PJ-BAC 519

660-0080

ZAIRE

Fish Culture Expansion

Project Paper

Revision

(Original Missing)

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

1. TRANSACTION CODE: [A] A ADD, C CHANGE, D DELETE

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10. ESTIMATED COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L C	FIRST FY D. TOTAL	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L C	LIFE OF PROJECT G. TOTAL
AID APPROPRIATED TOTAL	464		464	900		900
GRANT	(464)	( )	(464)	(900)	( )	(900)
LOAN	( )	( )	( )	( )	( )	( )
OTHER U.S. 1. Peace Corps	500		500	2,477		2,477
OTHER U.S. 2.						
HOST COUNTRY					1,666	1,666
OTHER DONOR(S)						
TOTALS	964		964	3,377	1,666	5,043

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY 78 F. GRANT	E. 1ST FY 78 G. LOAN	H. 2ND FY 81 I. GRANT	H. 2ND FY 81 J. LOAN	K. 3RD FY 82 L. GRANT	K. 3RD FY 82 M. LOAN
(1) ESF				464		-		-	
(2) ARDN				-		200		236	
(3)									
(4)									
TOTALS				464		200		236	

A. APPROPRIATION	N. 4TH FY 83 O. GRANT	N. 4TH FY 83 P. LOAN	Q. 5TH FY 84 R. GRANT	Q. 5TH FY 84 S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1) ESF	-	-	-	-	464	
(2) ARDN	-	-	-	-	436	
(3)						
(4)						
TOTALS	-	-	-	-	900	

12. IN-DEPTH EVALUATION SCHEDULED: MM YY

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN THE PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA, BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET.

[2] 1 NO 2 YES

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: Norman L. Sweet

TITLE: Norman L. Sweet
USAID/Zaire Director

DATE SIGNED: MM 05 DD 21 YY 81

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Fish Culture Expansion (660-0080)

Project Paper Amendment

PART I: INTRODUCTION AND SUMMARY

This Project Paper Amendment is occasioned by the perceptions that:

-- This Project has demonstrated its potential and its viability.

-- The Government of Zaire (GOZ) has demonstrated a shared appreciation of the Project's value and a preparedness to support the activity indefinitely as a permanent institutional responsibility.

-- The time has come to begin development of the activity on a national scale, expanding geographically beyond the three regions where the Project has been tested and developed, and reinforcing the institutional core needed to support a national program.

The roots of this activity go back to World War II when the Belgians initiated an extensive effort to promote pond fish culture. This action, motivated by the need for increased production of food for consumption in Zaire, was notably successful in introducing the basic techniques of fish culture throughout the country. The rural Zairians, most of whom were traditionally disposed to hunting and fishing, readily accepted the concept. Over the 20-year period leading to independence, some 93,000 fish ponds covering an estimated 4,000 ha were established. Following independence this activity, like most rural pursuits, was deprived of official institutional support. This deprivation was exacerbated by the succession of adverse political, military, economic, and social events over the years following independence. Consequently, fish culture languished, and the promise of earlier efforts slipped away as producing ponds were abandoned.

In 1973 the Peace Corps and OXFAM began looking into the possibilities for reinvigorating fish culture. In 1975 a joint program was undertaken to reestablish abandoned ponds and to introduce improved cultural methods. The successful early experience with this pilot program prompted USAID to lend its assistance to a larger pilot effort in 1978. Since that time the activity has demonstrated conclusively that there is a widespread readiness among farmers to practice fish culture and to adopt the improved methods fostered by the Project. In a protein-deficient food environment, farmers are quick to accept economically and socio-culturally sound sources of protein. The fish culture program thus has found a ready participant group. Requests for project services have consistently outpaced the capacity of the Project to respond fully to demand.

In the latter part of 1980, USAID commissioned a study to ascertain the feasibility of geographically expanding the activity beyond the regions of Bandundu and the two Kasais into Bas-Zaire and Kinshasa. The conclusions of that study suggested the feasibility of such expansion. Subsequently, in early 1981, USAID conducted the first evaluation of the USAID-assisted project.

Participating in the evaluation also were representatives of the GOZ and the Peace Corps. That evaluation reinforced the perception of a viable program suitable for expansion to other areas and further institutional development as a national rural development activity. The evaluation underscored also the need for technical assistance beyond the outreach activities provided by Peace Corps Volunteers (PCVs).

Specifically, institutional development at the level of national program direction and at the central technical training facility was cited as the fundamental requirement to support successful expansion into a national program. Concomitant with the evaluation, a USAID-contracted expert investigated institutional development needs and associated technical assistance.

The redesign of the Project reflected in this Amendement flows from the findings of the 1980 feasibility study, the 1981 evaluation, and the institutional development study. The new Project design builds on the experience and achievements of the Project to this point. Peace Corps support will be continued and broadened in the form of additional PCVs to act both as outreach agents and as on-the-job trainers of GOZ agents. USAID assistance will continue for commodity and equipment support and will be increased to support expert technical assistance in overall program management and direction as well as in developing and implementing the national basic training program. The GOZ will continue its support for the existing institutional infrastructure and will increase its contribution in the form of personnel and facilities and their associated maintenance.

This Amendment increases the life of the Project by three years through FY 1984. In dollar terms USAID's contribution is increased by $436,000, Peace Corps' by $1,500,000, and the GOZ's by $766,000.* By the end of the Project, the program will be operational in five of the country's nine regions, training and research will have been made systematic and routine, and the national program management will have been developed to the point that expansion of the program into the remaining regions may be coherently pursued and supported.

This Project Amendment is structured in two principal parts. The first presents the actions designed to strengthen the institutional capacities for the program's management, training and research functions. The second presents the plan for the geographic expansion of the program into two additional regions of Zaire during the increased life of the Project.

Summary

A. Grantee and Implementing Agency

The Grantee will be the Government of Zaire (GOZ). The implementing agency will be the Department of Agriculture and Rural Development (DOA/RD), specifically the Project Pisciculture Familiale (PPF) Directorat

* Local currency equivalent

B. Financing

	($000)		
	PP	PP Amendment	Total LO
USAID	464	436	900
Peace Corp	977	1,500	2,477
GOZ	900	766	1,666

C. Project Background

Fish culture was introduced during the colonial period but it did not survive the transition period of independence. Nonetheless, thousands of abandoned ponds indicate the importance that fish culture once had. Technically and socio-economically, fish culture is both compatible and consistent with the needs and abilities of the people in the project areas. The principal element necessary to revitalize the production of fish is an outreach program providing appropriate technical assistance and training.

D. Description of Project

1. Goal

The goal of this Project is to increase the availability and the nutritional value of food production for Zaire's low-income majority.

a) Measures of Goal Achievement
Achievement of the Project goal will be seen in increased fish production by small farmers. The measure of its success will be through observation of both the total number of fish farmers and the quantity of fish produced.

b) Means of Verification
Verification of the Project's progress toward attainment of its goal will be through readily available quarterly reports from extension agents. These reports will indicate, inter alia, the number of fish farmers and the quantity of fish produced.

c) Assumptions
-- Prevailing ecological, economic, and policy conditions continue along with consumer preference for fish.
-- The independent farm family will benefit from the consumption of some of its fish production; the excess production will be sold, introducing a restraining effect on market prices.

2. Project Purpose

The purpose of this Project is to establish a fish culture program oriented towards small farmers in Kinshasa, Bas-Zaire, Bandundu, and the two Kasais.

a) End-of-Project-Status (EOPS)

By the Project Assistance Completion Date (PACD) the following minimal conditions will have been met:

- -- All additions and renovations to the Gandajika Fish Culture Research and Training Center will be completed.
- -- The Gandajika Center will be actively training RD personnel.
- -- Ninety outreach sites, established under PCV supervision, will be turned over to RD extension agents.
- -- Five fingerling production centers will be in operation.
- -- The Project Management Unit will have all key national and local positions filled and functioning, and key personnel will have completed training.
- -- A study of the technical, organization, and policy aspects of a nationwide fish culture program will have been carried out.

b) Means of Verification

Once a year representatives of the GOZ, Peace Corps, and USAID (the Project Management Unit) will review and evaluate the progress of the Project. A final project evaluation will be conducted by outside experts. Quarterly reports will be evaluated by the Project Management Unit and adjustments, as required, will be made.

c) Assumptions

The GOZ will be able to meet its functional obligations to support the PPF and outreach personnel during the remainder of the Project period and will be prepared to assume the necessary continuity of the program at the end of the Project. In view of GOZ support to date, this assumption is warranted.

3. Outputs

The revised Project outputs are:

a) The Gandajika Fish Culture Research and Training Center

- -- Ninety Zairians trained in fish culture techniques and outreach methods.
- -- Physical plant constructed and/or renovated, as required, including construction of a combination dormitory/dining/classroom facility, staff housing, and an administrative building.
- -- An extension agent training program developed and tested.

b) Five Fingerling Production and Distribution Centers
   -- Five centers staffed and operational.
   -- Rotating tool fund established at each center.

c) A Fish Culture Outreach System
   -- Ninety RD fish culture outreach agents operating in the field.
   -- Eight hundred farmers entering the program each year of the Project.

d) RD Office of Fish Culture
   -- Office organized and staffed.
   -- Office Director completed advanced training outside of Zaire.

4. Inputs

a) USAID Contribution

1) Technical Assistance
   Long-term consultant, 72 pm
   Short-term consultant, 9 pm
   Evaluations, 3

2) Transportation
   Trucks, 1
   Diesel pick-ups, 9
   Motorcycles, 60
   Bicycles, 90
   Spare parts, tools

3) Equipment
   Station equipment and supplies
   Extension equipment

4) Participant Training, 10 pm

b) Peace Corps Contribution

Personnel (volunteers), 50

c) GOZ Contribution

1) Construction
   Gandajika and fingerling center
   Demonstration ponds
   Office/storage

2) Transportation
   Maintenance
   POL (petroleum, oil, lubricants

3) Equipment
Station equipment and materials

4) Personnel
PPF staff
Center staff
Outreach agents

5) Operations
Operational expense
Training
Other costs

5. Illustrative Budget

I. USAID		($000)
A. Technical Assistance		290,000
-- Long-Term TA, 72 pm	175,000	
-- Short-Term TA, 9 pm	85,000	
-- Evaluations (3)	30,000	
B. Vehicles		260,000
-- Trucks (1)	12,000	
-- Pick-Ups (9)	97,000	
-- Motorcycles (60)	60,000	
-- Bicycles (90)	41,000	
-- Spare Parts, Tools	50,000	
C. Commodities		253,000
-- Station Equipment & Materials	155,000	
-- Extension Equipment	98,000	
D. Participant Training		25,000
-- Short Term Training, 10	25,000	
E. Other		72,000
-- Other Costs/Inflation	72,000	
	L USAID	$900,000

II. GOZ Budgetary Support		(Z000)
1. Personnel	545	
2. Construction	1,400	
3. Transportation	790	
4. Supplies & Equipment	1,070	
5. Training	635	
6. Operating Expenses	260	
7. Other Costs	300	
	TOTAL GOZ	Z5,000

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PART II: INSTITUTION BUILDING

A. General

The GOZ presently employs 24 permanent staff personnel in the Fish Culture Service of the DOA/RD. About half of these are engaged in headquarters activities based in Kinshasa. Each of the three regions where the program has been operational have program representatives (Regional Coordinators) on the regional staff. These Regional Coordinators are counterparted by PCVs (PCV Leaders). The 35 PCVs serving as outreach agents operate under the general direction of the Regional Coordinator and the PCV Leader in their region. About ten professionals are engaged in fish station management and operation. Additionally, the Fish Culture Service employs some 140 non-professional personnel engaged principally in fish pond and facilities operation and maintenance.

Over the course of the three additional years of project activity (FY 1982-84), the GOZ (DOA/RD) will substantially increase its level of participation in the program through the fielding of trained outreach agents (agents piscicoles; APs) to replace the PCVs. Ninety APs are programmed for training (30/year) beginning in late 1981.

The Project will provide short-term technical assistance to the training program. Initial assistance will include course development and the conduct of the first training session (14 weeks). Long-term technical assistance will be provided to the headquarters staff in program planning and direction. Assistance also will be provided to fish research. A total of 81 months of technical assistance is programmed over the life of the Project.

B. Research

Research will receive more emphasis during the remainder of the Project. DOA/RD has initiated negotiations with the National University of Zaire (UNAZA) to participate in this aspect of the Project. The UNAZA agricultural faculty will make available its fish research facility at N'Djili, near Kinshasa, and the laboratory facilities on its main campus. This research will concentrate on breeding improved species for the Zaire environment. Other research will be undertaken at the four stations presently operating under the program as well as the new station to be rehabilitated at Kasangulu (see Part III). Station research will concentrate on testing alternate feeding, stocking, composting, and harvesting patterns. Selected research technicians will participate in short-term training in the US.

C. Training

Training at Gandajika Fish Culture Research and Training Center

Training is an integral part of this Project. Beginning in 1981, RD outreach agents will be trained at the Gandajika Fish Culture Research and Training Center to prepare them to replace PCVs. This training will enable the DOA/RD to independently manage, support, and expand the fish culture program upon termination of USAID and Peace Corps assistance.

Gandajika Fish Culture Research and Training Center

Gandajika Center is located in Kasai-Oriental, 90 kms southeast of Mbuji-Mayi and 8 kms south of the town of Gandajika.

The station was built in the early 1950's and virtually abandoned for a number of years, although it was used as a training center as recently as 1975. The center is a good facility with 36 ponds, totaling some 1.8 ha in area plus a series of concrete holding tanks. Fish production averages some 4,000 kg/ha/year--the result of good management and water quality. Currently, renovations are underway on 15 small (1 are) ponds.

During the past two years substantial progress has been made in putting the facility back into production. However, to adequately prepare the center for training Zairian outreach agents, a number of activities must be completed.

Currently, a $300m^2$ cement-block dormitory/cafeteria is under construction with space for 24 students. The major foundation work is finished although work still remains for toilets and showers, dorm rooms, a kitchen/dining room, and a salon/study area. A water system also will be installed as well as an electrical system and generator. Furniture must be purchased for this facility to include a lockable closet for each trainee, beds, chairs, and tables. Kitchen equipment must be purchased plus the necessary dining room supplies for feeding some 40-50 people.

An administrative office will be established at the center with a secretary, typewriters, supplies, and a duplicator/mimeograph machine. Funding will be provided to establish a library, for the use of students, where books, pamphlets, and journals can be obtained as reference material. A small pharmacy/first-aid facility will be provided. Commonly used medicines such as aspirin, cold medicine, and anti-diarrheal drugs will be included along with malaria suppressants. Provision of such basic medicines will promote program continuity and reduce student absences due to illness.

Presently the center has a 1-ton Chevrolet pick-up truck and a 3-ton Chevrolet stake-bed truck. Once training begins, a second pick-up truck will be made available for additional logistical support needs.

Official recognition by the Government of the Gandajika facility will be recommended. This will entail drafting a statute formalizing the Fish Culture Expansion Project by the GOZ. Such a convention will formally legalize the center and its graduates in the eyes of the Government and the general public.

Training Program

Approximately 75 percent of the 14-week training program is to be practical work. The first 7-10 days will provide an intensive, practical introduction covering the major aspects of fish farming. Trainees will not necessarily have any background in biology or fish work and such an initiation will rapidly introduce them to new terminology and concepts. Thus, from the first days, trainees will start sorting fish, draining ponds, feeding fish, manuring ponds, and working in teams.

Trainees must learn to work with others and they must attain a degree of self-confidence to work in outreach activities. To encourage this, clear responsibilities will be given to each trainee. Team leaders and assistant leaders will be appointed on a rotating basis. The team leader will be responsible for resolving trainee problems and will serve as a group spokesman. The training program will be facilitated by the use of audio-visual equipment such as a slide projector and a filmstrip projector.

The use of math is essential. The selection process will screen out candidates who are unable to do basic calculations. Nevertheless, trainees will need math tutoring. Trainees should understand percentage calculations, ratio and proportions, area and volume calculations as well as production calculations.

After daily practical and classroom sessions the trainees will work on compiling a training manual. (This will determine a percentage of their final grades). Also, homework assignments will be given weekly. These tasks will help guide both the trainees and the instructors with respect to assimilation of materials. Oral presentations will be required of trainees on technical subjects. As agents, they will be required to give such presentations and demonstrations for farmers once they are in the field. Exams will be given at the end of each week, including practical exercises.

Major training areas to be covered include pond construction, management, and extension. A practical approach with emphasis on trainee innovation will be followed. Each trainee will be assigned a pond to

manage during the four-month course. Fish will be stocked, feed will be distributed daily, compost will be applied to the pond weekly, fish will be sampled biweekly, and maintenance (such as cutting weeds on pond dikes) will be the responsibility of the trainees. Furthermore, the trainees will build a pond by hand during the training program so that they will have a thorough understanding of the difficulties and problems faced by fish farmers.

Pond construction is perhaps the most important subject to be taught. Although a farmer who builds good ponds is not necessarily a good producer of fish, more fish are produced in well-built ponds because they do not leak, nor do they have aquatic weed problems.

Site selection for pond construction is a subject learned only through practical experience. Although training time will be spent in the field on this subject, trainees will benefit most from the time spent with PCVs after training. Training will include estimating the volume flow of water in existing streams to determine if enough water exists year round to supply water to ponds. Soil quality will be judged in the field. Generally soils do not pose a problem in pond construction. Ponds cannot be built in 100 percent sandy soil, but most soils encountered will hold water well enough for ponds.

Basic principles of surveying also will be taught. Initial emphasis will be placed on measuring with a 10-meter tape and recording information correctly. Trainees will conduct practical exercises in small teams. Surveying demands a certain amount of precision and discipline. Exercises will be conducted on the alignment of stakes over long distances. Such exercises later will be useful in laying out canals and ponds. Use of both the hand level and sighting table will be taught for surveying contours (as is necessary in laying out water supply canals).

During training the students will manually build a small fish pond. Efficient, correct pond construction involves some 40 to 60 person-days of labor depending on the terrain. Emphasis will be placed on the efficient use of wheelbarrows and other tools, and good organization of the work site.

During construction, trainees will keep a work notebook noting person-days spent in construction, volume of earth dug, and the volume of the dikes (fill). Using profile string, dikes will be built with correct slopes.

A hands-on approach is necessary in teaching cement work to students A wood form will be built by the students and then they will build a drain system in their pond.

Students will be handling fish throughout their training. Several species of Tilapia will be sorted and numerous countings and weighings will be made. Fish will be transported in buckets or in plastic bags as will later be used in outreach work.

Demonstration tests will be held on stocking rates for fish ponds. Trainees can stock fish at several different rates in their individual ponds to compare results at harvest. Tilapia behavior and basic biology will be presented. Demonstrations of types of nests, nesting/spawning behavior, incubation, sexing of fish, and growth and coloration of males and females of various species will be presented. Fish will be dissected so that the students will gain some knowledge of anatomy.

Special sessions will be spent on identifying fish for sale in local markets as well as common species found in Zaire. The trainees will be taught to identify the several species of Tilapia present in Zaire. Some species have been judged unsuitable for fish farming. The preferred species is Tilapia Nilotica. Outreach agents will have to verify the species of fish among fingerling producers.

Water chemistry is too technical a subject to treat in-depth for outreach agents, but brief explanations of pond nutrient cycles will touch on oxygen, pH, alkalinity, and hardness.

Interrelationships that exist in a pond will be presented, and a food chain explained. Each student will construct an enclosure for compost in his pond. Layers of dried grass and manures will be added to the compost pile weekly. Composting to produce green water (good plankton blooms) will be stressed throughout training inasmuch as natural food production is the key to maximizing fish yields. Demonstrations will be held to show the effect of composting.

Students will feed their individual ponds daily and they also will have some responsibilities for feeding the station ponds. Daily feeding will employ the kinds of feeds available at the village level. Trainee ponds will be fed different feeds in order to compare results. At feeding, trainees will learn to "call" their fish to one spot. A good producing pond has very active fish. When the student approaches his pond the fish should be seen swimming towards him near the surface. A good outreach agent must teach such points to his farmers. It is such small points that encourage farmers to feed their fish daily. Training will include weighing feeds and maintaining feeding records.

Trainees will participate in the routine sampling of fish on the Gandajika station as well as periodic sampling of their individual ponds. Mean weights of fish and growth rates will be calculated and feeding rates adjusted appropriately. Trainees will participate in pond drainings at the station. By the end of the training course, they will be

experienced in the use of nets, sorting fish, handling fish properly, stocking ponds, and calculating production costs. Each trainee will organize his own pond draining and a record of the pond will be counted towards the final grade. Accounting will include all labor and feed costs as well as production and feed conversion calculations. Trainees will clearly understand how to calculate the cost of producing one kg of fish.

Trainees also will participate in the marketing of fish in Gandajika. A survey will be conducted in the local market of the various species for sale and the cost per kg, followed by an exercise in market analysis. See "Fish Culture Extension Agent Training Program" report by James W. Miller for detailed outline of the training schedule.

PART III: PROJECT EXPANSION

Setting

Preliminary studies for the geographic expansion of the Project into Kinshasa and Bas-Zaire indicate that at least nine of Kinshasa's 24 zones, and three zones in the northeast of Bas-Zaire, are suitable for fish culture. Other zones in the region will be surveyed starting in August 1981 to determine their suitability.

Kinshasa and Bas-Zaire are among the most densely populated regions in the country. Kinshasa accounts for 12 percent of the country's population while Bas-Zaire adds another 7 percent. All Kinshasa's population is classified urban. Bas-Zaire's is 30 percent urban and 70 percent rural. The zones studied account for a third of Bas-Zaire's population of some 2 million and a quarter of Kinshasa's 3.5 million. The Bas-Zaire region is the principal supplier of staple foods for Kinshasa.

These regions have some of the best roads in Zaire with the Kinshasa-Matadi paved road traversing each area. This transportation network should have a positive effect on the diffusion of fish culture, outreach agent mobility, and fish farmer marketing capability. The approximate distance from each Bas-Zaire zone center to Kinshasa is: Kasangulu 40 km, Madimba 95 km, and Mbanza-Ngungu 150 km.

Climatic conditions are similar in the two regions. It is generally warm and humid although the elevation moderates the average yearly temperature to between 24°-27°C. There are two main seasons: a rainy season occurring from October through May, and a short dry season from June through September. An average of 1400 mm of rain per year falls in this area.

Vegetation includes tropical semi-deciduous rain forest, moist savannahs, and mosaic grasslands. Crops include manioc, rice, corn, ground-nuts, sesame beans, palm nuts and oil, vegetables, and some cash crops such as wood, rubber, and cocoa. To a limited extent some animal husbandry, especially beef production, is practiced. An important note is that Bas-Zaire produces an estimated 89 percent of the primary staple food, manioc, consumed in Kinshasa.

Rolling hills characterize the topography for both regions. Altitude is in the range of 300 m-700 m. In a few areas sharply inclining hills would reduce the average size of ponds. The general topographical trend, however, is toward moderately sloped valleys.

Soil types generally are mixtures of laterite with sands. Only in the northeastern peripheral zones of Maluku are sand deposits a limiting factor for fish pond construction. Around the southern end of Kinshasa and toward Bas-Zaire favorable laterite soils are present for water retention and dike strength.

The station will be producing the necessary fingerlings for stocking by the time RD and Peace Corps outreach agents are recruited and trained. One PCV and one RD technician, provided with a pick-up truck, will be responsible for the station's construction and operation. During the year of station construction, all materials necessary for extension work will have been procured and five RD outreach agents will have been trained, thereby eliminating two other implementation drawbacks (i.e., lack of trained counterparts and of equipment).

As more farmers become actively involved in fish culture, there will be less rationale to operate the Kasangulu site solely as a fingerling station. Each farmer will be able to supply a quantity of fingerlings to new farmers every harvest (twice yearly). Not only will this reduce the farmers' dependence on the station for fingerlings but it also will have the added benefit of increasing the fish farmers' income through fingerling sales. This will permit the station to place more of its resources into food fish production. Each of the six planned ponds at the station will be 1.5 ares in size (1 are equals 100 square meters). A total of nine ares will produce an estimated 4,000 fingerlings/month. The production of food fish will strengthen the station's financial position and allow it to refine and develop such programs as cooperatives, training seminars, feed/fertilizer distribution, tool loans, and practical research.

Outreach Program

The outreach model to be employed has already proven its viability in African countries and is currently being used by the Project in three regions of Zaire. The outreach assistance will prepare small farmers to independently raise fish for personal consumption and sale.

The table below shows GOZ and Peace Corps personnel requirements. This includes six RD technicians already present in Kinshasa. These six technicians will be trained and provided with transportation. A PCV with an administrative background will be the "team leader" in Kinshasa and will work with five APs. The Kasangulu station will have one PCV and one station AP during the first year. In the second year there will be an additional AP with both station and outreach responsibilities.

Personnel Requirements	1982	1983	Total Station and Extension
Agents Piscicoles (APs)	1 (station)	15 (extension)	16
Peace Corps Volunteers (PCVs)	1 (station)	10 (extension)	11

To enable outreach workers effectively to launch a program of rural fish culture, bicycles and small 125 cc motorcycles will be provided. Two 4-wheel drive vehicles also will be provided, one to the PCV at Kasangulu and one to the PCV in the Kinshasa region. The vehicle at the Kasangulu station will be

used to transport construction materials, fingerlings, feed, and other commodities. The vehicle for Kinshasa will be used for supervision and support of the five APs in the area. The station at Gandajika will provide the necessary training for the APs.

Fish in Nutrition

In the Kinshasa region recent surveys have shown that one-third of the children below six years of age fall below the weight for age expectation (Harvard Standard). In a 1978-79 survey of three Kinshasa zones conducted by the National Nutrition Planning Center (with technical assistance from Tulane University), 42.4 percent of the young children were found to be malnourished. An updated survey in 1980 revealed a malnutrition rate of 39.3 percent.

Such high rates of malnutrition are attributable to a number of factors:

-- continuing high rates of inflation pushing quality (protein) foods beyond the reach of low-income families;

-- continuing urbanization that results in more unemployed family heads and more demands on limited food availabilities;

-- a disrupted marketing system that does not respond efficiently to effective food demand; and

-- natural phenomenon reducing supplies of food (e.g., the 1978 drought in Bas-Zaire).

Malnutrition, while attributable principally to inadequate food consumption, is exacerbated in some instances (especially among low-income families) by simple ignorance of proper health and eating habits. Such exacerbating factors can be addressed by educational programs (and USAID supports such programs through nutrition project activities), but the principal problem can be addressed only through increased production and marketing of nutritious foods.

Nutrition Center studies have revealed, not surprisingly, that protein deficiencies are the principal form of malnutrition in the areas surveyed. Cassava (manioc) is the staple food in Kinshasa and most of the country. While a relatively economical source of calories, it is a very poor source of protein. Household surveys in Kinshasa indicate that cassava, in the average amounts consumed, supplies 70 percent of calorie requirements but less than 25 percent of protein needs. This deficiency is especially deleterious to the health of small children when new infants displace them at the maternal milk source and they are relegated to cassava as a principal source of dietary sustenance. This protein deficiency, resulting in the chronic malnutrition found to be widespread in Kinshasa and Bas-Zaire, underlies the weakened state that lowers the defenses of growing children,

increasing their susceptibility to early disease and death. The same deficiencies in adults, while less likely to contribute to increased mortality rates, do contribute to increased illness, slower recovery, chronic energy deficiencies, and cumulative, reduced productivity.

Fish offer a culturally acceptable source of protein. Kinshasa surveys have shown that fish is the most common source of protein in the average diet. Most Zairians traditionally have been hunters and fishers. Although the country still retains large forest and game resources, these have been severely depleted in populated areas where slash-and-burn practices have substantially reduced the size of forested areas, and where the replacement of the bow and arrow by the rifle has accelerated the reduction of available game. Thus, fish have assumed a growing importance in the diet for both rural and urban dwellers. But simple exploitation of naturally produced fish cannot satisfy the demands of the growing populace. It is within this context that the valuable role of pond fish culture can be seen clearly. While fish culture will not solve all of Zaire's serious nutrition problems, it can make a significant contribution to the alleviation of some of the more severe consequences.

Fish Feed and Fertilizer Supplies

The majority of small fish farmers will have little difficulty in securing the minimally necessary amounts of pond feed and fertilizer from compost piles, animal droppings, leaves, and kitchen wastes. However, the fingerling station at Kasangulu and some of the larger fish farmers would profit from an additional steady supply of feed and fertilizer. It might be possible for the station to act as a distribution point if an economical and practical supply system could be developed. Fortunately, Kinshasa has a large and adequate supply of pond feed and fertilizer locally available.

The fish feed could come from local breweries. Kinshasa has the largest breweries in the country and there is an abundance of waste grain available. Most brewery waste presently is dumped into the Zaire River. With a proper system much of this waste could go directly into producing feed supplies available at no cost (transportation to haul the materials would be needed).

Breweries	Availability
Bralima	Twenty tons of waste/day
Unibra	Large or small quantities available daily
Société Brasserie de Kinshasa	Large or small quantities available daily

Fertilizer sources (including inorganic) also can be found in Kinshasa. The "Abattoir avec Corral" (slaughter house) has indicated its willingness to supply up to two tons/day of cow manure. Additionally, the "Poulet Masina" (poultry project) could made available about 10,000 pounds of chicken manure/month.

Other Organizations

The only other organization involved in fish culture, CECOMAF (Centre de Commercialisation des Produits Maraîchers et Fruitiers), has its operations located in several valleys in the Kinshasa region and has some 400 fish ponds. However, no fish culture outreach work is done. At Lembe-Imbu they have a 25-pond station that is capable of supplying fingerlings for fish farmers if managed properly. However, no pond fertilization is being practiced and harvested fish are mixtures of Tilapia Nilotica and Tilapia Zilli. This organization is not presently receptive to suggestions for a collaborative effort.

Economic Analysis

This economic analysis of the expansion into new areas is performed in constant prices (1980). It is assumed that general inflation will exert roughly the same relative impact on both inputs and outputs. While the analyses presented are based on quantifiable costs and benefits, there are also certain non-quantifiable aspects such as increased nutritional levels, wider income distribution, increased family security, and financial independence.

Field studies indicate that there are a substantial number of farmers with ponds that have not been productive due to lack of fingerlings, failure to harvest, unsuitable species of stock fish, and the lack of technical/managerial skills. Some of these farmers will be among the first to benefit from the project. Consequently, they will make up a large portion of the first year's production. During the second year, not only will there again be many old ponds renovated, but also the more innovative fish farmers will have completed their ponds and started to produce fish. The second year will probably reach the peak of new farmers. In subsequent years, the number of new farmers annually should level off to prepeak levels (including a small attrition rate).

The predominant controlling variable in the promotion of fish culture is the availability of outreach agents. Agents will be placed at various sites depending upon the potential of the area. Each agent, it is anticipated, will be able to mobilize a total of 30 new fish farmers in the first year, followed by 40 the second year, and leveling off to 30/year in subsequent years.

Cumulative Number of Fish Farmers*

Year	Kinshasa	Bas-Zaire & Kasangulu	New Fish Farmers Added Each Year	Cumulative Total by Years
1983	180	300	480	480
1984	420	1,000	940	1,420
1985	570	1,600	750	2,170
1986	720	2,200	750	2,920

*Based on 16 extension agents in 1983, 26 in 1984, and 25 each year thereafter.

Water quality proved satisfactory for fish culture in all areas tested. While most waters were slightly acidic (pH 5.5 to 6.5) a few Bas-Zaire waters were found neutral and even alkaline (pH 8). Hardness tests, as measured in soluble salts of calcium carbonate, indicated very soft, salt-free waters. The softness should not be considered a limiting factor inasmuch as limestone is available if needed.

Fingerling Production Center

As part of this Project, a small fingerling station owned by the DOA/RD at Kasangulu will be refurbished. The station will:

a) supply new fish farmers with their initial stock of Tilapia Nilotica;

b) serve as a demonstration and training site; and

c) produce marketable food fish to generate operating revenues.

Kasangulu is an old abandoned Belgian station located approximately 40 km southwest of Kinshasa. Madimba and Mbanza-Ngungu are 50 km and 100 km away, respectively. The station will be the central point of fingerling distribution within the Project area. The Kasangulu station covers about 2 ha of which 1.5 ha is in ponds. It contains four barrage (dammed) ponds. Soil is almost completely laterite with a shallow organic surface layer. Water quality tests indicate a pH of 6.5 to neutral and very soft. The source is a steady groundwater spring.

The renovation of this station will involve:

a) dividing two of the existing ponds into six 1.5 are fingerling ponds;

b) digging a derivation canal;

c) completing construction of a storage/office building;

d) dike repair;

e) clearing of overgrowth; and

f) general station upkeep.

There are two basically good dirt roads providing access to the station although work on one will be required to permit easier passage. To preclude what the evaluation called "the greatest bottleneck" of the Project, station renovation will commence one year before the outreach operation is initiated.

The average fish farmer will construct a pond of some $300m^2$. Semi-annual harvests of 30 kg (or 60 kg/year/farmer) of fish will be produced for personal consumption and market. During subsequent years, production will be increased by approximately 10 kg/are due to more intensive and refined fish management techniques.

The table below represents the annual estimated fish production of all fish farmers associated with this Project. The calculations take into effect the time-lag of fish production and the net effects of attrition and multiplication rates for the Project as a whole.

Annual Fish Production (in kgs)

Year	Kinshasa	Bas-Zaire & Kasangulu	Total by Years
1983	10,000	18,000	28,800
1984	30,600	69,000	99,600
1985	52,200	135,000	187,200
1986	78,300	219,000	297,300
TOTAL by Region	171,900	441,000	612,900

Production costs include paid labor, drainage pipe systems, fingerling stocking, tools, feed, and fertilizer. The first table below indicates what the average fish-producing pond would cost the individual farmer. While the initial investment might appear substantial, the farmer has the start-up option of constructing and operating fish ponds with virtually no cash outlay except for the initial investment in fingerlings. Then, as revenue from production becomes available, additional investments can be made in the pond as deemed necessary. The next table indicates the total production costs for all farmers projected to be associated with the Project.

Farmer's Cost of Production

Item	Year 1	Year 2	Year 3	Year 4
Pond Construction and Labor	400	75	75	75
Tools	80	40	40	40
Stocking	90			
Mgmt and Feed/Fertilizer	30	30	30	30
TOTAL	600	145	145	145

Annual Total Cost: Project and Farmers

Year	Project	Farmers	Total Cost in Z's
1981	212,075		212,075
1982	815,877		815,877
1983	1,782,641	288,000	2,070,641
1984	1,783,541	633,600	2,417,141
1985	1,780,000	655,900	2,433,900
1986	1,780,000	764,650	2,544,650

Farmers' Revenues

October 1980 prices for fresh fish in local markets ranged from 20Ƶ/kg to 30Ƶ/kg. This price included transport and handling fees. Small fish farmers' revenues will differ somewhat in that they will sell most of their harvest, especially in the early years of the Project, at the pond banks, thereby eliminating transport costs and enabling the fish to be sold at a slightly lower price. Therefore, an average farmgate price of 25Ƶ/kg is assumed to be the value received by the farmers. On an individual level thi figures out to Ƶ1,500 of revenue to the individual farmer in the first year of production (less personal consumption) and increases by Ƶ750 in subsequent years. For the Kinshasa and Bas-Zaire project area as a whole, the total below indicates the annual total value of fish production.

Annual Total Value of Fish Production (20Ƶ/kg)

Year	Kgs of Fish	Price/Kg	Total Value in Ƶ's
1983	28,800	25	720,000
1984	99,600	25	2,490,000
1985	187,200	25	4,680,000
1986	297,300	25	7,432,500

Cost Benefit Table

Year	Gross Incremental Cost	Gross Incremental Benefits	Net Incremental Benefit (Cash Flow)	Discount Factor at 12%	(in 000Ƶ's) Present Worth Cost	Benefits
1981	212		(212)	.893	189	
1982	816		(816)	.797	729	
1983	2,071	720	(1,351)	.712	1,475	513
1984	2,417	2,490	73	.636	1,537	1,584
1985	2,436	4,680	2,245	.567	1,381	2,654
1986	2,545	7,432	4,887	.507	1,290	3,768
TOTAL	10,497	15,322	4,825	4.112	6,601	8,519

Average Cost Per Kg of Fish (Ƶ/kg)

Year	*Cost of Production	Kgs of Fish Produced	Average Cost/Kg
1981-83	3,080,737	28,800	107.0
1984	2,415,066	99,600	24.2
1985	2,435,900	187,200	13.0
1986	2,544,650	297,300	8.6
TOTAL	10,475,989	612,900	17.1

*Includes both outreach and farmer costs.

The first table above shows the relative economic costs and benefits resulting from the expansion of the Project into the Bas-Zaire and Kinshasa regions. Constant prices are used for all calculations. A discount rate of 12 percent (a rate commonly used in developing countries) has been used to account for the time value of money.

The Net Incremental Benefit (Cash Flow) is simply the difference in Gross Cost minus Gross Benefits. While it does not provide any indication of the efficiency of the investment, it does show, on a yearly basis, the absolute amount of cash gained (or lost). The total cash flow projected amounts to Ƶ4,285,000 in constant prices and not discounted.

The Benefits/Cost ratio is a good index of profitability. At a 12 percent discount rate it states the ratio by which benefits exceed the costs. A ratio of 1:1 would indicate that benefits are equal to costs (not including risks). The Project has a projected ratio of 1.3:1, a rate which economically justifies the expansion of the activity into new areas.

The Net Present Worth (NPW) is the absolute difference between the Net Present Benefits and the Net Present Costs. Here the NPW at a 12 percent discount rate indicates a worth of Ƶ1,918,000 over the calculated period.

The Internal Rate of Return (IRR) is the discount rate that equates the present value of benefits with the present value of costs. At an IRR of 80 percent, unless another opportunity can be found to produce an investment return of more than 80 percent, it is economically sound to invest in the planned activity.

The second table above shows calculations of the Average Cost per Kilogram of Fish. Over the period 1981-86 the average cost of fish production will be 17.1Ƶ/kg. Compared with the cost of importing similarly high protein foods (assuming such imports are not effectively subsidized by maintenance of the zaire's relative value at artificially high levels) the benefits to the country are evident.

The Project's profitability is found to be insensitive to increases of up to 100 percent in the unit prices of such inputs as labor, vehicles, POL, and tools, and in the output price of fish. This is because of the proportionally minor investment cost and the favorable Net Present Worth value of the Project.

Changes in yields would have a more deleterious effect on the Project's worth. Not only would the financial benefits decrease in proportion to the decreasing yields, but the rate of fish culture diffusion and adoption likely would also decrease. However, it is estimated that project yields could be decreased by up to 50 percent before the Project would be jeopardized. Finally, delay in implementation is probably one of the least risks. Appropriate measures of time have been programmed based on past project experience. Even were the introduction of the activity into Kinshasa and Bas-Zaire to take twice as long as expected, the expansion still would be economically justifiable. Thus, all analyses suggest an undertaking that is technically and economically sound.

PART IV: IMPLEMENTATION

A. Evaluation and Monitoring

In order to ascertain the periodic progress toward the Project objectives, to increase interorganizational communications and coordination, and to produce background data for further activity expansion, a series of formal evaluations and reviews will be scheduled over the remainder of the life of the Project.

These will include:

-- semi-annual reviews by the Project Management Unit;

-- annual evaluations; and

-- annual review of conferences involving all outreach agents, PCVs, and the Project Management Unit.

B. Schedule of Implementation

Month/Year	Activity
5/81	Project Amendment approved.
6/81	Procurement initiated for vehicles and equipment.
7/81	Peace Corps programs additional PCVs.
8/81	Regional Coordinators begin Gandajika training. Detailed planning for Bas-Zaire (site surveys, approvals) initiated.
9/81	Technicien pisciole (TP) for Kasangulu station begins training.
10/81	Bas-Zaire study completed. PCV for Kasangulu station begins training (Group No. 2).
12/81	Gandajika Center completes first training phase. Semi-annual and annual reviews and evaluation conducted (USAID/Peace Corps/GOZ).
1/82	Gandajika training for Group No. 2 begins (15 APs).
2/82	Station equipment, agent materials, and vehicles (ordered 6/81) arrive.
3/82	TP and PCV arrive at Kasangulu station. Station work begins, workers hired, local materials procured.
4/82	New PCVs begin training in-country.

Month/Year	Activity
5/82	Gandajika training Group No. 2 completes training.
6/82	Six Kinshasa/Kasangulu APs begin training at Gandajika (Group No. 3).
7/82	New PCVs for Kinshasa/Bas-Zaire arrive at posts. Kasangulu station in production.
9/82	Fifteen additional APs begin training at Gandajika (Group No. 4).
10/82	Six APs for Kinshasa/Bas-Zaire arrive at posts.
12/82	Semi-annual and annual reviews and evaluations conducte
2/83	Fifteen trained APs (Gandajika Group No. 3) arrive at post.
4/83	Fifteen APs begin training at Gandajika station (Group No. 5).
6/83	Semi-annual review and evaulation.
8/83	Gandajika training Group No. 4 completes training.
12/83	Gandajika training Group No. 5 begins training.
3/84	Gandajika training Group No. 5 completes training.
7/84	Gandajika training Group No. 6 begins training. Final evaluation plans begin.
8/84	Final evaluation begins.
9/84	Final evaluation completed.
10/84	Gandajika training Group No. 6 completes training.