

685-0240

SENEGAL

LOWLAND FISH CULTURE

PID

FY 80

(ONLY CORE DOCUMENT

AGENCY FOR INTERNATIONAL DEVELOPMENT PROJECT IDENTIFICATION DOCUMENT FACESHEET <i>To Be Completed By Originating Office</i>	1. TRANSACTION CODE <input checked="" type="checkbox"/> A - Add <input type="checkbox"/> C - Change <input type="checkbox"/> D - Delete	PID <hr/> 2. DOCUMENT CODE 1
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3. COUNTRY/ENTITY SENEGAL	4. DOCUMENT REVISION NUMBER <input type="checkbox"/>
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5. PROJECT NUMBER (7 digits) <input type="checkbox"/> 685-0240 <input type="checkbox"/>	6. BUREAU/OFFICE A. Symbol AFR B. Code <input type="checkbox"/> 06 <input type="checkbox"/>	7. PROJECT TITLE (maximum 40 characters) <input type="checkbox"/> Lowland Fish Culture - AIP <input type="checkbox"/>
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8. PROPOSED NEXT DOCUMENT A. <input checked="" type="checkbox"/> 2 - PRP <input type="checkbox"/> 3 - PP B. DATE MM YY <input type="checkbox"/> 0 <input type="checkbox"/> 3 <input type="checkbox"/> 7 <input type="checkbox"/> 9	10. ESTIMATED COSTS (\$000 or equivalent, \$1 = 220 CFA) FUNDING SOURCE
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9. ESTIMATED FY OF AUTHORIZATION/OBLIGATION a. INITIAL FY <input type="checkbox"/> 7 <input type="checkbox"/> 9 b. FINAL FY <input type="checkbox"/> 8 <input type="checkbox"/> 0	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:10%;">b. OTHER</td> <td style="width:70%;">1. Peace Corps</td> <td style="width:20%; text-align: right;">214</td> </tr> <tr> <td> U.S.</td> <td>2. PL-480</td> <td style="text-align: right;">14</td> </tr> <tr> <td colspan="2">c. Host Country</td> <td style="text-align: right;">60</td> </tr> <tr> <td colspan="2">d. Other Donor(s)</td> <td> </td> </tr> <tr> <td colspan="2" style="text-align: right;">TOTAL</td> <td style="text-align: right;">499</td> </tr> </table>	b. OTHER	1. Peace Corps	214	U.S.	2. PL-480	14	c. Host Country		60	d. Other Donor(s)			TOTAL		499
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U.S.	2. PL-480	14														
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d. Other Donor(s)																
TOTAL		499														

11. PROPOSED BUDGET AID APPROPRIATED FUNDS (\$000)							
A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE		E. FIRST FY <u>79</u>		LIFE OF PROJECT	
		C. Grant	D. Loan	F. Grant	G. Loan	H. Grant	I. Loan
(1)	122B	077		64		161	
(2)							
(3)							
(4)							
		TOTAL					

12. SECONDARY TECHNICAL CODES (maximum six codes of three positions each)

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13. SPECIAL CONCERNS CODES (maximum six codes of four positions each)					14. SECONDARY PURPOSE CODE 322
BR	NUTR	LAB	PART		

15. PROJECT GOAL (maximum 240 characters)

To augment production and availability of highly nutritious food as well as increase income of rural farmers of the Fleuve Region of Senegal.

16. PROJECT PURPOSE (maximum 480 characters)

To introduce fish culture to the Senegal River Valley by establishing a small-farmer extension program.

17. PLANNING RESOURCE REQUIREMENTS (staff/funds)

Fish culture expert - PM and R funds; Sociologist/Anthropologist (Local Contract PM & R funds); Economist (USAID staff); no AID/W design assistance required.

18. ORIGINATING OFFICE CLEARANCE			19. Date Document Received in AID/W, or for AID/W Documents, Date of Distribution		
Signature	Eugene Chiavaroli <i>Eugene Chiavaroli</i>				
Title	Acting Director USAID/Senegal	Date Signed MM DD YY <input type="checkbox"/> 1 <input type="checkbox"/> 12 <input type="checkbox"/> 21 <input type="checkbox"/> 79	MM DD YY <input type="checkbox"/> 01 <input type="checkbox"/> 02 <input type="checkbox"/> 79		

LOWLAND FISH CULTURE PILOT PROJECT - AIP

I. Summary of Problem and Proposed Response

A. Summary

Peace Corps has established several successful freshwater fish culture extension programs in Africa (Cameroon, Central African Empire, Zaire). This pilot project would be based upon the proven extension and aquacultural techniques developed in the aforementioned countries. The region to be affected was described by leading fish culture expert Dr. Howard Clemens as having "one of the greatest potentials for fish culture I have encountered anywhere in West Africa". This project would also complement and cooperate with S.A.E.D. (Company for the Management and Exploitation of the Delta Lands), an organization devoted to the development of irrigated agriculture in the Fleuve Region. U.S.A.I.D. has been participating in S.A.E.D.'s programs.

The proposed project would be the responsibility of the Service of Waters and Forests (Service des Eaux et Forêts). Peace Corps/Senegal would provide the technical assistance, while Eaux et Forêts would provide the fish culture counterparts as well as infrastructural support.

some presumption
At the end of this two-year project, it is presumed that intensive fish culture's potential in the area would be clearly demonstrated and a tremendous impetus would exist for replicating the results in other

e.g.?

suitable parts of Senegal. These replications would be carried out by the Eaux et Forêts agents who will be trained during the project

The financial and technical assistance is needed to:

- (1) construct and manage a fish culture station for fingerling production, training, research and food production
- (2) train and support Eaux et Forêts fish culture extension agents
- (3) support Peace Corps fish culture technicians.

B. Problem

Although 70% of Senegal's population of 5.5 million is engaged in agricultural activities, the country presently imports up to 300,000 MT of cereals per year. Agriculture in Senegal is hampered by low and uneven rainfall, an insufficient market system, poor soils, lack of modern technology and poor health among the farmers. The availability of basic goods and services in rural areas is a major obstacle. Even when goods such as simple hand tools are available, many farmers cannot afford them on their meager income (often less than

How?

\$75 per year). Intensive freshwater fish culture can assist in mitigating these constraints by providing a cash income and an excellent source of protein for the rural families in the Fleuve Region. Although there is

no tradition of pond fish culture in the region, fish from the rivers and ocean form an important part of the people's diet when it is available.

C. Response

The purpose of this pilot project is to prove the test viability of intensive fish culture in the Fleuve Region by establishing an extension program that will address itself to:

- increasing quantity and availability of protein-rich food
- increasing small farmer income
- finding new techniques for fish culture and fish-rice culture
- developing infrastructural support for training and extension through the Service of Waters and Forests

The specific activities would include:

- the construction and running of an all-purpose fish culture station near Richard Toll to provide fingerlings, a research capability, a site for training and demonstration, and food fish for the people of Richard Toll.
- the establishment of one extension team (one Peace Corps Volunteer and one Eaux et Forêts agent) in each of five irrigated perimeters controlled by S.A.E.D. plus one team at Wendou Edi for extensive fish culture.
- the coordination of the work of the extension teams with other Eaux et Forêts personnel and the S.A.E.D. and C.S.S. (Senegalese Sugar Company) projects.

tech
ec.
sol. } ?

D. Background

The Fleuve Region of Senegal is located South of the Senegal River at the northernmost part of the country. During the drought years from 1972 to 1977, it was repeatedly the region the most severely affected by the lack of rainfall; agricultural yields have dropped markedly as a result of the drought, and rainfed agriculture in the western portion of the region has become so risky that a good percentage of the farmers who depend upon the rains for their livelihood were forced to migrate to the larger cities such as St. Louis and Dakar, which are currently experiencing severe overpopulation and growth problems.

For this reason, and because of the demonstrated immense agricultural potential of the region, the GOS and the governments of Mali and Mauritania have been devoting an increasing amount of attention and resources to the area and created O.M.V.S., a three-government council to oversee the future development of the river basin. Among the proposed projects to have resulted from this organization are a series of dams and ports to exploit the potential of the river. In addition, in 1965 the GOS created S.A.E.D., the Société d'Aménagement et d'Exploitation des Terres du Delta, which has been responsible since its inception for creating nearly 15 000 hectares of irrigated cropland for the production of rice and tomatoes - U.S.A.I.D. supports the efforts of S.A.E.D. through several projects, and hopes to contribute to

What does
this mean?

the long-term goal of food self-sufficiency in the region, and in the country as a whole.

OMVS with USAID funding is also financing an environmental study to determine the effects the construction of the proposed dams will have upon the health, economics, and ecology of the areas which border the river.

~~The GOS has already taken the preliminary steps towards establishing a fish culture program in the country. The Secrétariat des Eaux et Forêts has assigned an agent to S.A.F.D. to do investigative research and to begin a modest project of fish production.~~ Up until now, the project has consisted of "extensive" fish multiplication activities in ponds of several hectares. The U.S.A.I.D./Peace Corps project will complement these activities through introducing "intensive" fish raising on a much smaller scale, in ponds of between 5 and 25 ares.

water availability/control
salinity

E. Project Description

1. Location

The proposed pilot project for the Fleuve Region will establish a viable fish culture extension system under the direction of Eaux et Forêts. Six sites have been carefully selected by a Peace Corps Fisheries Consultant (November, 1978):

- Richard Toll: location of fish culture station and one extension team (2 Peace Corps Volunteers and counterparts)
- Dagana: one extension team
- Nianga: one extension team
- Guédé: one extension team

Wendou Edi: one team for Eaux et Forêts extensive fish culture project

- MBoumba: one extension team.

2. Requirements for Intensive Fish Culture

The type of intensive fish culture to be used in this project will be based upon the following requirements:

- 
- a reliable source of good quality water
 - soils with high clay content for good dam construction and for minimizing nutrient loss
 - a warm climate with adequate sunshine to insure good plankton production
 - a fast-growing species of fish that can be easily bred in ponds and that makes efficient use of the plankton bloom
 - a source of compost components (manures, grasses, crop wastes, etc.) to maintain high levels of dissolved nutrients for plankton production
 - supplementary feeds (rice bran, termites, various plant leaves, etc.) to maintain a high carrying capacity in the pond.

All of these requirements are met at the aforementioned sites. The fish to be used is Tilapia Nilotica, a proven fish culture species that is native to the Senegal River Basin. Ponds will be harvested at six-month intervals. The ponds will have a 50 cm to 1 meter depth and be built in such a way that they can be filled and completely drained by gravity flow. For a complete explanation of construction techniques and extension methods see Zaire Status Report - April, 1977. (Annex B).

3. Richard Toll Fish Culture Station

The station's primary purpose will be to support the extension effort. It will supply fingerlings to all involved perimeters at a nominal cost. It will serve as a training center for both Eaux et Forêts agents and farmers. In addition, research will be conducted to improve the farmers' production and profit. Initial experiments will be on integrated fish-rice culture and polyculture using locally available species. Two buildings will be constructed: an office/laboratory and a warehouse for storage of feeds and equipment. Although plans will be made for the eventual construction of a fairly large station, this pilot project will be concerned with:

- 4 five-are ponds (500 m² each)
- 2 twenty-five-are ponds (2500 m² each)
- 2-4 small holding tanks
- necessary canals, sluices and monks.

Source?

The water supply for the station will be assured by the central canal for C.S.S. (Senegalese Sugar Company). Eaux et Forêts has negotiated with C.S.S. for the use of this water by assuring C.S.S. that their employees will be able to purchase a portion of the fish produced. Since a closed system of fish culture will be used, water losses will be limited to evaporation and seepage.

The Peace Corps will fund the services of an expert on contract for the first nine months of the project, an ex-fisheries Volunteer

from an African country who has had experience in setting up and running similar programs. He will be responsible for the initial implementation of the project, including supervising the construction of the station, producing an adequate supply of fingerlings and running initial experiments. Later, he will be replaced by a Volunteer and a specially trained Senegalese expert from Eaux et Forêts who will be the station director.

To implement the training objectives of the station, a certain amount of training materials will be needed; Laboratory equipment (water test kit, microscope, etc.); a stock of tools and materials (shovels, cement, plastic piping, wheelbarrows, etc.); and a vehicle for transporting supplementary feeds, fertilizer and fish.

basic equipment

4. Perimeters

In each of the five selected perimeters, the Volunteer and his counterpart will supervise the construction of a test pond for integrated rice-fish culture and a number of ponds for fish culture for a total area under production of two hectares per extension team. These ponds will be constructed by hand and serve as a demonstration for the farmers in the surrounding area. One team will work on an Eaux et Forêts extensive fish culture project at Wendou Edi. The precise arrangement and sizes of ponds will necessarily vary according to the sites.

5. Development of Eaux et Forêts' capability for managing the program

One of the major goals of this project is to prepare ~~Eaux et Forêts~~ to handle the eventual development of fish culture throughout the Senegal River Valley. In the beginning period, the Peace Corps consultant will work with the Eaux et Forêts Project Director to coordinate the activities of their two organizations with all other involved groups (S.A.E.D., C.S.S., cooperatives, youth groups).

Qualifications of PCVs?

The Volunteers will have the responsibility for training their counterparts to be independent and competent extension agents.

How?

The Volunteer assigned to the Richard Toll station will work closely with the specially trained Senegalese station director. The long term success of the project depends on Eaux et Forêts' ability to continue the operation and expand it into new areas.

also on technical } feasibility
economic }
social }

F. Estimated Project Outputs

	FY 80	FY 81
1. Eaux et Forêts extension agents trained and operating	6	same
2. Senegalese Fish Station Director	1	same
3. Fish Station constructed and operating	1	same
4. Participating farmers (including cooperatives, youth groups)	90	180
5. Total Fish Production in Tons (estimated at 3 metric tons/ha/year for fish-only ponds; 1 ton for fish-rice ponds; plus 1 ton/ha for extensive fish culture)	12.5 T	37.5

	FY 80	FY 81
7. Value of Production (150,000 CFA/T or \$750/T)	\$9,375	\$28,125

very modest

G. Marketing

Fish is an important component of the Senegalese diet and is often eaten twice a day. Freshwater fish, and Tilapia in particular, are especially highly prized. Market prices currently fluctuate between 100 CFA and 200 CFA according to the supply of fish. The productivity of the Senegal River and the Lac de Guiers (several miles South of the River) has been declining.

Why?

U.S.A.I.D. estimated that the proposed dams on the Senegal River will decrease fish production by 14,000 tons. Thus, the fish produced by the proposed project will fill a demand that presently exists and will continue to do so as it expands and the supply of freshwater fish declines as a result of the dams.

CDSS

H. Relationship to the DAP and Host Country Priorities

The primary focus of the Government's developmental efforts as reflected in the recent GOS four-year plan, is to assist the rural poor to achieve self-sufficiency in food production.

The effects of the Sahel drought have played a major part in the GOS's emphasizing this sector, whose vulnerability to drought conditions was demonstrated during the last several years. Three of the goals which have received recent attention are the following:

1. Promotion of agricultural diversification. Senegal has suffered recently from the decline in the price of its major export crop, peanuts.

*this state-
ment is
not borne
out by
public invest-
ment statistics*

The Senegalese economy is based to a major extent upon foreign exchange earnings from this crop. For this reason, the Ministry of Plan has encouraged experimentation with vegetable and cereal crops, and recently with fish production and fisheries programs.

How have they survived?

2. Increased agricultural production. Senegal has always been deficient in food production, and must import nearly half of the food products it consumes. The fisheries project will contribute to increasing the amount of locally-produced food, and eventually to achieving self-sufficiency.

3. Conservation of natural resources. One of the benefits gained by the establishing of irrigated perimeters in the Fleuve Region is the barrier irrigated land presents against the encroaching desert. Desertification is a serious problem in the Fleuve Region, the effects of which can be seen in a number of ways.

The U.S.A.I.D. program in Senegal reflects the same concern with the development of the rural sector, through labor-intensive agricultural production projects, and health and nutrition projects which contribute to the well-being of the rural poor. In recent years, much attention has been given to the support of integrated rural development projects throughout the country, This fisheries project will add an additional dimension to the S.A.E.D. efforts at food -

I. Other Programs

No other inland fish culture projects have been identified in any part of Senegal, apart from an Eaux et Forêts experiment in extensive fish culture in the Fleuve Region.

J. Alternatives

Other possibilities exist for increasing food production and farmer income such as livestock improvement and irrigated tomato and rice farming. No alternative, however, comes close to meeting the advantages of intensive fish culture: efficient use of land, highly profitable production of extremely nutritious food of high-protein content, simple technology and an increase in soil fertility.

K. Beneficiaries

The project could eventually reach all of the 400,000 inhabitants of the Senegal River Basin. Recent demographic studies indicate that the population of the region is increasing steadily; unfortunately, food production has not been keeping pace with this growth. It is for this reason that S.A.E.D. has undertaken a vigorous program of irrigated agriculture. In order to make available an assured source of protein, S.A.E.D. has been cooperating with Eaux et Forêts on fish culture, working to involve local farmers in fish production.

The primary beneficiaries will be the rural farmers and their families who will have more protein-rich food and a higher cash income as a result of this project. Another result will be the contribution of the project

towards reducing the number of young people who leave the rural areas to search for work in the already over-crowded cities of Saint-Louis and Dakar. Finally, the increase in nutritious food will improve the health of the people in the project area who are not directly involved in fish culture.

L. Participation of Women

if they can afford to buy it

Traditionally, the women of the project area produce vegetables and other foods using irrigation water from the canals that feed the rice perimeters. The proposed fish raising project will provide an adjunct to these activities through the organization of women's cooperatives. The cooperatives' field of activity will include fish culture, improved organization of fish marketing in the area to supplement members' incomes, emphasis on better nutrition through increasing the fish content of the local diet, and marketing through cooperative efforts. The potential of these aspects of the fish culture project will be more fully developed when the socio-economic study is conducted for the Project Paper.

M. Assumptions

1. That Peace Corps will continue to play an active role in the project's development and management.
2. That Peace Corps will provide the required number of Volunteers.
3. That Eaux et Forêts will provide the necessary personnel, including counterparts, as scheduled.
4. That Eaux et Forêts will be able to manage the project in a suitable manner and coordinate the project activities with all other involved organizations (SAED, C.S.S., etc.).

they've just assumed project feasibility

-
5. That the proposed fish culture techniques can be suitably adapted to the Fleuve Region.
 6. That the rural farmers and farmer groups will be sufficiently motivated to insure the success of the fish culture extension effort.

N. Disbursement Period

The disbursement period will begin in early FY 79 (to allow for the construction and development of the Richard Toll station well before the extension teams begin working) and end in FY 80. The Eaux et Forêts Project Director will be responsible for all disbursements of funds. A reimbursable account will be set up in a Senegalese bank for equipment procurement and operating costs.

O. Project Development

1. Project Origin

This project is based on studies and recommendations by PCV Paul Derito (November 1976), fisheries consultant Dr. Howard Clemens (January 1977), fisheries consultant John Lemon (November 1977), fisheries consultant Harry Rea (September 1978), fisheries consultant Roger Palm (November 1978) and Eaux et Forêts personnel throughout this time span.

2. Project Paper Preparation

Development of the PP is scheduled for March 1979. This will be carried out by a Peace Corps fisheries expert funded by PM & R funds in conjunction with USAID/Senegal and the Service des Eaux et Forêts.

P. Discussion of AID Policy Issues.

1/ Relationships between the GOS organizations that will participate in the Project.

A. SAED is the principal agency for the Development of the Fleuve Region and as such will be involved in the planning and implementation of the project. The project paper will explore in detail the constraints on SAED to: (a). motivate farmers to participate in the project; (b). assure that the needed land and water resources are available in a timely manner; and (c); permit Eaux et Forêts personnel fit to within the SAED organization to carry out this project.

B. The relationship of CSS to the project on the issue of providing water to the fish pond when required should be more fully explained. Without the full cooperation of CSS in this matter, the project will encounter difficulties. The issues of prices paid and the proportion of fish that must be sold to C.S.S. by the project in order to use water from C.S.S. canals requires more indepth analysis. The alternative of paying for water rights instead of in-kind payment might be considered.

negotiation

2/ Evaporation and Infiltration rates.

The PP will look more closely at evaporation and infiltration rates in the Fleuve Region where ponds will be built. The importance of this issue lies in proper siting of the ponds to ensure that the adequate water is available on a year round basis, and that the soil contains the necessary clay content so that major water loss does not occur endangering the fish habitat.

3/ Food-for-Work

The possibility of using PL-480 Food-for-Work is being considered to reduce costs and provide an improved diet to the farmers who will participate in dig-

ging the ponds. The payment in food would be supplemented by cash to ensure a minimum wage. The Food-for-Work program would be administered by CRS who are willing to cooperate in the project and who estimate that no additional food allotments to CRS will need to be made to cover the quantities of food required by this project.

4/ Intensive fish culture vs salt water fishing.

OMVS is undertaking a program to increase the catch of salt water fish in the Fleuve Region. The effects this program will have on the availability and quantities of fish in the project area require further definition. It may be that it would be more acceptable to farmers to purchase salt water fish rather than raise them through the intensive fish-pond method.

*Indeed
But if this
is true, why assume feasibility*

Q. Approximate Calendar

JAN/FEB 1979	Completion of Project Paper .
MARCH 1979	Peace Corps Contractor arrives, financing approved, station equipment ordered.
APR/JUN 1979	Construction of Richard Toll station; fingerling production begun; vehicle procurement.
JUL/SEP 1979	Arrival Peace Corps Volunteers, training, selection of Eaux et Forêts counterparts completed.
OCT/DEC 1979	<u>Beginning of extension work, construction of perimeter ponds, rice fish experiment at Richard Toll, PC contractor leaves</u>
JAN/MAR 1980	First perimeter ponds stocked with Tilapia from Richard Toll
JUL/AUG 1980	First harvests of perimeter ponds
SEPT 1980	Evaluation of first phase.

Zaire program come up short w/ respect to qualified work in field

ill-timed departure

II. Financial Requirements and Plan

A. U.S.A.I.D., Peace Corps and Host Country Inputs

1. U.S.A.I.D. will finance the following:

- a) Construction. To carry out the applied research program and normal station management outlined above, it is proposed to construct an office building/laboratory, and a warehouse for storage of the equipment.
- b) Transportation. There will be an estimated 7 volunteers and 7 counterparts assigned to the project. In order to assure their effectiveness in extension activities, a vehicle is necessary for each. The project will finance 14 motorcycles, and will provide a small operative fund for repairs and maintenance. A land-rover type vehicle will be attached to the center.
- c) Land preparation costs. For the preliminary phase of the project it will be necessary to have access to funds for the construction of the ponds at the research station and in the perimeters.
- d) Equipment. This will include nets, small tools, manuals and certain medicines and laboratory equipment.

no training budget. per diem for farmers ~~to be~~ trained @ Richard Toll

I thought farmers were going to construct these

2. GOS Inputs

The GOS will fund personnel salaries and indemnities for the seven fisheries agents and the project director for the duration of the

what does GOS mean in this case? *

project; will undertake all building design, construction and engineering supervision; will be responsible for coordination of the activities of S.A.E.D., Eaux et Forêts, the Direction Générale de la Production Agricole; and will contribute the use of the land for the station and for the ponds on the perimeters.

3. Peace Corps. In addition to the project design work already completed at Peace Corps expense, they will fund living allowances and support costs for the seven volunteers, and will contract with an ex-fisheries volunteer from an African country for approximately nine months.

4. Construction. The construction planned for the project is minimal, including only two buildings. The first, an office/laboratory, will contain three rooms and a lavatory, and will occupy an area of 41 square meters, at an estimated cost of 1,640,000 CFA. The second, a warehouse, will have space for the storage of nets, of feed and equipment, and will have a small area for parking cars and minor repairs. It will cover an area of 90 square meters, and will cost approximately 3,600,000 CFA. The total cost for construction is therefore \$24.400.

*

Eaux et Forêts will be responsible for all construction on the project. The drawing up of plans, competitive bidding and engineering supervision, will be handled by Eaux et Forêts and Genie Rural.

5. Environmental/611e Concerns.

The issue that has most troubled mission staff was the one of contamination of the pond by insecticides used in the rice perimeters. However, we have been assured by American environmental experts conducting a study

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under the auspices of O.M.V.S. that the rate of pesticides presently being used by farmers in the Fleuve Region is minimal and the risk of contamination is negligible at this time. Also, if the ponds are properly sited and isolated from the rice growing perimeters, the possibilities of water being re-cycled, or air borne contamination are negligible. For these reasons, a negative threshold decision has been made. This problem should be readdressed, however, if expansion of the project is considered at a later date.

By whom?
Does Mission Director have
authority?

Financial Plan Budget

A. AID Contribution (\$)

	FY 79	FY 80
<u>Vehicles:</u>		
1 Passenger <i>4x4? see p.17. cheap</i>	\$8,000	
14 Motorcycles	14,000	
Parts, Gas, Oil	2,000	8,000
<u>Construction Costs:</u>		
<u>Pond Construction</u>		
(Bulldozer rental FY 79 and labor FY 80)	\$15,000	45,000
Construction Materials	2,000	
Pipes and outlets	1,500	
Station Equipment	1,000	
Tools (wheelbarrows, shovels, etc.)	1,000	
Station Buildings		25,000
<u>Equipment:</u>		
Nets	1,500	
Procurement of stockfish	1,000	
Lab and office equipment	5,000	
<u>Extension materials</u> <i>comment?</i>		1,000
<u>Operating Costs:</u> <i>eg?</i>	2,000	8,000
<u>Inflation and Contingencies:</u>	10,000	10,000
	TOTAL	97,000
Food for Work	14,000	
	TOTAL	\$97,000
<u>GRAND TOTAL = \$175,000</u>		

B. Peace Corps Contribution (\$)

7 Peace Corps Trainees at Oklahoma State and in Senegal	\$40,600
7 Volunteers on Fisheries Project a) \$11,206/year	156,800
1 Fisheries expert for 9 months	16,800

Total Peace Corps Cost \$214,200

Rounded to: \$214,000

farmers have not been able to work w/ clay soils in delta.

C. GOS Contribution (CFA)

1 Project Director	1,680,000 CFA
6 Counterparts	7,920,000
1 Driver	720,000
3 Laborers	1,440,000
Housing for staff in St Louis	1,440,000
	<hr/>
	13,200,000 CFA

13,200,000 CFA a) $220 \text{ CFA} / \$1.00 = \underline{\$ 60,000}$

Richard Toll is a long way away;
not a feasible commute.

ANNEX A

INITIAL ENVIRONMENTAL EXAMINATION.

Project Location: Senegal

Project Title: Lowland Fish Culture 685-0240

Funding: \$64,000 in FY 1979 and \$97,000 in FY 1980. Total AID funding:
\$161,000.

Life of Project: 2 Years.

IEE Prepared by: Roger Palm, Peace Corps fisheries consultant, December, 1978.

Environmental Action Recommended: that a negative threshold decision be given
this project in accordance with AID Regulation 16.

Mission Director's Decision:

Approve: Eugene Chivand Date: 12/29/78
Victory

Disapprove: _____ Date: _____

INITIAL ENVIRONMENT EXAMINATION

I. PROJECT TITLE: LOWLAND FISH CULTURE

DESCRIPTION OF THE PROJECT:

This pilot project will introduce intensive fish culture to the Fleuve region of Northern Senegal. It will do this by establishing an extension system in five of the irrigated perimeters controlled by SAED (Company for the Management and Exploitation of the Delta Lands). More specifically, the project will comprise:

- 6 extension teams composed of a Peace Corps Volunteer extension agent and a Senegalese counterpart
- a fish culture station for fingerling production, applied research, extension agent and farmer training, and food production.

The primary impacts of this project will be related to nutrition and income. All pond construction will be located in areas already prepared for irrigated agriculture by SAED or CSS (Senegalese Sugar Company). Projected environmental impact is negligible.

At present, no ponds suitable for intensive fish culture exist in the proposed project area. However, irrigation canals are functioning at each location. In all of the selected sites, the only source of water for these canals is the Senegal river and the Lac de Guiers. Therefore no major water diversion will be involved and all water entering the ponds will be free from possible contaminants originating in the rice and tomato fields.

The Senegal River Basin is a flat area with meager vegetation due to the low rainfall. In most cases, ponds will be built in areas already cleared of vegetation by SAED or CSS. In other cases, vegetation (small, scattered thorn trees (Acacia sp) and shrubs) will be removed over a small area. Total area to be affected by project will be less

than 30 ha, of which roughly 75% has been previously cleared.

This project will introduce a closed system of fish culture.

Once a pond is filled, no more water is allowed to enter except for occasional replacement of water lost through evaporation and small amounts of seepage.

During the six months that the pond is under construction, large amounts of nutrients are added to the water by constructing compost piles of organic matter (manure, grasses, etc.). Together with warm temperatures and ample amounts of sunlight for photosynthesis, these nutrients stimulate high phytoplankton production, which in turn ensures a high concentration of zooplankton. The zooplankton is the primary food for the species to be cultivated: Tilapia Nilotica. The production of Tilapia is further raised by providing supplementary feeds such as rice bran on a regular basis (1-3 times daily). Normally the pond is allowed to dry for 2-weeks following each harvest. Sometimes a crop of rice is grown in the pond after a fish harvest to take advantage of the accumulation of nutrients in the pond mud. Potential pond production can be judged by the pond color (a rich green/brown color indicates heavy plankton concentration) and the vigor with which the fish accept the supplementary feeds.

IN CONCLUSION, THE SAED AND CSS IRRIGATION PROJECTS HAVE ALREADY BROUGHT ABOUT A NUMBER OF MINOR ENVIRONMENTAL IMPACTS SIMILAR TO THOSE EXPECTED FOR THE USAID BAKEL IRRIGATED PERIMETER PROJECT. THE ENVIRONMENTAL ASSESSMENT UNDERTAKEN ON BEHALF OF THE AMERICAN PUBLIC HEALTH ASSOCIATION FOR THE BAKEL PROJECT CAME TO THE CONCLUSION THAT "THE IMPLEMENTATION OF THE PROJECT WILL RESULT IN NO FORESEEABLE SIGNIFICANT ADVERSE IMPACTS". THE ADDITION OF THIS PILOT FISH CULTURE PROJECT TO THE IRRIGATED AGRICULTURE PROJECTS UNDER SAED OR CSS MANAGEMENT WOULD NOT CAUSE ANY ADDITIONAL DETRIMENTAL IMPACTS.

II. IMPACT IDENTIFICATION AND EVALUATION FORM

Impact
Identification
and
Evaluation

Impact Areas and Sub-Areas

A. LAND USE

1. Changing the character of the land through:

- a. Increasing the population
- b. Extracting Natural resources
- c. Land clearing
- d. Changing soil character

N
N
L
L

2. Altering natural defenses

N

3. Foreclosing important uses

N

4. Jeopardizing man on his works

N

5. Other factors

None

B. WATER QUALITY

1. Physical state of water

L

2. Chemical and biological states

M

3. Ecological balance

N

4. Other factors

None

C. ATMOSPHERE

1. Air additives

N

2. Air pollution

L

3. Noise pollution

N

4. Other factors

None

D. NATURAL RESOURCES

1. Diversion, altered use of water

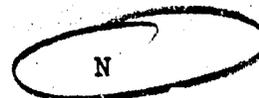
N

2. Irreversible, inefficient commitments

N

3. Other factors

None



E. CULTURAL

- 1. Altering physical N
- 2. Dilution of cultural traditions N
- 3. Other factors None

F. SOCIOECONOMIC

- 1. Changes in economic/employment patters M
- 2. Changes in population L
- 3. Changes in cultural patterns N
- 4. Other factors None

G. HEALTH

- 1. Changing a natural environment N
- 2. Eliminating an ecosystem element N
- 3. Other factors
Schistosomiasis & Malaria L

H. GENERAL

- 1. International impacts N
- 2. Controversial impacts N
- 3. Larger program impacts N
- 4. Other factors None

I. OTHER POSSIBLE IMPACTS (not listed above) None

Or discussion needed for H and I

III. DISCUSSION OF IMPACTS

A. LAND USE

1. Changing the character of the land through:

a) Increasing the population:

This project is aimed at improving the health of the rural farmers and their families in the Fleuve region. Over the long term, this project should bring about a slight increase in population by reducing infant mortality and lengthening the average life span through better nutrition. If this project is successful as predicted and is replicated in other areas, the present exodus of young people to the larger cities (which are experiencing tremendous overpopulation problems) could be significantly reduced by improving economic conditions such as employment opportunities. These potential beneficial impacts, however, would be the results of this pilot project's replication; the project itself is too small to make significant impacts in these areas.

b) Extracting natural resources

The only natural resource employed in this project is water. Water is only used to fill small/medium size earthen ponds (5 to 50 ares) and replace water lost through evaporation and seepage. Ponds are drained once every 6 months. Since seepage and drainage water would reach the water table or evaporate, only water consumption would be through evaporation. All water would be obtained from the Senegal river or the Lac de Guiers through already functioning irrigation networks. Estimated total pond area at end of project: less than 30 hectares.

c) Land clearing

In most cases, pond construction would take place on land already cleared by SAED in connection with their irrigated rice and tomato fields. In this region, clearing usually involves the removal of a few widely scattered shrubs and small Acacia trees.

Natural vegetation is fairly sparse due to the low rainfall. Thus, in the few small areas to be cleared, no economically important stands of trees would be destroyed. Furthermore, the government has set aside a number of large reserves in the Fleuve Region (sylvo-pastoral reserves) where native flora is conserved. At any rate, the area to be affected by this project is extremely small: less than 10 hectares to be cleared.

d) Changing soil character

Due to the high clay contents of the soils in the sites selected for fish culture, the only significant change in soil character will be the formation of a nutrient-rich pond bottom mud. This soil can be used for crops by transporting it to nearby fields or by alternating fish production with crops such as rice in the pond itself.

2. Altering Natural Defenses

No altering of natural defenses is foreseen since ponds will be built within already existing irrigation systems managed by SAED/CSS. The sites chosen are already protected from possible floods by a series of dikes. This project would not alter natural runoff or river flow to any significant extent. The ponds would be filled from already functioning irrigation canals and would not alter the normal course of the river. It must be added that the total surface area of the proposed ponds is very small and spread out among 6 widely separated locations.

3. Foreclosing Important Uses

The project sites are not occupied by human dwellings and, in most cases, are not even cultivated. In cases where cultivation is taking place, the farmers are more than willing to substitute a small fraction of the land available for rice/tomatoes for fish production. The need for more protein-rich food and higher income being the primary reasons.

4. Jeopardizing Man or his Works

Only the rice/tomato fields and the ponds themselves can be considered since people do not live in the areas to be affected and no other works of man are present. Due to the relatively small size of the ponds (.05 to .5 hectares, 1 meter depth) and their location within the perimeters (with corresponding drainage canals), the breaching of one pond would not jeopardize any cultivated fields or other ponds. Also, all ponds will have overflow devices to prevent the accumulation of excess water. If a pond goes breach, the small dam (maximum height 1.5 meters) is easily repaired at almost no cost. Often, fish loss is negligible due to the rheotropic tendencies of fish.

5. Other factors

None

B. WATER QUALITY

1. Physical state of water

The water contained by the ponds would undergo two physical changes: an increase in temperature and a decrease in clarity. The temperature increase is due to:

- the pond water being stagnant
- exposure to sunlight
- decrease of clarity (i.e. increased heat absorption)

The reduction in clarity results from an increase in the plankton concentration brought on by pond fertilization. Both of these changes are desirable in this type of fish culture.

The water is released from a pond once every production cycle (six months). This drainage water would empty into the pond's evacuation canal. In some cases, most of the water would evaporate as it crossed dry, uncultivated land. In other cases, it would joint the perimeter's drainage water and eventually flow into noncultivated marsh or swampland. Normally, only one pond in an area would be drained at any given time. Since the average

pond would contain only 750 m³ of water, the effect on the areas into which the water would be released would be small. This is especially true because of 2 additional factors:

- there is already a large amount of drainage water coming from the rice and tomato fields
- the drainage water catch basins are already very turbid and heavily fertilized due to the livestock in these areas.

Both of the above dwarf any possible effect from the pond water.

2. Chemical and biological state

The main changes involved are the increase in nutrients in the pond water and the resultant increase in the concentration of microscopic plants and animals (plankton). For the reasons stated above, these changes would have insignificant impacts on the environment.

No significant changes in PH, hardness or alkalinity are envisioned.

No herbicides or pesticides are used. All water used to fill the ponds will be coming via irrigation canals from the lake or the river. No drainage water from the perimeter fields (which might contain pesticides) would be involved. At certain sites, during extreme drought conditions (once in ten years), drainage water might be recycled through the canals. Since pond inlets are kept closed except for occasional replacement of evaporation losses, this poses no threat. Pond inlets would be kept closed until drainage water was no longer recycled.

3. Ecological balance

All types of fish to be used in this project are found in the Senegal River Basin. The primary species to be cultivated is Tilapia Nilotica. Thus the escape of fish into wild waters from the ponds is of no consequence.

The presence of large numbers of Tilapia Nilotica will insure the almost total eradication of small aquatic insects and larvae (e.g. mosquito larvae).

C. ATMOSPHERE

1. Air Additives

none

2. Air Pollution

Essentially none. Compost piles and the pond bottom during the drying period sometimes give off a mild odor similar to areas of high livestock concentration.

3. Noise pollution

None

4. Other factors

None

D. NATURAL RESOURCES

1. Diversion - Altered use of Water

This project does not involve any major water diversion. Water is already being diverted by means of pumps and irrigation canals from the SAED and CSS projects. The ponds to be used for fish culture would be filled with water from the irrigation canals by gravity flow. Except for the filling period, the ponds would require no more water than a similar area under rice or sugar cane production. Once a pond has been filled, water needs to be added only to replace losses due to evaporation and a small amount of seepage. Seepage is expected to be quite low since the soil at the selected sites has a high clay content. Averaged out over a twelve month period, the quantity of water required for fish culture is only slightly greater than the amount needed for most forms of irrigated agriculture. Also, the filling of ponds (i.e. harvests) can be scheduled to coincide with periods of water abundance.

2. Irreversible, Inefficient Commitments

Pond construction is essentially limited to the clay dikes used to hold the water. These dikes are quite small and can be knocked down fairly easily by hand labor. Even with dikes in place, fish culture can be instantly converted to other forms of agriculture such as rice by draining all or most of the water.

Since no exotic species are involved in this project, no description of the ecological web will be possible.

3. Other factors

None

E. CULTURAL

1. Alternating Physical symbols

The proposed sites contain no cultural artifacts or other physical symbols.

2. Dilution of cultural traditions

This project does not call for the displacement of human dwellings nor any behavior changes that would alter cultural traditions.

3. Other factors

none

F. SOCIOECONOMIC

1. Changes in Economic/Employment

Though the major goal of the project is improved nutrition, farmers will be able to sell fish for a profit. Since the supply of fish in the region is decreasing as the demand continues to increase, the farmer will have a "seller's market" situation into the foreseeable future.

Fish culture will bring about a gradual increase in employment opportunities as well. These employment opportunities can be scheduled to avoid periods of high labor demand: planting and harvest of other crops.

2. Changes in Population

Over the long term, improved nutrition due to fish culture will bring about an increase in population through lengthening the life span of the people in the area.

Increased employment opportunities as a result of the development of fish culture could help reduce the exodus of young people from the region to the overcrowded cities in particular Dakar and St. Louis.

3. Changes in Cultural Patterns

No changes required or stimulated

4. Other factors

None

HEALTH

1. Changing a Natural Environment

The only significant change involves the increase in stagnant water in the area. Possible adverse effects are discussed in No. 3 below.

2. Eliminating an Ecosystem element

This pilot project would not bring about the elimination of any ecosystem element.

3. Other factors

Two diseases are endemic to the area which often increase proportionally with the amount of stagnant water to be found: malaria and schistosomiasis.

Female mosquitos lay their eggs on the surface of stagnant water. The resulting larvae live at or near the surface of the water for a period of 4 to 10 days. In natural pools of water, protective vegetation and a low concentration of predators insures a high survival rate to the adult stage. In ponds used for intensive fish culture, however, very high concentrations of fish such as tilapia combined with the lack of protective cover (e.g. emergent aquatic vegetation) insures an extremely low survival rate for the mozquito larvae. Since malaria can only be transmitted by

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anopheles mosquitoes, fish culture would not result in a significant increase in the incidence of malaria. Rice culture presents a far greater risk when it is practiced in areas that cannot be easily drained completely.

The spread of schistosomiasis depends upon a certain genus of snails which act as the intermediate hosts and human contact with infested water. Human contact with pond water can easily be limited to harvest time (once every 6 months) when farmers could utilize rubber gloves and waders. This is not normally necessary. As pointed out by USAID Aquaculture Advisor, Richard Neal, in a letter to USAID/Senegal: "The snails require emergent aquatic vegetation on which to lay their eggs and feed. These water weeds can be eliminated by building ponds with a steep bank and by fertilizing the water regularly to encourage phytoplankton growth thereby reducing available light on the pond bottom and preventing weed growth."

Avoidance of contact with the water, steeply sloped banks, and regular fertilization of pond water are all normal components of intensive fish culture pond management, and will be followed throughout this project. Since ponds will not normally be located near human habitation, the fecal contamination of the water required for the spread of schistosomiasis would often be lacking.

In conclusion, even in infested areas, pond fish culture would not cause a significant increase in the incidence of schistosomiasis.

Annex B

PEACE CORPS/ZAIRE

FISH CULTURE PROGRAM

STATUS REPORT

APRIL 1977

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- I. Background of Peace Corps Involvement
- II. Program Administration
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 - D. Expectations
- III. Stations
- IV. Extension
 - A. Current Status
 - B. Techniques
 - C. Future Directions
 - D. Philosophy
- V. Training
 - A. Farmer Training
 - B. PCV Training
- VI. Problems

Status Report PC/Zaire
Fish Culture Program

April 1977

I. BACKGROUND OF PC INVOLVEMENT

Zaire, like so many third world countries in which subsistence agriculture is the economic base, suffers from food shortage and a lack of readily available high protein food. It was with the object of providing a base of high quality protein at a minimum financial cost and with a nominal investment in time and labor, that the Peace Corps first began researching the possibilities of intensive fish culture in the region of Bulungu in 1973. Prior to this time, no significant developments in the field of fish-culture had been made. During the colonial era, the Belgians had embarked upon a plan to develop a fish culture program in many areas of the country. Under their supervision, many ponds were built and even operated for a time. However, the program lacked impetus and with little emphasis placed upon intensive feeding, composting and maintaining water quality, the operation fell into a state of lethargy. Yields were low and ponds were not properly constructed or maintained. As a result, fish culture continued to have very little impact upon the country.

In April of 1973, Peace Corps Zaire began a joint feasibility study in cooperation with OXFAM under the guidance of former PC Cameroun Volunteer, Barry Hall. The study centered on three zones in the region of Bandundu: Fashi, Gungu and Bulungu. After four months of research and site observation, it was concluded that the Zone of Bulungu, bisected by the Kwilu River, would be the most desirable area to initiate a Peace Corps sponsored fish culture program due to the density of population and the availability of well-watered valleys and good potential pond sites. There was also an existing fish station at Nzirda in Kikwit, the commercial center of the Zone, and it was hoped that this station could be improved with GOZ support and utilized as a center for fingerling production.

In Sept. of 1973 two Volunteers were assigned to the Kikwit area for the purpose of evaluating previous pond sites and seeking out new ones which could be readily developed. In May of 1974, Steve Anderson, a PC staff member, was sent to Kikwit to provide technical assistance and support to the project and to solicit Government support. After discussing the possibility extensively with the Commissaire de Region and the Chef de Division de l'Agriculture, he was assured that the GOZ would be entirely willing to support the project and collaborate with the Volunteers.

After observing fish-culture operations in the Cameroons in June of 1974, Anderson and the two Volunteers became convinced that a viable

fish culture program could be launched in the Bulungu region and plans were made for its development. The final goal of the program was to establish a network of production sites which would function entirely on a local level in such a way as to significantly raise the incomes of participating small farmers while providing, at the same time, an inexpensive, dependable source of protein to local village consumers. It was hoped that responsibility for the operation would eventually be taken over by GOZ agronomes and that the project through popular appeal would become self-perpetuate.

Following the pattern of similar Peace Corps development projects, it was requested that the GOZ provide each volunteer with a Zairois counterpart to learn the technical aspects of fish culture and eventually replace the Volunteer Financial support, as well as transportation, were to be the responsibility of the GOZ. In addition to this, the GOZ was also to be responsible for the procurement of needed construction materials for the rebuilding of the Nzinda fish station and for providing the labor for the project. Gradually, as the program developed, the government was to assume entire financial responsibility.

II. PROGRAM ADMINISTRATION

A. Host Country Involvement

The original PC/Zaire fish culture program was founded as a pilot project to test the feasibility of fish culture in the Bulungo Zone; under the assumption that a successful trial effort there would lead to an expanded program supported by the Department of Agriculture. In spite of the overwhelming success of the pilot effort, governmental support has been slow in materializing. As originally conceived, the project was to include one station, in support of the extension activities of the other PCV's. For various financial and personnel reasons this station never really got off the ground.

In mid-1976 a new department was created, the Department of the Environment, Conservation and Tourism, that incorporated the Office National de Pêche. At first, this development was viewed as a reprieve for the fisheries program, which had yet to see any support from the Department of Agriculture. The Department of the Environment, unfortunately, never received any significant funding and proved incapable of supporting the project. It also became apparent that freshwater pond fish culture was of no interest to the Office National de Pêche, which prefers to concentrate on river and lake commercial fisheries.

As a result of the total lack of previous practical involvement of Zairois counterparts in the projects, the PC/Zaire fisheries projec

was often criticized as being purely a Peace Corps project. This has to a great extent been true, in that there has been no real host country institutional base for the program. However, we believe that the pure extension nature of the project means that, in reality, it is totally a Zairois project. If anything, the successes that the project has had, without any real institutional support, may indicate some wisdom in continuing to operate in a relatively independent fashion. As long as the technology utilized remains at a somewhat unsophisticated level, there is little need for any outside involvement.

However, we have all along believed that it is important to identify some mechanism to guarantee the eventual "Zairianization" of the program, through the establishment of a system of host country fish culture technicians. This is the direction that we are taking in our current discussions with the Department of Agriculture concerning future program emphasis and support. We have proposed the establishment of a training program to produce "assistants piscicoles", and the creation of a system to place and support them in the project area, eventually reducing the responsibility of PCV's for continued activity there. Peace Corps Volunteers would assist in the development of the training center and in the subsequent training, as well as in the supervision of the assistants for the first few years.

In January, we began a "campaign" to have the fisheries program reinstated under the aegis of the Department of Agriculture, arguing that the project, as it currently operates, is a pure extension effort compatible with and complementary to the Department's other small-farmer-oriented agricultural extension efforts. This argument has been accepted, in principle, and is leading to some interesting new implications for the future direction of the fisheries project.

B. Future

It is important that fish culture in Zaire is recognized as a complementary aspect of small farmer agriculture. One of the important contributory factors to the success of our work is that fish culture meshes perfectly with the labor demand cycle of small farmers. Rather than compete for labor with other food producing activities (as the introduction of a new crop or a rabbit project might) the nonseasonal nature of fish culture allows the farmer to raise fish and still devote all the necessary time to the planting and harvesting of staple food crops during the appropriate seasons without risking losing the fish. It fills a "gap" in his seasonal work cycle.

The recognition of this intimate relationship between fish culture and the small farmers' other traditional agricultural pursuits, coupled with the high level of credibility that the fisheries PCV's have

individually achieved in their areas, has led to the development of a proposal to expand the project into a more integrated approach to rural development. We are now discussing with the Department of Agriculture and AID the possibility of assigning PCV crop and animal technicians to work side by side with the fisheries Volunteers. While Peace Corps Zaire has been toying with this idea for several months, it has actually been the Department of Agriculture who proposed that the program take a more integrated approach. This will have the important benefit of permitting the funding of the fisheries program within the broader area of agricultural extension and will provide a ready-made institutional base - the existing system of extension agents - which can be expanded to provide counterpart support for the fisheries PCV's. In practice, the fisheries program will operate essentially autonomously, without particular reference to the other aspects of the agricultural extension program.

C. Funding

The current 8 Volunteers have been supported in various ways. They were each originally attached to some organization to provide a semblance of institutional support. Three were assigned to Belgian-financed AIDR centers. Two were assigned to an American Baptist mission's agricultural program. Two others have been assigned to Catholic mission-sponsored agricultural programs. The eighth has always been independent. The degree of support each Volunteer has received has varied considerably. Some were provided housing by their projects, others had to finance and supervise the construction of their mud and thatch homes themselves. Two have received any significant project-related funding (labor for station construction, fuel, etc.).

To date, the financial needs of the fisheries program, while small, have been critical. The major expenses have been for the purchase and operation of motorcycles for the PCV's. The purchase of the initial cycles was funded by AID through a Self-Help grant. The original motorcycles are just about worn out and we have begun investigating new sources of financing them since there are no longer any Self-Help funds available in Zaire. Oxfam has agreed to purchase three motorcycles for individual Volunteers. We have asked PC/Washington to permit us to purchase the remainder. Until now, operating funds for the purchase of fuel and spare parts also came out of the Self-Help grant. We have proposed that a new grant be made from counterpart funds through the Department of Agriculture to cover this for a period of five years.

In addition to the transportation problem, another area of need for financial support has been for tools and some construction. One PCV received a grant from Oxfam of \$585 for the construction of a community fish station at his post. We hope that such individual grants will still be possible, but are also proposing that a separate tool fund be established with counterpart funds to provide each PCV with a basic stock of tools for the farmers in his region and for such small-scale projects.

A third area where funding has not previously been available, but for which it is being sought now is the financing of short-term training programs for farmers. This training would take two forms. One would be two or three day field trips, transporting the farmers from one region to visit ponds and witness harvests in other regions. The second is a project to organize intensive, one week technical training sessions in the local language for farmers at one of the PCV's posts where a Catholic mission already operates an agricultural training program.

Other than AID and Oxfam, there has been no outside funding of the project. We have discussed other sources, such as the Peace Corps Partnership Program and foundations, but have taken no action yet. A proposal for a total of \$500,000 over a five year period has been submitted to the Department of Agriculture to provide a solid financial base for the existing program, fund the construction of a fish station/training center, and finance establishment of a system of "assistants piscicoles". A separate proposal for \$70,000 per year for three years has been submitted to AID to permit the realization of some of the aspects of the broader program (tool stock, farmer training, motorcycle purchase and operation, and the establishment of a smaller fish station).

D. Expectations

Peace Corps Zaire finds itself now in a discouraging position. The pilot fish culture project has proven an unquestionable success (this success has been confirmed by both AID and FAO technicians). We are, for the first time in the life of the project, about to receive the level and quality of cooperation and support from the government that the program merits. However, we have just learned from Peace Corps Washington that the whole program is in jeopardy due to the inability of Recruitment to find candidates for the project for this year. This is the direct consequence of the news in the U.S. about the problems in Shaba region. Five of the eight current PCV's in the project are extending for a third year, but much of our hope and plans for the project have revolved around an ability to expand to a level of 10 to 12 PCV's in order to provide a more in depth regional coverage. If PC/Washington's predictions remain true, not only will there not be new areas added, but some of the existing ones will be discontinued and the program will suffer a serious setback.

III. STATIONS

Before Peace Corps' arrival in 1974, fish culture in Zaire was minimal. The Belgians did a fair amount of fisheries research during the Belgian Congo period (1945-1960). Their best accomplishments

were in pond construction techniques. However, working with Tilapia melanopleura their production results were never very impressive.

After independence (1960) there was very little fisheries activity and most of the Belgian fish stations were abandoned.

Peace Corps Zaire's only involvement with a fish station has been the attempt to reconstruct the government fish station at Nzinda. PC supplied three volunteers over a two year period to direct the work at Nzinda. Various accomplishments were achieved. Our original T. nilotica stock of 300 fingerlings were flown to and stocked at Nzinda, the first harvest of the new species produced a yield of 2,000 kgs/hectare/year, and Nzinda provided the original stock of fingerlings for the present 8 fisheries volunteers. However, since the GOZ failed to show adequate interest in the station (the government agronome as assigned to Nzinda rarely showed up to work) PC abandoned the project in July 1976 and the Volunteer working there moved to a new site.

Two of our Volunteers are presently constructing privately-operated fish stations. Both stations will have a series of approximately 24 ponds covering 2 to 3 hectares. Each would provide a constant source of fingerlings and fresh fish to the local population, as well as provide an example of well-built and well-managed fish ponds. We hope to build several permanent buildings at one of the two stations to provide a training center for village farmers; government agricultural agents; or anyone interested in learning about intensive fish culture.

IV. EXTENSION

A. Current Status

1. Average distance to farmers - 18.7 Km
2. Average number of contacts made/Volunteer - 88
3. Average number of farmers Volunteer working with on a steady basis - 20
4. Average number of ponds worked with by each Volunteer - 23
5. Average total area of ponds worked with by each Volunteer - 60 ares
6. Average production - 2-3T/ha/yr
7. Maximum production - 8T/ha/yr
8. Total distance traveled on motorcycle from Oct. 76 - Jan. 77
120,931 Kms.

B. Techniques

1. Topography

Topographic conditions vary from narrow clay valleys to broad, sandy

valleys. There are numerous narrow valleys which are generally heavily forested with good laterite clay for building dams, also broad valleys with sandy-clay are found. Broad sandy savannah-type valleys are found at two posts. These sites are grasslands with very sandy soil. Ponds have been successfully established in rich forest soils as well as in sandy savannah areas.

2. Making Contacts

This has presented us with no problems in Zaire since the demand for fish is so great that it seems like everyone wants to raise them. Contacts have been made in villages, bars, at social events, along roads, at meetings, through visits to Volunteers' homes, recommendations from already existing farmers in program, and the less successful method of first finding the site then looking for the owner.

Almost every farmer will express an interest in the program and will want the Volunteer to see his pond and bring along the "white man's" fish. But experience has shown that only a small percentage are serious and will work hard and follow advice.

3. Selection of Good Farmer

There are various methods used by Volunteers to determine a worthwhile potential farmer from one who will not make it. The following are examples of three:

- a) Talking with a contact to determine how serious or determined he is.
- b) Insist on the contact coming to your house to discuss the program and to set up date for a site visit.
- c) Insist that the contact visit already-existing ponds and talk with other participating farmers.

These methods can help to eliminate a lot of uncooperative people who would waste a lot of your time and energy during initial pond site visits and follow ups. If the contact does make the effort to do these things we feel he is serious. Then we visit his site.

a) Things looked for at pond site on the initial visit:

- Soil type (clay, sandy, etc.),
- Water type (source, stream, ground),
- Availability of water during dry season,
- Slope of land (drainable),
- Amount of work needed to complete pond,
- Help available (workers, family, friends, etc.),
- Distance from house,
- Available foods or compost to be used for management.

b) How to tell if a farmer is a hard worker and conscientious:

- Construction of farmer's house,
- Condition of fields,
- Other existing agricultural projects and their conditions, such as paddy rice production and gardens.

If the Volunteer determines the site workable, he then will advise some initial work to be done. A follow up visit 1-2 weeks later will often find no work done and one less potential farmer. If the work has been completed further advise and visits will be made until completion.

4. Construction

Construction is a critical time because if close supervision isn't kept up, a mistake can be made due to misunderstanding. This can result in a badly built pond or in unnecessary work. This is why we try to see farmers with a pond under construction 1-2 times a week. If he has built a previous pond, such close supervision isn't necessary.

a. Site Evaluation

- i. Enough water to fill in dry season.
- ii. Good clay to build dikes.
- iii. Clean pond site:
 - Cut trees and remove stumps and debris.
 - Drain all existing pools.
 - Removal of mud if necessary.

b. Construction - all derivation - type ponds

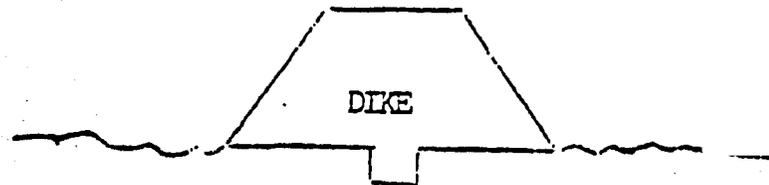
1. Dug-out type pond above water table.
 - Good type of pond if there is good clay.
 - Set out stakes for farmer to follow with markers indicating depth desired.
 - Deep end 1-1.5 meters deep to 40 cm - shallow.
 - Remove all sticks and trees then begin to move earth to the dikes towards the deep end.
 - After all earth is removed and proper slope on pond bottom (1% - 3% depending on terrain), level off dikes on top.
 - Cut a slope on the dikes approx 2-3:1.
 - Then pack the earth on the slope by beating with heavy sticks.
 - Plant paspalum immediately.
 - Close up the pond.
 - Fill the pond by a canal.

- ii. Dug-out type pond in water table (Idiofa)
- Some areas of broad valleys, mostly sandy soil have a high water table.
 - Basically same as i but is more difficult to drain and may be necessary to dig a long drainage canal.
 - It is necessary to leave a large dike between ponds (5 meters).
 - Paspalum is important because of erosion.

- iii. Cut and fill type pond
- Usually built in forested areas where good laterite is used.
 - Existing ponds or pools drained and all trees and stumps and debris removed.
 - There is usually some ground water in these places, so must first dig a drainage canal.
 - Arrange the pond bottom so that the pond will drain well.
 - Dig the derivation canal and use the clay to make an even slope on the inside of that canal.
 - If the clay is good, make the top of the dam about 0.50 meter wide with a nice even slope to the shallow end of pond bottom.



- For the 3 dikes which are left - if there is a lot of mud or loamy soil, dig a core trench about 30 cm wide and deep enough to reach solid soil.
- Cut clay out of the flank of the mountain and build a base by filling the core trench first then continuing with the base of the dike (4 meters wide).



- Keep building out and keep running wheel barrow back and forth to empack earth well.
- Deep end should have a slightly wider dam at the base because of greater depth and more water pressure.
- From time to time during construction, beat the slopes and the loose dirt areas with heavy sticks to empack earth.

- For a deep end where water will be for example 1.5 meters deep, 0.5 meter of freeboard is desired. Add approximately 0.30 m more earth to account for natural settling of earth - 2.3 meters. After one year the dike will be a solid 2 meters high.
- Plant paspalum.

5. Stocking

The ponds, when completed, must meet a certain standard before being considered ready for stocking. Exact requirements vary between Volunteers, but common requirements are:

- Well built, sloped walls,
- Minimum leakage,
- Proper water depth ($\frac{1}{2}$ - 1 meter slope),
- No flow through (diversion canal if necessary)
- No trees or stumps in pond,
- Plenty of sunlight,
- Overflow bamboo pipes,
- Compost,
- Some kind of screen or filter on inlet and outlet pipes,
- Grass planted on dikes.

When each Volunteer's initial criteria is met, the pond can be stocked. We usually stock 1 fingerling/1 m² or 20-30 brooders/are. Sometimes when fingerling numbers aren't adequate, we have been forced to stock fingerlings together with brooders to assure adequate production from a pond.

6. Management

We are trying to introduce an intensive management program. This will involve well constructed ponds, frequent maintenance, daily feeding, composting to produce plankton bloom, harvests after 6 months, repair of pond (if needed), drying pond two weeks and restocking of pond.

Maintenance required:

- Constant water level,
- Grasses kept cut near pond,
- Any signs of erosion corrected,
- Trees are kept cut back,
- Aquatic plants removed,
- Tadpole removed with fine net feeding.

Types of feed being used:

- Termites - Coffee husk,
- Manioc leaves,
- Pounded peanuts,
- Corn,
- Rice bran,
- Manioc flour,
- Millet,
- Commercially prepared chicken feed

Types of compost used:

- Manure (chicken, cow, pig, goat, rabbit),
- Cut grasses and leaves,
- Palm nut fiber,
- Rice straw.

One Volunteer is in a situation where he works with very sandy soils and acidic water of PH4. With the application of lime and heavy compostin he has produced blooms on the ponds. He has found an application rate of 1-2 Kg/are/month can raise and maintain the PH in a stagnant pond from 4 to 8.

Farmers are usually visited once every 2-3 weeks. This varies according to the individual farmers and how much of a check is needed to assure good work.

Management is a difficult part of extension because it involves daily up-keep and feeding of a pond. This goes against traditional concepts of agriculture and raising livestock such as chickens, cattle, goats and pigs which are believed to be able to do alright on their own or with a minimum amount of care. But this might be overcome by a few good harvests showing the relationship between Kgs produced and amount of work put into pond management.

7. Fingerling Harvest and Transportation

Our best success at fingerling harvest has been with a lift net. With this method fingerlings can be taken out in excellent condition for transport. Another method used but with less success has been the seine net. Actual transport is done by motorcycle with plastic jugs, metal powdered milk cans or plastic bags carried in back packs or carried by farmers themselves if not a great distance. When large numbers are transported over great distances, a 200 liter barrel will be used in a land rover.

8. Materials

Materials used thus far in our extension program:

Lift net

Seine net

Transporting materials (nido can, plastic jugs, plastic bags, barrel, back pack)

Monk construction:

Cement

Bricks

Wood (frame)

Bamboo (drains, overflow, inlet)

Hand levels

Scales - 50 lb fisherman's hand scale

Screening

9. Harvest

Ponds are harvested six months after stocking.

The most common method is broken dam, though there are some ponds with monks and drain pipes, sluice gate. Nets, baskets or catch basins are used to capture the fish.

C. Future Directions

The future direction of the extension program will be determined by the decision of the Zairian Government on the amount of support it will be willing to give our program. Without sufficient support and lack of counterparts, Volunteers will be forced to concentrate their work on a small select number of promising farmers in the hopes they will continue the work alone after the Volunteer leaves.

With governmental support, counterparts or replacements, the Volunteers can be more flexible by working with a larger number of farmers less intensively, teaching counterparts, trying new projects and methods of extension.

D. Philosophy

Our fish culture program is entirely extension-oriented, working at a grass roots level. We work directly with the village farmers, often making weekly visits. Credibility was quickly gained by establishing ourselves in the local communities. We speak the major local language (Kikongo), for French would be of little use in the bush. Several of us

live in mud, stick, and grass-roofed houses located in the villages.

Most villagers express an interest in raising fish, but since the amount of our time and resources is limited we must choose the best farmers. Model fish ponds are not built or operated by the Volunteers themselves as bases from which to conduct our extension work, for successful fish farming controlled by "whitemen" would not have much effect on the local farmers.

Successful farmers are the best publicity for the program. Since the initial supply of fingerlings was limited, Volunteers sought quality rather than quantity. Only farmers who demonstrated that they were willing to follow the suggestions of the Volunteers and do their work conscientiously were sold fingerlings. The first farmers' ponds served as effective models of what can be done in the field of fish culture when modern techniques were applied and adhered to. The farmers who successfully established themselves early in the program derived additional income through the sale of fingerlings to other farmers. This original group of farmers is now doing much of our work for us by showing many other farmers modern fishculture techniques.

Though we work in a relatively small area each Volunteer's personal extension philosophy is affected by local conditions. Tribal differences can be great. One tribe may refuse to destroy ancestral ponds so the Volunteer must work with changing deeply established attitudes. Another tribe can be extremely receptive to new ideas and the Volunteer need explain something but once and it will be done well. Topography affects the Volunteer's work philosophy. The population is denser in the forest regions so the Volunteer's itinerary will be more restricted than in the savana. Construction also depends, on soil clay content and the shape of the valley. A sponsor organization's presence or absence will directly effect a Volunteer's work. If the Volunteer is part of an organization with a well developed infrastructure, he can devote most of his time to strictly fish culture. For those of us who have no sponsor we must create our own infrastructure, such as farmer coops and tool supplies. And finally, each Volunteer must follow his own ideas and goals.

We are now reaching a point in our program where the Volunteer can think of a more integrated development planning. We can advise farmers on how to utilize ponds in conjunction with small animal husbandry, rice production, gardening, or other areas of rural development. We hope that with the personal credibility that we have achieved through the success of the fish program, we can encourage the people of our communities to pursue other ways of improving the quality of their lives.

V. TRAINING

A. Farmer Training

Several of our Volunteers are providing farmer training on a regular basis. One PCV heads his farmers' fisheries cooperative meeting every month or so. They may discuss pond construction and management, fish transportation, or monk construction. The Volunteer only directs the discussion and adds new ideas, the farmers do most of the talking.

Another Volunteer cooperates with his sponsor, a Catholic mission. The mission provides a four year agricultural training program and the fishery Volunteer teaches two courses per week on fish culture. The mission also holds a two day farmer meeting every month and fish culture usually provides some input. The Volunteer is also organizing a one week seminar on all aspects of fish culture for village farmers.

He has asked some of the other fish Volunteers to send a few of their farmers to the seminar so that we have a good representation from the whole region.

We have several training plans for the future such as the training center mentioned under stations. We also hope to organize our own training for Peace Corps fishery Volunteers in Zaire.

B. PCV Training

1. Current status

Training is a major concern for PC/Zaire. In 1975, the PC/Z fisheries Volunteers trained with Cameroun's Volunteers at Mbengui station. We had hoped to do so again this year, but this will not be possible. Thus, PC/Z is faced with the challenge of developing its own in-country training capability.

Since no suitable station exists, this will require the construction of a series of training ponds at or near a center suitable for housing and feeding the trainees, as well as developing a French and local language (Kikongo) training capability. Assuming that such minor roadblocks as sufficient funding, availability of language staff, etc. are easily overcome, the simple logistical problems of housing and feeding a group of people in the interior of Zaire are quite a hassle. PC/Z is currently planning to organize its own in-country training for the Summer of 1977. This will require the services of a fulltime-FSC training director, as well as the hiring and training of a new language staff. We will build the necessary ponds for training and classroom space.

2. Problem areas

The essentials of fishculture appear to be the same for all fresh water pond, fish culture programs in tropical areas, allowing for variations in fish species raised. Zaire, however, has two important special requirements for training. The first is that, while the PCV's need a basic minimal conversational ability in French, a thorough fluency in the local language is required. Luckily, it is not a particularly difficult challenge.

The second special area is extension techniques. We are becoming aware of the fact that past PCV's have not been adequately trained for the nontechnical aspects of motivating small farmers. Problems of group dynamics in the Zairian cultural context, for example, have never been addressed. It is one thing to be technically competent to raise fish. It is another, far more complex task to be able to teach someone else, especially a small farmer, how to do it and motivate him to want to.

One other area of special training worth briefly mentioning is motorcycle maintenance. PC/Z fisheries Volunteers depend totally on their motorcycles. Perhaps as a result of the penny-pinching nature of the program, we are constantly aware of the need for timely and careful preventive maintenance to keep them on the road. Our PCV's must know their bikes inside and out. Adequate attention to this in pre-service training could prevent many future problems.

3. Joint Regional Training

PC/Z is very interested in developing a system of joint regional training for Central African fish culture trainees. Given the common technical training requirements, this certainly seems feasible. A four, six or eight week training session together would greatly reduce costs and increase our ability to effectively use scarce resources such as good training sites and qualified trainers. The following suggestions or points are worth considering:

a. Site - A central training site could be selected in one country, for use by all.

b. Language - French training could be provided in common. Countries that require local language would have the options of sending their own language trainers to the main training site or holding separate local language training in-country.

c. Cross Culture - As in the case of PC/Zaire in 1975 an orientation/cross cultural training session could be organized in-country following technical training and/or countries could devise individualized cross-cultural input during the main training session.

d. Timing - If the number of FCT's proves to be too large for any one site, countries could be urged to stagger their training programs (different countries in different seasons). This would also permit more efficient utilization of the training personnel

VI. PROBLEMS

As in all underdeveloped countries, Zaire has its problems. To succeed at any project is quite difficult in Zaire and it is necessary to work with tact and a lot of patience.

The main problem facing the fisheries program right now is government support. In the past we have received a minimum amount of support such as free rent for the APCD's house and a Volunteer's house in Kikwit. A reasonably good site for rebuilding ponds, a state agroncme and a few workers were provided but a lack of interest and other problems such as lack of transportation for the agroncme, resulted in total failure at Nzinda station. It seems as though everywhere the Government is involved there is an overdose of problems. That is possibly the reason that our credibility is quite high since, at present, we are in no way affiliated with the Government. A good example was a recent harvest. Because of pressure for getting government support we invited the agroncme sous-regionale and the veterinaire sous-regionale to attend this harvest. Peace Corps furnished their gasoline costs. After witnessing a nice, ninety kilogram harvest from a small pond, the veterinaire sous-regionale reached in and filled his plastic bucket with seventeen kilograms of fish. After some arguing with some other Volunteers, he was shamed into paying for them. Later we learned that his wife made a nice profit that same evening reselling the fish.

Finding other means of support is also a great problem for us. Our program has been very well exposed to people of various organizations from several countries. The program has been visited by USAID, US Information Service, Association Internationale de Developpement Rural (Belgian), agroncmes from Unilever Corporation, the Museum of Natural History, Brussels, various missions and NBC news. Everyone says the same thing basically, "Your project is wonderful and very much needed in Zaire, we're behind you 100 percent". But when it comes time to count out the dollars... that's a problem.

Following these two major problems there is also a barrage of lesser problems. One of which is probably common to all African countries: traditional ideas about farming. On one hand the farmer is quite willing to accept the white man's fish because these fish grow well and were sent by God. On the other hand to get the farmer to raise his fish with a modern management program is quite difficult. Then there

are other problems concerning their ancestors' traditional ponds. If a farmer is not the progressive type, he may refuse to destroy one of these ancestral ponds, even if it would totally ruin plans to develop a potentially excellent site.

The scarcity of tools is a difficulty, especially good quality ones. The shovels and machetes made in Kinshasa are a very low grade tool and farmers are really hesitant about buying them simply because they don't last. Other farmers are located in such isolated corners that even the poor quality tools are not available. The main tool however, which is lacking is the wheelbarrow. A lot of people build dams by transporting dirt in woven baskets on their head - a very difficult and slow process.

Also, on the farmer level for instance, ponds located near a city have problems with thieves. The farmers are near an excellent market, there are usually good sources of supplemental feed, but the risk of theft is very high.

Often, management techniques which are slightly hard to grasp pose problems. Many times farmers have constructed picture-perfect ponds but forget to use a good screen while filling the pond which results in an accidental polyculture. Some farmers are also lacking manure for their composts simply because they don't have cattle and the farmer next door who does have cattle is getting wise and not allowing others to use it. The farmers also lack publications in either Kikongo or French. These could have quite a deal of impact because the Zairois believe that if it's written it's the gospel truth.

The farmer is really confronted with day to day problems and so is the Volunteer. Gasoline availability has been one of our greatest headaches. In Kinshasa, the biggest city in Africa, a gasoline crisis could last a week or two and are quite frequent, imagine what the situation is like in the interior. A barrel of gas which costs seventy Zaires in Kinshasa could cost three hundred in the Kasai region. Transportation in general is in a poor state. The roads are terrible with deep sand and ruts. This greatly limits our distances in hauling fingerlings as well as just visiting farmers.

Surely many of these problems are not uncommon to other African countries. If these problems did not exist, there would probably be little reason for us to be here.