheries management. Graduates of the 4-year work-oriented curriculum are expected to serve as inland fisheries managers, extension workers, teachers, researchers, or as private operators.

The three departments of the College are: Department of Aquatic Biology, Department of Aquaculture, and Department of Fisheries Management.

FAC staff, for the most part, teach and supervise students. The CIF building is located at the northern portion of the CLSU campus beside the College of Agriculture. There are three lecture rooms, three laboratories and a study room available for 200 students. A research library for freshwater fisheries has been established in the CIF to support the scientific literature needs of its students and faculty.

The CIF also operates seven raceway-type ponds with a total area of 1.23 ha in the University Park and two concrete pools in front of the CLSU Infirmary with an area of 0.06 ha.

Research studies of the CIF faculty and the students are also conducted at the FAC where 74 experimental ponds and well-equipped research laboratories are available.

A proposed 2.7 ha production pond system and a limnological station to be established beside the Pantabangan Reservoir will boost the instructional and research capabilities of the CIF in the future.

Programs (Instruction).--The CIF curriculum is the only one of its kind in the Philippines today. It offers the thesis and field practice options. As of February, 1977, there were 121 students enrolled in the CIF at the second and third year levels. The CIF will have its first batch of graduates in 1979.

The courses offered by the CIF are:

Department of Aquatic Biology--Ichthyology, Aquatic Biology, Parasites and Diseases, Aquatic Invertebrates, Aquatic Flora, Marine Fisheries and Estuarine Ecology.

Department of Aquaculture--Aquaculture, Fishpond Management, Fish Processing, Hatchery Management and Fish Nutrition.

Department of Fisheries Management--Fishpond Engineering, Limnology, Fishery Laws, Inland Fisheries Management, Fishery Skills and Research Methodology.

To summarize, the FAC staff has played a leadership role in the development of the CIF at CLSU. The College will definitely serve a useful function of producing trained fisheries personnel. A major concern is that FAC, in serving a dual role of research/teaching, could be overlooked as primarily a research agency. The concept of researchers also teaching is good, however.

- b) **UPCF-BAC.**--In November 1974, UP instituted a graduate program at BAC. The program is administered under the UPCF but actual administration, instruction and supervision of students was conducted at the BAC by the Center's staff. Establishment and subsequent development of the graduate program is a significant contribution of the BAC. The first student ever to receive a graduate degree (M.S.) in aquaculture from an institution in the Philippines did so in April 1978.

In June of 1976, the graduate program increased substantially as a result of a memorandum of agreement between UP and SEAFDEC. The latter organization agreed to provide all the funds for the program. In 1978, the graduate program budget amounted to ₱1.3 million. The UP retained administrative control, with the BAC Director as head. Faculty were initially provided by BAC. Now a number of SEAFDEC scientists have become adjunct faculty members of UP.

At present the graduate teaching program comprises 16 members, four from BAC and 12 from SEAFDEC. Courses are taught at the BAC and at SEAFDEC.

The graduate program requires 2 years beyond the B.S. level and consists of 24 semester hours plus a thesis. A total of 10 courses are taught, but future plans call for additional courses. Thus far two students have graduated, three are in the final preparation of their theses, and 46 are at various stages.

Overall, the graduate program will make a valuable contribution to the GRP in providing trained fisheries graduates.

3. BFAR--Extension workers

Ten BFAR extension workers have completed short and/or long-term training in the U.S. and are now assigned key roles in the BFAR extension program.

Aquaculture training for local extension workers in Regions V and VI included training on fish-farm management and development, fisheries economics, and extension principles and methods; seventy-two extension workers received 10 days to 1 month of training during 1977 and 1978.

C. Extension

1. Organization and staffing

The Bureau of Fisheries and Aquatic Resources (BFAR) by virtue of Presidential Decree 704 was designated as the agency to conduct a fisheries extension program. The BFAR extension component was programmed to follow the development of the research components which were constituted in the BAC and FAC. The extension function became operational only 2 years ago in 1976.

The major extension activities are concentrated in Regions V and VI which were designated as the pilot regions for the extension segment of the APP.

The Chief of BFAR Extension Division assists on matters pertaining to fisheries extension and monitors and evaluates the BFAR's extension effort. Extension workers are responsible to BFAR's regional directors and the Regional Directors are responsible to the BFAR Director. Thus the Chief of the BFAR Extension Division is in effect a staff assistant to the Director. BFAR Regional Directors are responsible for direct supervision of extension staff.

The extension division of BFAR presently employs a total of 620 extension workers throughout the 13 Regions of the Philippines. This includes all extension activities. Region V (Bicol) has 52 extension workers and Region VI (Panay) has 70 extension workers. Of these totals, 15 extension teams (30 people) in Region V and 13 extension teams (26 people) in Region VI serve as the "front line" core for extension work in inland fisheries.

2. Program Objectives

The stated objectives of the BFAR operated extension effort in inland fisheries are: (a) to increase fish yields from fishponds, sea farms and other inland bodies of water; and (b) to develop additional areas for fish farms. Major thrusts of the program focus upon milkfish farming and rice/fish culture.

3. Program Implementation

To achieve the desired objectives BFAR extension activities are implemented in a region following the general sequence of: (a) data gathering--extension workers gather data on number, location and size of fish farms, production inputs and outputs, services available from financial institutions and location of fertilizer and pesticides dealers and sources of milkfish and tilapia; (b) training of extension workers--when possible, extension workers are given a month of special training and fish culture technology and extension methods and techniques before being deployed in the field; (c) field implementation--extension workers conduct educational meetings with fish farmers and other interested persons to make them more aware of advanced technology, to set up field demonstrations and trials, to provide direct assistance to fish farmers and monitor demonstration and farmer progress, and to evaluate demonstrations and field trials.

Available data for 1977 indicated the following accomplishments:

Region V (Bicol), 1977

Individual visits, 678

Area of fishponds covered:

brackishwater, 2,655 ha

freshwater, 31 ha

Demonstrations established:

rice/fish culture, 4

milkfish, 2

Educational meetings, 5

Region VI (Panay), 1977
 Individual visits, 388
 Area of fishponds covered:
 brackishwater, 2,018 ha
 freshwater, 470 ha
 Continuing assistance or demonstrations, 97
 Educational meetings, 31

4. Extension Literature

BFAR extension workers utilize extension literature developed by the APP, SEAFDEC, BFAR and elsewhere. Following is a list of extension materials generated by the APP:

- a) Pond culture of Nile tilapia--R. D. Guerrero
- b) Disease and parasites of cultured fish--E. M. Cruz
- c) How to grow large tilapia--R. D. Guerrero
- d) Sexing, segregation and maturity of spawners--R. D. Recometa
- e) Know your tilapia--R. D. Guerrero
- f) Rice-fish culture--R. G. Arce
- g) Plan for rice-fish culture demonstration in the provincial rice seed and fish production demonstration farms--BFAR Staff
- h) Notes on the cage culture of Nile tilapia--R. D. Guerrero
- i) Problems of freshwater catfish culture--IFP/APP Staff
- j) Bangus transfer from one salinity to another--IFP/APP Staff
- k) Length-weight table for bangus--IFP/APP Staff
- l) Plankton method for raising bangus--IFP/APP Staff
- m) Platform method of fishpond fertilization--IFP/APP Staff
- n) Fishpond fertilizers and fertilization--IFP/APP Staff
- o) A simple salinometer--IFP/APP Staff
- p) Fish nutrition (freshwater species)--IFP/APP Staff.

IV. PROJECT ACCOMPLISHMENTS (see APP Logical Framework)

A. 1. Goal

Improve nutrition of Filipino poor and increase incomes of poor inland fish producers.

2. Measures of Goal Achievement

- a) National consumption of pond-raised fish increased from 3.0 kg per capita per year in 1973 to 4.0 kg per year in 1978. Consumption will increase to 6.4 kg per capita per year in Regions V and VI.

- b) Net incomes of fish producers adopting and using technologies recommended by BAC and FAC increased by 20%.

3. Assessment

- a) Data are not currently available from NFAC, NEDA, or BFAR which allow end-of-project evaluation of goal achievement (national level). There are indications (Project Evaluation Summary, July 1977) that per capita consumption of 6.4 kg per year of pond-raised fish will be reached in Region VI, and possibly Region V by 1978. These regions were then targeted by the APP for extension of technology generated by APP.
- b) Data were not available regarding change in income of milkfish farmers. However, one case history of rice/fish farming in Panay showed a 24% increase in net income for combining fish with rice.

B. 1. Project Purpose

Increase brackishwater and freshwater fisheries production.

2. End-of-Project Status

- a) Purposeful research completed and results published; extension workers developing and testing new technology; training programs being conducted for extension personnel; new technologies publicized among fish producers; and fish producers are using improved technologies.
- b) Milkfish production increased from 355 kg/ha per year in 1973 to 700 kg/ha per year in 1978 in Region V and from 704 kg/ha per year in 1973 to 1300 kg/ha in 1978 in Region VI.
- c) National freshwater fisheries annual production increased from 4,000 mt in 1971 to 15,000 mt by 1978.
- d) National fish production in irrigated rice fields increased from negligible amount in 1973 to 1,000 mt by the end of 1978.

3. Assessment

- a) Research is near completion on several pertinent subjects, including rice/fish culture, acid-sulfate soils, survival of milkfish fry, polyculture, fertilization trials, and mono-sexing of tilapia. At the FAC, several papers have been published in national and international journals, while at the BAC, which has been in existence a shorter period, several papers have been prepared and selected for publication.

Extension workers of BFAR are stationed at the FAC and BAC research facilities, and are continually observing and adapting new technology in freshwater and brackishwater aquaculture and are presently assisting in field tests, especially for rice/fish.

Training programs have already been conducted at FAC for other extension personnel of BFAR and NFAC extension personnel dealing with rice/fish culture. At BAC, a joint effort between BFAR and BAC is being planned for training BFAR extension workers in brackishwater aquaculture.

Rice/fish culture has been field tested nationwide, and is now being promoted actively by a consortium of several government agencies, with BFAR taking the lead role. Similarly, the plankton method and a combination of lab-lab/plankton is being promoted for increasing milkfish production in brackishwater. Soil/water analyses are being routinely utilized by BFAR extension workers to determine fertilizer needs for milkfish farmers.

Rice farmers are eager to apply the new technology of combined rice/fish; apparently, the application is limited only by the supply of tilapia or carp fingerlings. Many milkfish farmers are using the technology developed by APP, but technology transfer is severely limited by levels of extensionists with the farmers. Application of the technology is further limited by supply of fry and fertilizer, and by lack of credit.

- b) Milkfish production increased from 355 kg/ha per year in 1973 to 364 kg/ha in 1977 for Region V. It is unlikely that the projection of 700 kg/ha for Region VI by 1978 will be achieved. BFAR personnel indicate that problems are based on the fact that fish farming is non-traditional in Region V, having been practiced fewer than 20 years. New technologies are less eagerly accepted than in Region VI (Panay Island), where fish farming has been known for more than two centuries. Milkfish production in Region VI increased from 704 kg/ha per year in 1973 to 1,119 kg/ha in 1977. If limitations on seedlings, fertilizer and credit are overcome, the projection of 1,300 kg/ha per year by 1978 could well be met.
- c) Data do not exist which allow an evaluation of change in freshwater fisheries annual production for the nation. Latest statistics from BFAR for 1976 estimate a total of 1,128 metric tons from all fishponds; approximately one percent of this total is reportedly from freshwater. BFAR in Region VI recently conducted a survey to identify and classify freshwater resources within the region, and intends to follow up with an estimation of production from each class of resource. This effort is to be commended, and should be followed in all regions. Until such is accomplished, there can be no measurement of the impact of management practices.
- d) Data were available only for the rice/fish activity supervised by BFAR in Region III, near the Freshwater Aquaculture Center. There were 11.85 ha, involving 15 farmers. The average yield in a recent nationwide field test of 19 fields in 14 provinces was 204 kg/ha. The production of fish in Region III rice fields for one crop per year annually (1977), therefore, was estimated at 2,417 kg. Following the nationwide field test in 1977, there has been heavy demand for fingerling fish by those who wish to implement rice/fish culture. However, there is not the capacity by BFAR or the FAC-CLSU to provide sufficient fingerling tilapia or carp. If the fingerlings were available, and given the rapid rate of adoption of the high-yielding, insect-resistant rice varieties, the projections of 1,000 metric tons of fish from ricefields might have been easily met. Surely, with the impetus already given the rice/fish concept, adoption will move forward at a rate directly related to the supply of fish.

C. 1. Project Outputs

- a) Extension services to inland fish producers.
- b) Priority research at the BAC and FAC.
- c) Training of private and public personnel related to increased aquaculture production.

2. Magnitude of Outputs

- a) Extension systems in Regions V and VI staffed with a total of 50 or more personnel, equipped and in operation by June 1977; extension systems in each of the other regions strengthened by two or more personnel.
- b) Research: At least 10 priority research projects completed by each FAC and BAC in key problem areas by June 1978.
- c) Training completed by September 1978: 300 extension workers trained; 500 fish producers received orientation on new technology. Six participants received a total of 90 PM graduate degree training abroad and 10 participants received a total of 60 PM non-degree training abroad.

3. Assessment

- a) Region V (Bicol) has 52 extension workers. Region VI (Panay Island) has 70 extension workers. Seventy-eight other workers function in the other regions for a total of 200 engaged in inland fisheries development.
- b) At the BAC, 21 research projects were completed in 1977 in priority areas, and eight additional projects were on-going in 1978. (See Section III, Project Review). At the FAC, 12 research projects were completed in 1977, and 13 additional projects were on-going in 1978. (See Section III).
- c) A total of 70 extension workers received training at formal short courses and seminars, mainly relating to rice/fish culture. The BAC is just now completing facilities for training, and will soon be prepared to conduct joint seminars for extension workers of BFAR in brackishwater aquaculture technology. In fact, a seminar will be held in 1978, sponsored by BAC, BFAR, and USAID/APP.

At the FAC, 101 fish farmers have received orientation on rice/fish culture in 1977 alone. In addition, FAC staff served as speakers on 32 different occasions at fisheries meetings. BAC staff made numerous presentations on brackishwater fish culture, especially related to fertilizers and acid-sulfate soils problems. These, with presentations and extension contacts by BFAR technicians to 1066 fish farmers of Regions V and VI, fully met the output targets.

The participant training will all be accomplished as scheduled by the end of the APP.

D. 1. Project Inputs

a) AID

Technical assistance; participant training; equipment commodities and supplies.

b) GRP

Core personnel; Budgetary support for BFAR, FAC, and BAC; physical facilities.

2. Implementation Target

a) USAID

	FY 75 PM	(\$000)	FY 76 PM	(#000)	FY 77 PM	(\$000)	FY 78 PM	(\$000)	Project Total	
									PM	(\$000)
Tech. Asst.	26	142	35	113	27	99	28	165	116	519
Participant Training	112	106	48	44	24	20	28	30	212	200
Commodities	--	72	--	62	--	10	--	26	--	170
TOTALS		320		219		129		221		889

b) Philippine Government (GRP - ₱000)*

	FY 75 PM	(\$000)	FY 76 PM	(\$000)	FY 77 PM	(\$000)	FY 78 PM	Project Total
								(\$000)
PL 480		2,005		1,415		945		945
GRP Budget		7,440		7,845		8,225		8,750

*7.35 pesos = US\$1.00.

3. Assessment

Generally, the project inputs were delivered in a timely manner. However, USAID supplied jeeps from excess property which often were not in satisfactory condition when delivered, and there have been delays in providing special analysis equipment for acid sulfate soils research at the BAC. The equipment for the soils analysis has now been purchased and shipped, and alternate plans for transporting extension workers are being explored by BFAR/USAID.

V. CONCLUSIONS AND RECOMMENDATIONS

A. Overall Evaluation of Project

The project was a definite success. High output and achievement were obtained relative to AID funding. GRP outputs have greatly increased during the last two years. This can best be shown by additional inputs of money into the overall project, exemplified by the increased NSDB funding.

The GRP has demonstrated its support in many other ways. Examples include recognition of the FAC and BAC as the national centers for freshwater aquaculture and brackishwater aquaculture, respectively. The Presidential Decree 704 further strengthened the government's role in fisheries. One component of the decree placed extension as the responsibility of BFAR.

The project has several very desirable spinoffs not programmed in the PROP. Among them were the formation of the College of Fisheries at CLSU and the graduate training program of the UPCF at BAC. Both programs were due to the vision of the FAC, BAC, UP, and others. This graduate-level training will help to provide badly needed personnel for fisheries/aquaculture in the Philippines.

Further interest in fisheries began--the formation of other fisheries/aquaculture programs such as SEAFDEC and ICLARM. Most important is the linkage established between the FAC and ICLARM and the BAC and SEAFDEC. ICLARM is providing major funding for FAC in cooperative research in agro-aquaculture (i.e., pig/fish and duck/fish). SEAFDEC likewise has a major input of funds to the graduate training program involving BAC and SEAFDEC staff.

Both FAC and BAC are well staffed, and the staff are well qualified and motivated to produce effective mission-oriented work. The only concern is that the staff may be overworked. Originally FAC and BAC staff were concerned mainly with research. Concomitant with this duty was the time expended in facility development. It is suggested that as the research and graduate-training programs expand additional staff will be required.

Facilities of both FAC and BAC are truly excellent and virtually completed. It is suggested that emphasis be placed on utilization and maintenance of existing facilities. With completion of facilities, research outputs should increase significantly.

Research is being conducted that is germane to the APP--to increase nutrition of the poor. It cannot be overemphasized, however, that a strong research/extension linkage must exist for this to be accomplished.

Research and extension personnel interaction and coordination at the worker's level is satisfactory. This can be increased by formalizing the coordination at the central administration (Manila) level and at the field level. Research proposals should not only be reviewed by professional peers but also by the extension staff with responsibilities that relate to the particular research effort. This could be achieved by a rather specific memo of agreement at the agency level and by establishment of a program review committee.

Major limiting factors affecting the economic growth of the fish farmers are: 1) inadequate financing, 2) supplies of fingerlings for stocking, 3) supplies of fertilizer and other materials, and 4) access to available technology.

The planned GRP/USAID follow-up Freshwater Fisheries Development Project focuses upon the major limiting factors and should be very effective in gaining application of the available technology which can result in widespread opportunities by fish farmers for increased profits and better family nutrition. The Freshwater Fisheries Development Project is well conceived; application is feasible and all contacts with extension staffs in the pilot regions indicate strong support for the planned follow-up effort.

The APP included a strong extension dimension that was to be implemented after establishment of the research center. Thus, the extension function really became functional only in 1976. The basic concepts and program directions of the extension function are sound. The fact that the extension function is in one agency (BFAR) and its research base (BAC and FAC) is in another organization will demand continued attention toward effective coordination.

It is difficult to determine the number of extension workers that are needed in a given region; it seems, however, that program effectiveness is presently more limited by opportunities for adequate training of extension workers and by limited mobility of extension workers than by the number of extension workers. Attention should be given to more intensive, practical training of extension workers. The morale, dedication and enthusiasm and attitude of each extension worker contacted was very high and is certainly commendable. There has been less than one percent annual turnover in the extension staff. A promotion system or career ladder is in place.

Extension activities at the BAC and FAC should be encouraged but limited to "on-site" training activities for extension workers and farmers. However, research scientists should be encouraged to travel and participate in BFAR coordinated farmer and extension worker training efforts. Research scientists should be encouraged to author and co-author (with extension specialists) extension publications. Writing of such publications should be viewed as "publications" and be equal to journal articles in staff evaluation.

No attempt to duplicate extension efforts carried out by BFAR should be attempted by the BAC and FAC or SEAFDEC.

Extension specialists should be actively involved in applied research when possible and should coordinate effective field testing efforts in the various regions with the scientists at the BAC and the FAC.

The extension publications available at this date are well written but kinds and number are very limited because of budget constraints. The publication on milkfish culture is out of print and it is not being reprinted presently because of costs.

Considerations for giving publication a higher priority in the budget seems appropriate. The one published extension newsletter is well done and useful. Two more have been written but have not been printed as of this date. Support for publication could be met by simple low-cost outline type production guidelines. This publication need should be addressed in the new Freshwater Fisheries Development Project.

There is considerable variation in regional climatic and production conditions in the Philippines. Extension specialists and workers should be encouraged to do effective and thorough field verification of research data produced in the centers and elsewhere. Minimum public facilities or adequately controlled private cooperator facilities will be needed to achieve such research verifications.

Documentation and reporting of extension activities are adequate. A program for evaluating the effectiveness of extension activities is needed. Methods for effective evaluation of regional and national extension efforts should also be given priority.

Equipment for water analyses, for use by extension workers, is limited and needs prompt attention.

Many of the supplies and vehicles supplied by USAID were reported to be in poor condition when received and maintenance costs have been excessive.

Emphasis on adequate training of extension workers before deployment in the field should be continued. A structured plan for such training should be developed and adhered to. To date some workers have received only 10 days with others receiving as much as 30 days. The teaching outlines that have been proposed for training sessions seem well designed and adequate.

B. Suggested Methods for Improving the Project Evaluation Process

1. Strict interpretation of successful project completion with respect to the variable indicators was not possible in some instances because of the lack of available data.
2. Final evaluation of the APP log frame output could be made by AID and GRP officials when data are available and added as a supplement to final reports.
3. Firm scheduling of a review team far enough in advance to allow for a total of 3 weeks time for travel, information gathering and report writing is needed.
4. Agencies should continue to gather pertinent needed information and reports in advance of team arrival.
5. The time it takes for new technology to go from researcher to extension worker to cooperator to farmer is probably much longer than most people realize. It may take ten or more years before new technology is practiced by farmers. It is suggested that increased production in kg/ha and other tangible evidence be evaluated at the cooperator level. This then will be a good indicator of whether or not new technology is successful. Further, reliable data will be much easier to obtain when compared at the cooperator level. Long-term evaluation of a project could be made at the farmer/consumer level after the project has had sufficient time to function.

Important to know by the time the report is written

C. Transferability of Techniques and Procedures of the APP to Other Developing Countries

1. The model of the APP focused upon development of (a) research capabilities, (b) manpower training, (c) extension programs, and (d) administrative support.

2. In the Philippines, the APP appropriately placed initial emphasis on the development of the research capability and on manpower development. This was followed by implementation of the extension component.

3. Application of the APP procedures and components should be applicable to most developing countries with fisheries and aquaculture potential. However, the sequence of the project components and the intensity of each effort must be studied carefully in each country. For example, if available technology exceeds application, then the extension component might be given first priority, or vice versa. Effective administrative support will always be a key to effective implementation of project components.

In the transfer of APP procedures to other countries, ample initial studies should be made with the people to be affected (current and potential fish farmers) in order to determine problems, identify priorities, and establish the sequence of emphasis for establishing the desired components of a development project.

D. GRP's Continued Effort/Direction in Aquaculture

The GRP's role in aquaculture has good focus. Particularly evident is continued support of FAC and BAC.

BFAR is the designated agency to administer fisheries programs in the GRP. Its role in extension is a particularly important one. Gradual expansion of extension programs in other regions (besides Regions V and VI) is now a part of BFAR's plan. It is doubtful that full-fledged extension programs can begin in all regions at once. It is suggested that strengthening of extension be done to one region at a time to more fully utilize available resources (funds, personnel, etc.).

BFAR should continue to play a leadership role, melding together all aspects of fisheries, particularly research/extension linkage.

USAID has correctly assessed that the lack of fry and inadequately trained extension workers are the most important limiting factors for providing the needs of freshwater fisheries development. The follow-up GRP/USAID Freshwater Fisheries Development Project should alleviate these major obstacles.

E. USAID's Future Role in Aquaculture in the Philippines

The proposed follow-up Freshwater Fisheries Development Project focuses upon two of the major existing problems in aquaculture and should be implemented.

The presently conceived outputs of the new Freshwater Fisheries Development Project are achievable under the GRP and USAID operational framework. The basic output will be (1) a strengthened and expanded freshwater fish fry production and distribution system, (2) a strengthened and expanded extension effort in the target region (Central Luzon), (3) stronger research-extension coordination, and (4) a coordinated freshwater fisheries production and marketing information collection and distribution system.

USAID should keep abreast of problems and opportunities to help the most disadvantaged fish farmer or segments of the aquaculture industry. Specific examples in which USAID assistance may be needed include: (1) milkfish fry collection and survival; (2) clam, oyster and mussel culture; (3) tilapia production; and (4) acid soil problems in brackish water fishponds.

Another area defined again and again by the GRP as a major interest is the artisan fisheries (municipal fisheries). The interest of the GRP in artisan fisheries is well documented in the 1977 report, "The Philippines: Fisheries Sector Study." It is suggested that USAID consider support to artisan (municipal) fisheries, especially with elements of mariculture.

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APPENDIX A

Itinerary for Aquaculture Production Project (APP)

<u>Evaluation Team</u>		
<u>Date</u>	<u>Time</u>	<u>Activity</u>
9/9/78	1940	Dr. R. O. Smitherman, Professor of Aquaculture, Auburn University, arrived Manila.
9/10	1930	Smitherman met with Keith Sherper, Deputy Chief, OAD/USAID.
9/11	0940	Dr. J. W. Avault, Professor, Aquaculture, Louisiana State University, arrived Manila.
9/12	0830	Smitherman, Avault and Johnie Crance, Fisheries Advisor, USAID, traveled to Munoz, Nueva Ecija. Visited President Campos and staff at CLSU-Freshwater Aquaculture Center (FAC).
9/13	1300	Avault, Crance, Smitherman traveled to Manila. Met with Dean Rogelio Juliano, UP College of Fisheries.
9/14	0730	Dr. Wallace Klussman, Fisheries Extension Program Leader, Texas A&M University, arrived Manila. Klussman, Avault, and Smitherman met with Mr. Lane E. Holdcroft, Chief, OAD/USAID.
	1360	Klussman, Smitherman, Avault and Crance visited BFAR, Arcadia Building, Quezon City.
	1630	Avault and Smitherman met with Dr. Herminio Rabanal, South China Sea Investigation, Makati, Metro Manila.
9/15	0530	Smitherman, Klussman, Avault and Crance departed Manila for Iloilo.
	0800	Visited BFAR, Region VI office personnel, Mr. Heminigildo Magsuci, Regional Director, and Mr. Edgar Clemente, APP Extension Action Officer.
	1300	Visited BFAR rice/fish and milkfish extension demonstration cooperators, Iloilo province.
9/16	0800	Avault, Smitherman, Klussman and Crance visited Brackish-water Aquaculture Center and staff and reviewed research/teaching activities.
	1330	Klussman, Smitherman, Avault and Crance visited SEAFDEC/AIF facilities and site of the proposed UP-Visayas Campus at Tigbauan, Iloilo.
9/16	2040	Crance, Avault, Smitherman and Klussman returned to Manila.

- 9/17 Team collected data and began assembling information for report.
- 9/18 0915 Crance, Klussman and Avault departed Manila for Naga City. Smitherman worked on APP report in Manila.
- 1100 Avault, Klussman and Crance visited with BFAR Region V office personnel, Mr. Frank Pili, Regional Director.
- 1400 Avault, Klussman and Crance visited BFAR cooperators' fish farms, BFAR freshwater fish station at Lake Buhí and traveled to Legaspi.
- 9/19 0730 Smitherman worked on data at USAID, and conferred by telephone with Dr. Jose Carreon and Mr. Rudy Ventura, participants under IFP/APP who are now at UP, Diliman.
- 9/19 0955 Crance, Avault, Klussman departed Legaspi for Manila.
- 1300 Avault, Klussman, Crance joined Smitherman at USAID.
- 1400 Mr. Abraham Gaduang, Chief, BFAR Extension Division, and his assistant, Mr. Rodolfo Pinto, met with the team at USAID to discuss BFAR's overall extension program and the progress toward construction of USAID-assisted BFAR hatchery-extension training facility to be built at the FAC, Nueva Ecija.
- 9/20 0730 Avault, Smitherman and Klussman began debriefing and writing end-of-project evaluation report.
- 1430 Team met with Mr. Lane Holdcroft and Mr. Keith W. Sherper for debriefing.
- 1500 Avault, Klussman and Smitherman reported project evaluation to Mr. Peter M. Cody, Mission Director, USAID/Philippines.
- 1700 Crance, Avault, Klussman and Smitherman met at USAID with Mr. A. Gaduang, Mr. R. Pinto, and Mr. B. Tayamen (BFAR) on national extension statistics and plans for the FFDP.
- 9/21 Avault, Klussman and Smitherman prepared draft report.
- 9/22 Klussman and Smitherman departed for U.S.
- 9/23 Avault submitted draft report to USAID; departed for U.S.

APPENDIX B

List of Participants Trained

Status of Participants Funded Under Aquaculture Production Project (492-11-180-266)

Name of Participant	GRP Agency	Field of Training	Location	Degree	Present Position/Status
1. Abraham Gaduang	BFAR	Extension Education	Wisconsin	Cert.	Chief, Extension Div. BFAR/QC
2. Joemari D. Gerochi	BFAR	Extension Education	Wisconsin	Cert.	Exec. Asst. to Dir., BFAR/QC
3. Billy P. Blanco, Jr.	BFAR	Pond Const./Aquaculture	Auburn	Cert.	APP Coordinator, BFAR/QC
4. Edgardo C. Clemente	BFAR	Pond Const./Aquaculture	Auburn	Cert.	Ext. Action Off. BFAR Reg.6/Iloilo
5. Apolonio A. Alapan	BFAR	Aquaculture/Extension	Auburn	Cert.	Extension Specialist II
6. Fernando P. Bernardino	BFAR	Aquaculture/Extension	Auburn	Cert.	Reg. 7 BFAR/Cebu Supvsg. Fish. Biol.
7. Primitivo O. Clave	BFAR	Aquaculture/Extension	Auburn	Cert.	Off. in Chg., Reg. 2, BFAR/Tuguegarao
8. Jose J. Marquez	BFAR	Aquaculture/Extension	Auburn	Cert.	Supvsg. Fish Ext. Spec. Reg. 10
9. Ricardo R. Lim	BFAR	Aquaculture/Extension	Auburn	M.S.	Ext. Div. Chief, BFAR, Reg. 5
10. Melchor M. Tayamen	BFAR	Aquaculture/Extension	Auburn	M.S.	Ext. Coordinator, BFAR, Manila
11. Florian M. Orejana	UPCF	Process/Qual. Control	U. Washington	Ph.D.	Asst. Prof., UPCF, Diliman
12. Jose A. Carreon	UPCF	Aquaculture	Auburn	Ph.D.	Asst. Prof., UPCF, Diliman
13. Romulo C. Aure	UPCF	Fish Farm Management	Auburn	Cert.	Pond Supt., UPCF, BAC/Leganes
14. Renato D. Recometa	CLSU	Fish Farm Management	Auburn	Cert.	Research Biol. & Instr. III, CLSU-FAC
15. Oscar D. Quines	CLSU	Fish Diseases	Auburn	M.S.	Asst. Prof., CLSU Vet School
16. Ruben C. Sevilleja	CLSU	Aquaculture Economics	Auburn	M.S.	Asst. Prof., CLSU-FAC
17. Rolando B. Edra	BFAR	Extension	U. Missouri	Cert.	Chief, Marine Fish. Section, Ext. Div., BFAR/QC

Participants Funded by Inland Fisheries Project (1971-1974)

Name of Participant	GRP Agency	Field of Training	Location	Degree	Present Position/Status
1. Arsenio S. Camacho	UPCF	Aquaculture (Nutrition)	Auburn	Ph.D.	Director, Brackishwater Aquaculture Center (BAC)
2. Romeo D. Fortes	UPCF	Aquaculture (Fish-Culture)	Auburn	Ph.D.	Research Biologist, UPCV, BAC
3. Catalino de la Cruz	CLSU	Aquaculture (Pond-Engineering)	Auburn	Ph.D.	Director, Freshwater Aquaculture Center (FAC)
4. Rafael D. Guerrero	CLSU	Aquaculture (Fish-Seedling Production)	Auburn	Ph.D.	Dean, College of Inland Fisheries, CLSU
5. Rodolfo F. Ventura	UPCF	Aquaculture (General)	Auburn	M.S.	Asst. Prof., UPCF, Diliman
6. Gaudiosa Almazan	UPCF	Aquaculture (Water Chemistry)	Auburn	Ph.D.	Asst. Prof., UPCF, Diliman
7. Rodolfo G. Arce	CLSU	Aquaculture (Fish-Culture)	Auburn	M.S.	Rice/Fish Culture Project Leader, CLSU-FAC
8. Emmanuel M. Cruz	CLSU	Aquaculture (Nutrition)	Auburn	Ph.D.	Assoc. Prof. of Fisheries, CLSU-FAC
9. Virgilio A. Dureza	UPCF	Aquaculture (General)	Auburn	M.S.	Asst. Project Leader, BAC
10. Joel R. Canlas	UPCF	Aquaculture (General)	Auburn	M.S.	Asst. Prof., UPCF, Diliman

APPENDIX C

List of Acronyms

APP	Aquaculture Production Project
BAC	Brackishwater Aquaculture Center
BAEx	Bureau of Agricultural Extension
BPI	Bureau of Plant Industry
CIF	College of Inland Fisheries
CLSU	Central Luzon State University
FAC	Freshwater Aquaculture Center
FAO	Food and Agriculture Organization
GRP	Government of the Republic of the Philippines
ICLARM	International Center for Living Aquatic Resources Management
IFDR	Institute of Fisheries Development and Research
IFP	Inland Fisheries Project
IRRI	International Rice Research Institute
NEDA	National Economic Development Authority
NFAC	National Food and Agricultural Council
NSDB	National Science Development Board
PCARR	Philippine Council of Agriculture and Resources Research
PCV	Peace Corps Volunteer
PROP	Project Paper
SEAFDEC	Southeast Asian Fisheries Development Council
UP	University of the Philippines
UPCF	University of the Philippines College of Forestry
UPLB	University of the Philippines at Los Banos
USAID	United States Agency for International Development