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ABSTRACT

This document is designed for policymakers, program planners, trainers, and coordinators who are considering the potential contribution of fresh water fisheries to the people for and with whom they work. Although based on materials generated by Peace Corps experiences, the document is intended for a broader audience. The specific topic area addressed is intensive fishculture in warm, fresh water bodies and particularly in artificially constructed fishponds. The first section is devoted to feasibility determinants for establishing intensive fishculture programs. Findings and recommendations resulting from a fisheries program feasibility survey carried out in the Bandundu Region of the Republic of Zaire are included. Following sections review: (1) Peace Corps involvement in a number of fishculture programs in Togo, India, Cameroon, Central African Republic, Central and South America, Nepal, and the Philippines; (2) tasks undertaken to meet fishculture program goals in these countries; (3) criteria (job skills) that host countries request volunteers to have; and (4) training objectives for fisheries workers. In addition, criteria for assessing intensive fishculture programs and a list of resources are included. (JN)

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Peace Corps

FRESHWATER FISHERIES:

PROGRAM PLANNING

BY

STEVEN GREGORY

ACTION / PEACE CORPS

OFFICE OF MULTILATERAL & SPECIAL PROGRAMS

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Readers of this volume will also be interested in Peace Corps Program and Training Journal Manual No. 1B, Freshwater Fish Pond Culture and Management, a joint Peace Corps/VITA Publication.

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INTRODUCTION

Rapid population growth and extensive damage from drought, earthquakes and other natural disasters have magnified the worldwide struggle for adequate food supplies. In those countries already hampered by extremely limited capital resources, that struggle is especially desperate. Optimum use of available natural resources is mandatory if starvation and malnutrition, and their attendant problems, are to be minimized. In many instances, development of a new "natural" resource may be advisable.

Introduction or expansion of intensive fishculture may be a viable solution to these problems. Intensive fishculture is the growing of fish, usually in ponds, for the purpose of producing a food crop and, it is hoped, a surplus that will bring capital to those sectors of society involved in fish farming. Local consumption of fish naturally will help alleviate dietary protein deficiencies. It is useful to remember that, compared to other protein sources:

100 gms. fish = 500 gms. milk = 85 gms. dhal = 165 gms. wheat = 285 gms. rice = 155 gms. (3) eggs.

Intensive fishculture is an especially important protein source in equatorial lands where lateritic soils, humid climates and widespread disease make livestock production only marginally profitable. It can be a dependable year-around source of protein, a quality that does not always apply to natural fisheries.

Moreover, fish exports may provide income necessary for the provision of health facilities and care, education programs, and a variety of other development projects. An analysis of the comparative return on fish to agricultural crops in two Indian States in 1969-1970 follows.

TABLE I.*

ECONOMIC COMPARISON OF FISH CROPS TO AGRICULTURAL CROPS ON A PER HECTARE BASIS

	Madhya Pradesh 1969-70		Rajasthan 1969-70	
Crop	Kilograms/Hectare	Rupees[1]	Kilograms/Hectare	Rupees
Rice	784	1,000	860	1,200
Wheat	714	420	1,015	812
Gram	562	450	606	500
Groundnut	703	1,200	486	800
Mustard	334	234	451	350
Sugar Cane	2,511	2,000	1,332	1,100
Fish	2,000	3,000	2,000	3,000

*Source: R.S. Bharadwaj, Stephen E. Crawford, Lauren C. Watson. Manual for Fish Culture in Rajasthan and Madhya Pradesh. New Delhi: U.S. Peace Corps, 1973

1 Net profits of the crops are estimates.

The first harvest of tilapia nilotica from a single fishpond at Nzinda Fish Station, Kikwit, Zaire illustrates the potential contribution of even a limited fishculture program. The pond was stocked with 297 t. nilotica weighing a total of three kilos. Six months later, several thousand fish were removed, the largest exceeding eight (8) inches in length and 150 grams in weight. The fish were sold immediately in two lots: 68 kilos were sold for eating and 600 fingerlings to farmers for restocking their private ponds. In neither instance were there enough to go around.

With careful preparation, hard work and some luck, this success in Zaire can be matched in other parts of the world. Fresh Water Fisheries Part I: Program Planning is designed for policy-makers, program planners, trainers and coordinators who are considering the potential contribution of fresh water fisheries to the people for and with whom they work. Although based on materials generated by Peace Corps experiences, it is intended for a broader audience. It addresses itself exclusively to intensive fishculture in warm freshwater bodies (henceforth simply "intensive fishculture"), particularly artificially constructed fishponds.

This concentration reflects our desire to share materials in which we have particular and unique expertise. While Peace Corps has been involved in varied fisheries programs since the mid-1960's, "intensive fishculture" is the area of deepest Peace Corps involvement in developing a subsistance level activity into an economically viable source of income. The first chapter in this Manual is devoted to feasibility determinants for establishing intensive fishculture programs. Following chapters review Peace Corps involvement in a number of fishculture programs, task analyses, recruitment criteria and training objectives for fisheries workers. In addition, criteria for assessing intensive fishculture programs and a list of resources are included.

The companion volume, Fresh Water Fisheries Part II, is a practical "How To" volume for fisheries workers. It is intended to serve the needs of extension workers, Peace Corps Volunteers and other local development agents whose efforts are frequently hampered by lack of information.

Many people--Peace Corps Volunteers, staff and consultants, development agents from throughout the world, and host country nationals from ministry offices to small villages--have contributed both to Peace Corps programs and to this volume. Their contributions are deeply appreciated. The Peace Corps offers this, and other volumes, with thanks, and with hopes for continued cooperative efforts.

INTENSIVE FISHCULTURE FEASIBILITY DETERMINANTS

Individuals or groups who are contemplating initiating an intensive fishculture program must pose some difficult questions before proceeding to plan such a program; the decision maker(s) should establish the need for an intensive fishculture program before moving to implement one. Will an intensive fishculture program help improve the nutrition and/or the economic condition of a population? Is intensive fishculture the "best" way to alleviate starvation, malnutrition and/or abject poverty of a population? Will an intensive fishculture program take hold and become self-sufficient in an area considered for such a program?

Bill Rudd, a former Peace Corps Volunteer in an intensive fishculture program in Cameroon, established feasibility determinants for freshwater fisheries programs. Applying some of his determinants specifically to intensive fishculture programs gives an idea of the kinds of questions that need to be asked and answered in order to judge whether or not the institution of an intensive fishculture program would be the most beneficial kind of investment to make in a given area.

FEASIBILITY DETERMINANTS FOR THE ESTABLISHMENT OF AN INTENSIVE FISHCULTURE PROGRAM (89)

1. What is existing fisheries structure?
   a. Maritime and/or continental?
   b. How much staff and money?
   c. What are their goals or aims?
   d. What is realistic potential?

2. Do people eat fish?
   a. In what areas and how much?
   b. What kind of fish and in what manner (dried, cooked...)?
   c. Freshwater fish eaten?
   d. From where and how is fish transported and marketed?
   e. Cost of fish?

3. What is social situation?
   a. Who in social structure owns property?
   b. Who does work--men or women?
   c. General attitude toward manual labor?
   d. What daily activities would encourage/discourage fish raising?
   e. Local beliefs re: water, rivers...?
   f. Acceptability of Volunteers in area based on previous Volunteer experience?

4. What contributions does government want Peace Corps to make?

a. What, if any, has been past fisheries development?

1) When, by whom, to what extent?
2) Why was it discontinued?
3) What were successes and failures?
4) What remains of what was done?

b. River fishermen and/or fish culturist?
c. As government workers, extension workers?
d. Working with private farmers or as private agent?
e. Working within existing structure or integrating into other field, e.g., agriculture?
f. Material or monetary contributions?

1) Equipment
2) Transportation
3) Housing

5. Feasibility of fishculture?

a. Water

1) Yearly rainfall amount?
2) Yearly distribution of rainfall?
3) How much water in dry season?
4) What is high water mark?
5) Accessibility of waterways; ownership and control of same?

b. Land

1)Topography: mountainous, elevation, seasonal temperatures?
2) Soil types: rocky, sandy, clay, laterite, etc.?
3) Who has title to land?

c. What common foodstuffs available?
d. What fertilizers available, and cost?
e. Availability and cost of building materials?
f. Transport and marketing systems?
g. Heavy equipment availability and cost?
h. Cost of manual labor?
i. What outside funding available?

Once a decision to initiate an intensive fishculture program is made and the initial steps in implementating the program have been completed, another set of factors must be considered concerning where the optimal location for a pilot project, most likely a pond, would be. Considerations include (2):

1. Choice of farmer--look for incentive, interest, imagination, coopera-

tiveness and a willingness to take risks.

2. Markets:

   --since a goal of raising fish is to make a profit, a market should exist.

   --due to perishability, the farmer and the market should be close together and access to the market should be easily available.

3. Land tenure--a farmer who either owns land or has a binding agreement to use the land for a fixed period of time will be more willing to make a long term investment in equipment, money and energy than a farmer who is insecure on land not his own.

4. Costs--construction and operating costs will vary depending upon how much work the farmer is willing to do on his own.

With these general guidelines for determining the feasibility of intensive fishculture in mind, it will be useful to review the survey on the following pages prepared by Calvert Hall in Zaire in 1973 (21).

INLAND FISHERIES FEASIBILITY SURVEY

7 APRIL - 28 MAY 1973

BANDUNDU REGION

REPUBLIC OF ZAIRE

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N.B. The statistics presented in this report should not be considered highly reliable. They are intended to convey a general idea only.

I. INTRODUCTION

This report presents the findings of, and recommendation resulting from, a fisheries program feasibility survey carried out in the Bandundu Region of the Republic of Zaire from 7 April through 28 May 1973. The ultimate goal is completion of a program document for a Peace Corps Inland Fisheries Development Project in Bandundu. The Survey was sponsored by Peace Corps/Zaire and OXFAM, in anticipation of cooperation between these two organizations in establishing the resulting program.

II. SPECIFICS OF THE SURVEY

A. LOCATION. Bandundu Region was chosen as the general survey site because of: 1) the relatively serious protein deficiency in the region, and 2) the inland fisheries development that occurred there during the colonial period. The survey was further limited to Bulungu, Gungu and Feshi Zones, and Kikwit Sub-Region where the greatest need for additional protein supply exists, and where inland fisheries activities under the colonial administration were concentrated.

B. ITINERARY. The survey was carried out by Peace Corps Consultant C.B. Hall and EDAR Agronomist Citizen Kinandhi. All travel was done in OXFAM-donated Landrovers, and travel expenses were shared by OXFAM and Peace Corps.

Dates	Places
April 7 - 12	Kikwit Sub-Region
April 13 - 14	Gungu Zone
April 15 - 17	Feshi Zone
April 18 - 30	Gungu Zone
May 1 - 2	Kikwit Sub-Region
May 9 - 28	Bulungu Zone

C. METHODS. In order to amass the required information, the surveyors employed extensive interviews and site visits.

1. Interviews. In each collectivity, the chiefs, other traditional leaders, and as many farmers and villagers as possible were interviewed. The representatives of all development organizations in the area--AIDR, EDAR, the Rice Project, the Catholic Mission, Vanga Hospital, and the local OXFAM team--were consulted. The following government officials in all localities and administrative headquarters were also interviewed:

Sub-Region	Commissioner of the Sub-Region Agronomist of the Sub-Region
Zone	Commissioner of the Zone Agronomist of the Zone
Collectivity	Chief of the Collectivity Agronomist of the Post Chief of the Post Secretary and Treasurer of the Collectivity
Groupements and Localities	Chief of Groupement or Locality Agricultural Agents

2. Site Visits. The surveyors visited existing fish ponds and farms in the collectivities in order to get a representative sampling of the current grassroots fisheries situation. They also visited government ponds and stations, local communities, markets, commercial centers, development projects and general areas of interest.

III. GUNGU ZONE

A. GENERAL. Gungu Zone is located in the southeast corner of Kwilu Sub-Region. Its population of 238,000 is very sparsely settled in an area of approximately 15,000 sq. kilometers. The zone is sub-divided into groupements and finally localities. The headquarters of the zone is the locality of Gungu, a town of approximately 8, 000 inhabitants, located 165 kilometers south of Kikwit.

Collectivity	Population	# Groupements	# Localities
Lukamba	11,200	7	62
Gudi	16,800	Did not visit	
Gungu	35,800	14	100 +
Kandale	22,300	11	77
Kilamba	17,200	10	44
Kilembe	10,700	16	56
Kisunzu	17,200	7	56
Kobo	14,200	9	48
Kondo	8,400	16	49

Collectivity	Population	# Groupements	# Localities
Lozo	27,000	12	36
Mulikalunga	22,300	12	86
Mungindu	25,400	14	102

B. STAFF AND MATERIAL SUPPORT. The Government of Zaire has a substantial cadre of sixty-two full time agricultural officials and agents in Gungu Zone. There is one agronomist of the zone, five post agronomists, fifty-three agents and deputy agents, and three employees for the office headquarters in Gungu. The agronomist of the zone has an adequate office in Gungu, but the post agronomists have very limited office space.

What limits the work of these men is that absolutely no material support exists for their agricultural programs. There is only one four wheel vehicle to support their work: a Landrover donated by OXFAM. The government does not supply adequate gasoline to keep this vehicle on the road; thus the extension workers are totally without transport, equipment, or any sort of programming resources.

Theoretically, the agronomist of the zone is the administrative head of the agricultural work in the zone, while the post agronomists are responsible for the work of the agricultural agents and general laborers stationed in the collectivities under their jurisdiction. The agricultural agents are the extension workers, usually one agent per two groupements, who go from locality to locality instructing the farmers in basic agricultural methods. With some exceptions, the agronomists have a secondary education followed by advanced study in agriculture. Most of the agents are primary school graduates with a good deal of agricultural experience, although many of them are inadequately trained for their important role as the real instructors of the people.

Unfortunately, the governmental cadre is limited as an agent of agricultural development because, lacking material support, they lack the necessary spirit and initiative. However, virtually all of these personnel are in agreement that if a Volunteer with basic material support were to become involved in agricultural operations at the collectivity level, he could very significantly activate the agricultural and general development scene. The agronomists and chiefs of each collectivity have accordingly made it clear that they will make available to any Volunteers posted in the area whatever staff they require.

A specific breakdown of the governmental personnel involved in agricultural development in the zone follows:

Commissioner of the Sub-Region of Kwilu (Bulungu) Citizen Bavuwu

Agronomist of the Sub-Region of Kwilu (Bulungu) — Citizen Kiunga

Commissioner of the Zone of Gungu

Agronomist of the Zone of Gungu — Citizen Fataki

Collectivity	Chief	# Post Agronomists	Agricultural Agents	Office Workers
Kisunzu	Citizen Mulimakati		4	
Muliakalunga	Citizen Kisudila	2	12	
Mungindu	Citizen Mangala	1	5	
Kilamba	Citizen Guasuga		3	
Gungu	Citizen Mukabuta		6	
Lukamba	Citizen Mukubu		4	
Lozo	Citizen Munduka		3	
Kilembe	Citizen Madilo	1	3	
Gudi	Did not visit			
Kondo	Citizen Lokwasa		3	
Kandale	Citizen Kamanda	1	5	
Kobo	Citizen Mwanza		3	
Zone		1	2	3
TOTALS		6	53	3

C. HISTORY OF FISHERIES DEVELOPMENT. Although there are accounts of fish pond construction in Gungu Zone before the colonial era, significant developments started in 1952 under the colonial administration which at this time began to require people throughout the zone to build fish ponds. In most cases a site was chosen by the administration, a dam and a water channel were constructed by the population, and then each family was required to build its own fish pond in the adjacent area.

In addition to this, each collectivity built government ponds to serve

as fingerling reproduction areas. The results of this program were the most impressive in Equatorial Africa: approximately 30,000 fish ponds were constructed in Gungu Zone alone with a total area of about 1,000 hectares.[1] The wide, gradually sloping valleys are topographically ideal for the construction of large complexes of ponds, with an adequate water supply. Pond construction in these valleys was relatively easy because of the sandy soil and lack of vegetation. However, the sandy soil and lack of vegetation were two of the major causes for the program's failure. With a program of successful intensive fish farming, one can produce at least 1,000 to 2,000 kgs. per hectare per year. The production of tilapia from the 28 best maintained ponds in the area in the 1950's was an incredibly low 90 kgs. per hectare per year. In other words, a farmer with an average size pond of about 3 acres harvested only about 3 kgs. of fish per year.[2] More specifically, the ponds were poorly constructed. The dikes were small and hurriedly built, while the sandy content of the dikes and the pond bottom made both very permeable. The already very sterile water (Ph of less than 4) was allowed to flow continuously through the permeable pond, precluding any buildup of fertility. The general lack of fertility in the soil resulted in poor agricultural production and a general absence of vegetation. There were very few sources of fish feed and consequently there was virtually no production.

At the same time the colonial administration's imposition of pond construction and maintenance upon the people took away their initiative. They considered the ponds a burden. No one ever approached the farmers at a personal level to explain the benefits of fish farming or how to go about it. This aloofness was in the long run self-defeating. To make matters worse, the government imposed a tax upon each pond with obvious negative results. Finally, the ponds were easy targets for thieves because they were usually constructed in large complexes away from the villages. Thus the few kilograms of fish which were produced were even further depleted by the ubiquitous fish robber. In short, the inland fisheries development situation was somewhat grim by the time of independence.

After independence, about 75% of the governmentally imposed fish ponds were abandoned, and there has been no governmental program of extension

[1] In Kwilu Sub-Region there was a recorded total of 64,470 ponds with an area of 2301 hectares at the end of 1955, while Feshi Zone of Kwango Sub-Region had 9142 ponds totaling 263 hectares.

[2] One acre is 100 square meters or 119.6 square yards.

work to activate the farmers' and villagers' interest in fish farming. However, a number of people have constructed new fish ponds or renovated the old ones as private enterprises.[3] These ponds, averaging in size from two to three acres, are usually constructed in the forests near small rivers, then filled with water and too many small tilapia and indigenous fish. They are usually fairly well constructed with adequate dikes and cleared of stumps and other vegetation. Still located far from inhabited areas, they are victimized by thieves and are not managed (in terms of intensive fishculture) except for an occasional manioc leaf to feed to the small fish. Concepts of natural food for the fish, intensive supplementary feeding, stocking of fish, and so forth are totally alien to the farmers and villagers that own these ponds.

Therefore, although the history of fisheries development in the zone has not been dramatic, there are a number of farmers and villagers who are aware that fish farming exists and who are interested in learning how to increase their production of fish. There is also a recuperable investment in pond construction. The most important current problems are lack of fish pond management, a mild suspicion of government agents, a species of fish (Tilapia melanopleura and machrochir) whose reproduction is difficult to control, varying quality of fish pond construction, very sterile water, sterile and sandy soil, no dependable supply of fish foods, and no government service for support and advice.

Although statistics for ponds which are not "maintained" could not be obtained, a rule of thumb for the following statistics is that 10% of the ponds of 1961 are presently producing fish, and about 30% are still filled with water.

Statistics 1961

Collectivity	# Farmer Ponds	Total Hectares	# Government Ponds	Total Hectares
Mugindu	2,749	116	1	.90
Kilamba	2,170	90	1	.35
Gungu	2,278	120	2	1.70
Lukamba	2,865	110		

[3]The ponds are owned by both "farmers" and "villagers". A farmer, "fermier", is a man who has been given a plot of governmental land for agricultural production. These plots are usually a few kilometers away from any locality. The farmer concentrates on production for profit. He is taxed by the government. Nearly all villagers have farms, but these farms are basically for subsistence and are managed by the women. Both farmers and villagers have fish ponds, but the farmers' ponds are usually the best.

Collectivity	# Farmer Ponds	Total Hectares	# Government Ponds	Total Hectares
Kilembe	1,302	50	1	.14
Lozo	6,329	231	4	1.3
Kisunzu	1,877	93		
Mulikalunga	3,193	109	1	.50
Kandala	661	27	1	.75
Kondo	743	19	3	.95
Kobo	1,106	30	3	.70
Gudi (not visited)				
TOTALS	25,273	1,018	17	7.50

D. ASPECTS OF INLAND FISHERIES DEVELOPMENT

1. Need. Although one doesn't see many cases of serious kwashiorkor, the children are generally malnourished with somewhat swollen bellies, thin arms and legs, and occasionally discolored hair. There is thus a great need in the Gungu Zone for a supplementary protein supply. According to the Kwilu, by Henri Nicolai, the total production and consumption of protein in the sub-region is only 32% of the total minimal need. Gungu has a smaller protein supply than any of the five zones which make up Kwilu Sub-Region, and thus should merit high priority for agricultural development. At the same time the farmers of the zone need other means of producing revenue to meet their economic needs. Fish farming is an ideal means of helping to solve both of these problems, and is therefore greatly needed in the zone.

2. Fish Supply and Demand. A problem with many grassroots elevage programs is that the people, once they produce the protein, don't want to eat it. This is not a problem with fish, which are traditionally a very high demand commodity throughout the zone. Fresh fish supplied by the local rivers amounted to approximately 80 tons for Gungu Zone in 1972. This amounts to an average of only 1/3 kilo of fresh fish per person per year. This small quantity of fish is sold at a very high price of from 50 Makuta to 150 Makuta per kilo depending upon the size and quality of the fish. Even the small tilapia harvested from fish ponds are sold for 50 Makuta per kilo or more. The people here love to eat fish in all forms. This can be seen in every local shop or the smallest market where one of the main products being sold

is either dried or canned fish. Fish are also caught in the many marsh lands. They are usually dried, preserved on sticks, and sold for 10 Makuta per 200 gram stick. This supply, however, is very inadequate and/or too expensive for the average villager and his family. Another source is needed--one which will put revenue in the pockets of the farmers and fish in the bellies of their children.

3. Agricultural Situation in 1972. The Gungu Zone was severely struck by a variety of Manioc Blight which almost wiped out the population's staple for a fata period. Emergency efforts greatly relieved what could have been a disaster. The fact that the population is that reliant upon manioc for its survival is indicative of the lack of diversification in the agricultural program. Millet, maize, peanuts, rice and other crops are raised but only in very restricted quantities because of the poor soil. Poultry, pigs, goats, sheep, pigeons, and a few cows are raised, but neither they nor their products are commonly eaten, and grassroots programs of animal reproduction and nutrition are virtually nonexistent.

Many of the farmers and villagers harvest palm nuts and sell them to the oil factories in the area. The factories pay a very low 22 Makuta per 35 kilogram basket. If the farmer processes his own oil, he can then sell the much smaller kernel of the palm nut for only 2.5 Makuta per kilo. It is quite possible that the palm nut could play a very important role as a high quality fish food in the area. At the same time, since the used fibers of the nut have absolutely no market value at all, they could perhaps be used as a form of fertilizer for the ponds. Experimentation will have to be carried out in the near future. There are approximately 15 palm oil factories in Gungu Zone, which indicates the quantity of nuts available.

What small amount of agricultural produce used as fish food in the past has been restricted almost solely to manioc leaves. Unfortunately manioc leaves are not very nutritious resulting in an anemic conversion rate of 16:1 kilograms of manioc leaves to kilograms of produced fish, while reasonably good feed would result in from 5-8:1. Since the population also eats the manioc leaves, it seems much more practical to reserve them for human consumption than to feed them to the fish. Manioc is of additional concern to the inland fisheries program in that the villagers ferment (detoxify) the manioc in fish ponds thereby jeopardizing the fish.

4. Geography. The climate in Gungu is seasonal and highly variable: the main dry season lasts from May until October with another shorter dry season during March; the rainy season lasts from October to March, and again between the dry seasons. Needless to say, the rainy season is a concern because too much water can destroy a fish pond or keep an extension worker away from the farmers, and a dry season can result in dried up ponds and wasted fish.

Gungu Zone is an area of savannahs punctuated by river valley forests

known as "gallery forests." The forests are at times thick and at times very sparse. Many of the streams and rivers flow across the savannahs through very gradual valleys with little vegetation. It was in these valleys where the fish ponds were constructed under the colonial administration. The most critical geographical consideration for the zone is the quality of the soil which is sandy throughout except in the larger valleys around Kandale and Kilembe. In some areas the savannah is a virtual desert as a result of annual brush burnings and no soil conservation measures.

E. SOCIOLOGICAL ASPECTS. The population of Gungu Zone is poor. They eat manioc, millet and maize fufus rarely accompanied by higher quality food. They live in bamboo houses, at times plastered with mud, notably around Kilembe and Kandale. They have very little money to spend, as evidenced by the glaring lack of commercialization in the area.

The chiefs of the groupements and localities are hereditary, but their power has waned in the last twenty years and is now minimal. The Mouvement Populaire de la Revolution (MPR) is certainly the strongest institution in the zone, being supervised at the local level by the chiefs of the collectivities and other party leaders. Two of the current concerns of the MPR at the local level are "Salongo"--community labor, especially on Saturdays; and authenticite--based upon some of the more generalized traditions of Zaire and Africa.

The population is concentrated in localities dispersed more or less evenly throughout the zone. One travels for kilometers without seeing a farm or a house; a small town occasionally crops up and then again nothing. Only the Kandale, Kilembe, Mukedi areas are more densely populated. Such long distances between small centers of population make concentrated extension work difficult. The people, especially the women, are ambitious enough to engage in new activities, especially those which promise revenue. The men spend most of their time in revenue producing activities such as cutting fruit and tapping palm wine. They also engage in political and social activities. The women are certainly the backbone of the agricultural economy, although the "farmers" are becoming important. Both men and women engage in fish farming. The men clear the land, while the women make the dikes. The men are in charge of management and fish sales, while the women are in charge of harvesting and preparing the fish for food. This, of course, varies from individual to individual: in some places the men handle everything, although rarely, and in other places the women handle everything, especially when the fish produced are eaten by the family.

The people throughout the zone seem very receptive and friendly to guests and strangers, including whites. They are a very social people who like to talk, dance and play instruments. The government representatives in all the collectivities are great hosts, and in general very friendly and easy-going people. Foreigners are considered an attraction in the area, not an object of either antipathy or deification. If they are

outgoing, they will be included readily in community social life.

Depending upon the collectivity, the population's first language varies. The lingua franca is Kikongo, although French is spoken at the administrative level. Any extension worker would have to learn Kikongo. Although some of the farmers do not speak it, all can comprehend it.

F. DEVELOPMENTAL ASPECTS. Roads in the zone range from bad to fair: none are hardtop, and none are maintained by heavy equipment. However, most are sand, and are therefore not particularly bumpy or dusty during the dry season, or muddy during the rainy season. The real bush roads are the best because they are .arely used. Assuming a heavy duty vehicle, all except forest roads are passable at all times. because one can usually make a parallel road if necessary. Motorcycling would be a tiring and slow means of transportation because of the deep sand. No collectivity is more than 90 kilometers from the headquarters of the zone, Gungu. The purchase of material goods in the zone is difficult. In Gungu there are ten small shops, and in the headquarters of each collectivity there are from one to half a dozen small shops, in addition to which there is very little commercial enterprise. Unlike West Africa, there are no elaborate markets where traders come to sell their goods, although some of the collectivities have a weekly manioc, maize and millet market for the traders that come from Kikwit. In Gungu there are a couple of "buvettes" with record players for night life, and in a few of the collectivities the chiefs have their own personal "buvettes", which are very often sold out of beer. In short, there is really very little or no commercialized social life.

Almost all of the chiefs of the collectivities said that they could find housing for Volunteers. In general, this housing would be appropriate: small cement or plastered mud houses with cement floors, windows, zinc roofs, no running water and no electricity. There are missions dispersed throughout the zone, many of which could probably offer Volunteers housing of a higher quality, but in a totally nontraditional, and religious environment: probably not what a Volunteer is looking for. The chiefs of Kandale, Kobo, Kilembe, Mulikalunga, Kisunzu, and Lukamba, all had good housing to offer.

There are dispensaries in the headquarters of each collectivity, only one hospital with one doctor in Gungu. At some of the missions there are additional medical facilites and personnel. Emergency communications from the collectivities is in all cases difficult, unless a Volunteer is stationed near a mission which has a radio.

G. EVALUATION OF INLAND FISHERIES DEVELOPMENT POTENTIAL

1. Positive Aspects. Gungu Zone has a great need for an inland fisheries program. The officials in the area want to work with Peace Corps in establishing such a program. The agricultural personnel cadre is appropriate for a firm Peace Corps "plug in" and there are more than enough counterpart possibilities. OXFAM is highly interested in the

development of this poor zone, and would therefore probably be willing to supply all the necessary materials. A number of fish ponds already exist. With Volunteer technical advice, these could be renovated and started upon a program of real fish farming. The people are friendly and receptive.

2. Negative Aspects. A Volunteer would necessarily be located quite a distance, over very sandy roads from most of the fish ponds in the collectivity. Because there are no population centers except Gungu, he would be located in a small village which offered few diversions and few material goods. He would be confronted immediately with three very serious technical problems: barren sandy soil, sterile water, and no immediate source of good fish food. Because of the great distances between localities, what the Volunteer would be able to develop with a few selected farmers during his two years might have no multiplier effect.

3. Summary. Given both positive and negative aspects, perhaps a program could be started with very good Volunteers (and that would be the key) which would be a great success, but there are a number of problems which could possibly preclude such a success. This being the case, Peace Corps should look for an area where there is a greater chance of success, and then perhaps in the future, after becoming accustomed to fisheries development in Zaire, Peace Corps can expand into Gungu Zone.

4. Interim Recommendation. In the meantime, Peace Corps can definitely become involved in the area in a more general way. Perhaps the answer is to get a team of general agriculturists in the area--one per collectivity to serve as agricultural extension workers and development catalysts, advising the farmers on new methods of agricultural production, working with governmental agricultural agents, and generally injecting new ideas into the agriculture program at the grassroots level.

IV. FESHI ZONE

A. GENERAL. Feshi Zone is located just southeast of Kwilu Sub-Region. It is one of five zones in the Kwango Sub-Region. Its population is 103,000 (half that of Gungu) while its area is approximately 25,000 sq km. The headquarters of the zone is the town of Feshi, located over 200 kms. from both Kikwit and Gungu. The zone is subdivided into the following four collectivities:

Collectivity	Population
Mukoso	27,900
Lobo	22,500
Nganaketi	22,300
Maziamo	30,000

B. STAFF AND MATERIAL SUPPORT. The situation here in terms of the governmental cadre is the same as that of the Gungu Zone. There are a good number of agricultural workers who want to start agricultural programs, but have absolutely no material support. The agronomist of the zone has an OXFAM-donated Landrover, but an insufficient government gasoline allowance. Specific staff positioning follows:

Collectivity	# Agronomists	# Agents
Mukoso	1	7
Lobo	1	10
Nganaketi	1	10
Maziamo	2	15
TOTALS	5	42

C. HISTORY OF FISHERIES DEVELOPMENT. The history of the program here, although less intense, is in many respects the same as that of Gungu Zone, and resulted in the construction of 9,142 ponds totaling an area of 263 hectares. The first distinguishing feature is that Feshi Zone has not just sandy soil, but rather, is a veritable desert of white sand covered by an annually diminishing crop of low quality grass. Because of this desert-like condition, the colonial administration was very limited in its choices for fish farming sites. Second, Feshi Zone was chosen as the site for the construction in 1948 of the most important fingerling reproduction and distribution center in Bandundu Region, the Centre d'Alevinage Principal (CAP), located at Kianza in Mukoso Collectivity. CAP consisted of 13 ponds for fingerling operations (total area of 45 acres), 16 experimental ponds (total area of 51 acres), and three large barrage ponds (total of 5.7 hectares). Unfortunately, no production or transaction records are available. The massive deterioration of the station since that time is due to a number of factors: the station was constructed in a very sandy area; all the ponds are porous; some have large holes; the water is very sterile; and the water system needs to be repaired. There is presently no program of fingerling reproduction and distribution at the station, the last fingerling having been distributed in 1970. However, the government still employs eight full-time workers and agents to "maintain" the station. They live in some dilapidated but reparable cement houses bordering on the station. There is absolutely no equipment on the station--not even one net or bucket. CAP is under the control of the Agronomist of Mukoso Collectivity, who very much wants to reactivate a program of fingerling reproduction here. However, he lacks material support for such a program. In addition, CAP is located over 80 kilometers from Gungu and over 150

kilometers from the town of Feshi. Although there are a few private ponds close by, CAP is actually in the middle of a very sandy "no man's land". Even if the station could be restored, which would not be easy, the logistic barriers to fingerling distribution make the project unreasonable. CAP, it seems, was a prestige project for the very poor Feshi Zone. The colonial administration made an investment in a needy area without paying sufficient attention to practical realities. It is very difficult to envision how the station, as an operational center, could be functional in a practical, grassroots inland fisheries program. Specific fisheries statistics follow.

Collectivity	# Functional Ponds	Area Hectares	# Abandoned Ponds	Area Hectares
Maziamo	1,708	66	1,688	22
Nganaketi	2,205	89	337	8
Lobo	1,012	41	1,083	7
Mukoso	509	28	736	7

Fifteen governmental barrage ponds for fingerling reproduction were also constructed throughout the zone. All of these have been abandoned and appear to have been improperly constructed in the beginning.

D. - F. OTHER SECTIONS. Refer to Gungu Zone. Feshi is very much like Gungu, except that all the bad points of Gungu are even worse here: 1) great need for inland fisheries program; 2) small supply and high demand for fresh fish; 3) undiversified agricultural production; 4) very poor quality agricultural production; 5) extremely sandy and sterile soil; 6) very sterile water; 7) very poor population; 8) almost no commercialization of produce; and 9) very great distances between small population centers (localities).

G. EVALUATION. For the same, but more intensified, reasons as those cited for Gungu Zone, Peace Corps should not make its initial effort in inland fisheries development here, but it should certainly take steps to find ways to make a significant input toward the development of this very depressed zone.

V. BULUNGU ZONE AND KIKWIT SUB-REGION.

A. GENERAL. Bulungu Zone is the most important zone in Kwilu Sub-Region with a population of 387,000 inhabitants, 18,000 of which live in the zone and sub-region headquarters at Bulungu. Kikwit, with a population of 112,000, is the largest city in Bandundu Region. Although it is geographically located in the center of Bulungu Zone, it is administered as an autonomous sub-region because of its importance. The area is located approximately 500 kms. east of Kinshasa.

The administrative breakdown of the area is the following.

Bulungu Zone

Collectivity	Population	# Groupements	# Localities
Imbongo	26,500	11	104
Nkara	38,000	14	160
Kipuka	15,000	11	185
Nko	19,000	6	100 +
Kwenge	23,000	10	122
Kwilu	59,000	19	86
Due	48,000	13	74
Mikwi	35,500	10	62
Luniungu	46,000	17	143
Kilunda	60,000	10	90

Kikwit Sub-Region

Zone	Population	# Collectivities
Lukolela	22,000	3
Nzinda	23,000	4
Kazamba	15,000	4
Lukemi	45,000	6

The area of the zone is approximately 15,000 sq. kms. making its population density more than twice that of Gungu Zone.

B. STAFF AND MATERIAL SUPPORT. Like the other zones, Bulungu Zone has a large staff of 104 agricultural officials and extension workers. There is no material support for the operation of these men, although some of the agricultural agents do work fairly closely with the villagers and farmers. There are an additional 40 to 50 agricultural staff in Kikwit, but most of their time is devoted to the organization and supervision of "Salongo". The theoretical work-related responsibility of all the agricultural staff is the same as that of Gungu Zone. Despite their unhappiness about lack of support for agricultural programs, the

agricultural officials in the zone are enthusiastic about the input that Peace Corps Volunteers could make in their agricultural operations, especially if the Volunteers had the materials necessary to activate agricultural development.

Probably because Bulungu Zone is not as needy as the Gungu and Feshi Zones, the chiefs of the collectivities were slightly less enthusiastic about an inland fisheries development program. Unlike the other zones, the chiefs of Bulungu all had some sort of transport, usually at least one lorry, for governmental work in the individual collectivities.

A more specific breakdown of staff related to inland fisheries development follows:

Chief		# Agronomists	# Offices	# Workers	# Agents
Bulungu Zone		2	4	9	7
Imbongo	Citizen Kulungisa	1	-	-	8
Nkara	Citizen Ilonga	1	-	-	6
Due	Citizen Nsenge	1	-	-	6
Kwilu	Citizen Nkulumbanda	-	-	-	10
Mikwi	Citizen Kanikani	-	-	-	6
Kilunda	Citizen Kimbudi	-	-	-	5
Luniungu	Citizen Gibadi	1	-	-	6
Nko	Citizen Kongo	-	-	-	9
Kwenge	Citizen Bulamatadi	-	-	-	12
Kipuka	Citizen Kimbila	2	-	-	8
Kikwit Sub-Region		1	6	-	40 +

Government Personnel

Commissioner and Agronomist of the Kwilu Sub-Region
Commissioner of the Zone of Bulungu: Citizen Nyme
Commissioner of the Kikwit Sub-Region: Citizen Kity
Agronomist of the Zone of Bulungu: Citizen Kawadiko
Agronomist of the Kikwit Sub-Region: Citizen Makongo
Agronomists of Post: Mayungu (Luniungu), Bafikele (Bilili), Monshe (Kwilu), Kayembe (Kipuke), Ndombe (Imbongo)

Non-government Personnel

Director of EDAR: Citizen Lakubu
Associate Director of EDAR: Citizen Ngamba
Agronomist EDAR: Citizen Kiniandhi
AIDR: Mr. Valendoc (Mr. Werner Cornelis is AIDR Director in Kinshasa)
Director of PPA: Mr. Peter Kroecker
Catholic Mission: Pere Charles and Abbe Nguya
Agronomist and Director of Agriculture, Vanga Hospital: Mr. Gene Gentry
Director of the Rice Project
The OXFAM Team

Virtually all of the above men and women agreed that an inland fisheries program in Bulungu Zone was needed and could work. The governmental officials have offered the services of their agricultural agents to work closely with the Volunteers in all the collectivities. The agronomist of Kikwit has offered from one to four agents to work exclusively with a Volunteer that might be stationed in Kikwit. He himself would like to work full time with a Volunteer. Thus, the personnel situation is conducive to the establishment of a program. OXFAM has also made it clear that Bulungu Zone merits high priority for the allocation of its resources, so that the necessary material support which is presently non-existent will quite probably be supplied by OXFAM.

C. HISTORY OF FISHERIES DEVELOPMENT. In general the history of fisheries development in this zone is similar to that of Gungu: it started in the 1950's with governmentally-imposed fish ponds, production was not very good, the ponds were abandoned after independence, and individual ponds were rebuilt as private enterprise during the 1960's. The difference is that in this zone, the number of ponds reconstructed on an individual basis was much higher. According to the records of the present agricultural agents, over 40,000 ponds, with a total area of almost 1,000 hectares, now exist there. Most of the ponds are found in the river valleys, which are generally heavily forested, but which have occasional clearings for pond sites. The ponds are usually in small, terraced complexes of from five to fifteen ponds, located in the stream beds themselves, sometimes being bypassed by a constructed water channel. The soil in these ponds has a good clay content making the ponds water-retentive, although in most cases the farmers allow water to run through the ponds. At times, when the ponds are not "well-maintained", the water remains stagnant and builds up a very encouraging phytoplankton "bloom".

In general, the ponds are poorly constructed with no drainage apparatus and no water control devices. At times the ponds are in reality bodies of water perhaps six inches deep divided by quickly constructed small dikes, filled with trees and tree stumps, and virtually impossible to drain since the water level outside the ponds is the same as inside. Thus, many of the ponds included in the statistics would be very difficult to renovate or manage. However, quite a few of the ponds are already

fairly well constructed, and other could be renovated. Usually "farmers" own the small complexes of ponds which are operational fish farms. Their management programs are practically non-existent, except that they produce fish for sale and to eat on an annual basis. A few farmers stated that they have produced from one to five 200 liter drums of fish per year.

Those few farmers that feed the fish use manioc leaves and occasionally other wastes such as palm kernel fibers and root skins. The concept of fertilizing fish ponds to build up the natural food content, however, is unknown to anyone, including any of the agricultural workers or expatriates in the area.

There are several reasons that so many people in the area have constructed fish ponds. First, there are more available sites (available sources of water) here than in the other zones. Second, the people in this area are reputedly particularly enterprising. Third, other organizations, especially the Catholic Mission, have maintained ponds in the area since the early 1950's and have had some degree of success with them. For example, at the SOA Mission in Kipuka Collectivity, Père Charles had a number of ponds, one of which produced over a thousand kilos per hectare per year in the early 1960's. He fed the pond a few times per week with manioc leaves and assorted wastes. Since the wars of the 60's, however, most of these mission ponds have been neglected. More recently, AIDR, in cooperation with the Catholic Mission, stocked 2,500 tilapia from Bas Zaire in the mission fish pond at Kinzambi. Vanga Hospital is highly interested in promoting grassroots fish culture to fight the protein deficiency prevalent throughout the zone. PPA is building six demonstration production ponds. The Centre de Développement at Djuma is also very interested in establishing a program of fish farming.

Most of the government-inspired ponds in the collectivities have been abandoned, although they can be renovated. In bulungu, there is no station equivalent to the CAP. However, there are twelve modest governmental ponds in the Nzinda Valley in the Kikwit Sub-Region about five kilometers from the city and one kilometer from the airport. These ponds were constructed in the 1950's, and although the government has no management program or plans for these ponds, they are kept very clean and filled with water and fish. As a matter of fact, the government directs the work of 24 workers toward the maintenance of these ponds which have a total area of only 78 acres. The agronomist of the sub-region in Kikwit has assured Peace Corps that if a program is started, he will give the Volunteers full supervision of the Nzinda ponds, with all requested labor and official support, although funds for the pond renovation will have to be found elsewhere. More specific statistical information follows.

Bulungu Zone Pond Type	# Ponds	Area (Hectares)
Villagers	35,354	667
Farmers	8,957	307
Collectivity	11	2
State	32	3
Societies (Factories)	6	3
Missions	11	22
Kikwit Sub-Region		
Villagers/Farmers	495	4.54
State	14	.93

Only limited statistics for individual collectivities were available. They are as follows.

Collectivity	# Villagers Ponds	Area	# Farmers Ponds	Area
Imbongo	2,300	24	400	4
Luniunga	5,060	122	1,688	50
Kilunda	3,907	77	1,574	44
Mikwi	3,346	60	1,067	21

More generally, there are a good number of ponds throughout the zone, about an equal density of ponds in each collectivity, and a high concentration of ponds around Bulungu and Kikwit.

D. ASPECTS OF INLAND FISHERIES DEVELOPMENT.

1. Need. The people of Bulungu Zone are in general richer than their counterparts in Gungu and Feshi Zones. Their agricultural output is greater and more diversified. Their houses are more durable, and the communities are more commercialized. Nevertheless, their diet is as starchy and as lacking in protein as that of the people in the Kwilu Sub-Region. As noted, in the Sub-Region of Kwilu, the population produces only 32% of the protein it needs. Although substantially better off than the population in the south, the people of Bulungu are by no means rich, and need a new source of revenue at the grassroots level. A fisheries program would provide both new sources of revenue and pro-

tein for the villagers and farmers.

2. Fish Supply and Demand. This aspect is virtually the same as that of Gungu Zone: very high demand with a limited and expensive supply.

3. Agricultural Situation. The people of Bulungu produce primarily the staples manioc and maize, plus peanuts, rice and assorted legumes. Almost all of the villagers have small animals and some even raise cows, but they rarely eat what is produced. The greatest source of revenue for the villagers and farmers is the sale of palm nuts to the many factories in the area. The per kilo price they receive is the same as in Gungu. Almost all farmers have palm nut trees and sell to the factories, although some of the more industrious farmers have started their own small scale palm oil processing operations. Because of the ubiquity of the palm nut tree in this zone, it would be an ideal source of fish food. The palm nut kernel, which is apparently a highly nutritious substance, could indirectly be more revenue-producing as a fish food than directly as a "for sale" item at 2.5 Makuta per kilo. Almost certainly, a sort of fish food could be made by each farmer which would give a conversion rate of less than 10:1 and therefore less than 25 Makuta per kilo of fish, which sell at the rate of at least 50 Makuta per kilo. In addition, those farmers who have their own small scale oil producing schemes could feed the palm nut fibers to their fish, since the fibers still contain a bit of oil and nourishing substance. Thus, there are probably several possibilities for tying together the palm nut and fish culture. Also, we should not overlook the limited but first-rate natural fertilizer for the fish ponds produced by the domestic animals in the area.

4. Geography. The climate in this area is the same as that in Gungu, although the topography and soil are different. There are fewer savannah areas and more forest valleys in Bulungu Zone. The savannahs, although sandy, have a greater clay content than the white sands of the south. Most of the stream and river valleys are thickly forested, sometimes making it very difficult to construct well-cleared fish ponds. The soil in these valleys, however, is relatively fertile and holds water. In the southern areas of Kipuka, Kwenge and Imbongo, the geography becomes a bit more like Gungu, with very sandy savannahs, not as much vegetation, and fewer good sites for fish pond construction.

E. SOCIOLOGICAL ASPECTS. Th sociological situation here is generally comparable to that in Gungu Zone, with the difference that the people in this more forested area are allegedly more industrious, but somewhat less friendly to strangers, although once a person is known in the village he is warmly received by the people. The two population centers geographically inside the zone, Bulungu and Kikwit, have had a westernizing influence. In any case, the people are very social, and are very friendly once they understand that a person is well-motivated, whether or not he is foreign.

F. DEVELOPMENTAL ASPECTS. The roads in the area are quite bad and at times even worse than those in the other zones, because they are constantly used but not maintained. Kikwit is located 100 kms. south of Bulungu, and none of the ten collectivities is located more than 50 kms. from one or the other of the two major towns, so that the zone is pretty well tied together.

Although there are areas where one can go es without seeing a house or a village, this is much less common than in the south. In this zone, along most of the roads, the common interval between villages is a few kilometers. Consequently, concentrated extension work on a motorcycle is quite feasible.

Most of the collectivities have a number of small shops, where one can purchase basic canned goods, cloth and odds and ends. None of the collectivities are too far from the commercial centers of Bulungu and Kikwit, where one can purchase anything from the basics to fresh bleu cheese and Sony tapedecks. There is little social life in the collectivities, although each boasts a number of "buvettes", which are certainly the centers of social activity in the evening.

Housing in the collectivities is a problem. The chiefs of Mikwi, Kilunda, Nko, and Imbongo said that they would probably be able to obtain durable housing for a Volunteer, whereas the others were at best indefinite. Perhaps the answer is to look for quarters in Bulungu and Kikwit, to which six of the ten collectivities are adjacent. There are a number of good hospitals in the zone, and at least one dispensary in each headquarters of each collectivity. Emergency communication is possible only via mission radios.

G. EVALUATION. Bulungu Zone and Kikwit Sub-Region are ready for a Peace Corps program of inland fisheries development for the following reasons:

1. The government officials and people are very receptive to the idea of a Volunteer program in inland fisheries development.
2. The area needs supplementary sources of protein and agricultural revenue.
3. The present fisheries situation--many private ponds which are improperly constructed and managed--is one in which Peace Corps Volunteers can make a valuable contribution.
4. The government fish ponds in the Nzinda Valley are a suitable site for the introduction, reproduction and distribution of appropriate species of fish.
5. The government personnel structure is such that the PCV's could be well "plugged into" the government operation in order to better ensure a successful "phase out" of Peace Corps operations.
6. The government has offered adequate counterpart personnel.
7. The people are relatively industrious.
8. There are feasible solutions to the problems of fish food, both supplementary and natural.

9. The area is not so remote that the Volunteers would be totally isolated from commercial centers and more westernized social activities.
10. OXFAM has indicated that development of inland fisheries in the Bulungu Zone will be given high priority in the allocation of its resources.

VI. RECOMMENDATIONS.

1. PEACE CORPS SHOULD POSTPONE ANY INLAND FISHERIES DEVELOPMENT PROGRAM IN GUNGU ZONE.

2. PEACE CORPS SHOULD POSTPONE ANY INLAND FISHERIES DEVELOPMENT PROGRAM IN FESHI ZONE.

3. PEACE CORPS SHOULD TAKE STEPS TO ESTABLISH A CONCENTRATED PROGRAM OF INLAND FISHERIES DEVELOPMENT IN THE BULUNGU ZONE AND KIKWIT SUBREGION.

4. PEACE CORPS SHOULD CAREFULLY EXPLORE GUNGU AND FESHI ZONES TO DETERMINE EXACTLY HOW IT CAN MAKE A DEVELOPMENTAL INPUT, IN TERMS OF AGRICULTURAL PRODUCTION, THE RAISING OF ANIMALS, OR GENERAL COMMUNITY DEVELOPMENT.

5. PEACE CORPS AND OXFAM SHOULD COOPERATE IN THE ESTABLISHMENT OF THE FISHERIES PROGRAM IN THE BULUNGU ZONE.

6. BEFORE THE FISHERIES PROGRAM IS FINALIZED, THE GOVERNMENT OF ZAIRE SHOULD FORMALLY AGREE TO SUPPLY ALL HOUSING, TO AUTHORIZE ANY COUNTERPARTS DEEMED NECESSARY FOR THE VOLUNTEERS, AND TO TURN OVER MANAGEMENT OF ALL GOVERNMENT FISH PONDS IN THE ZONE.

7. ALL SOURCES OF MATERIAL SUPPORT FOR THIS PROGRAM SHOULD BE EXPLORED, SUCH AS THE U.S. SELF HELP FUND, USAID, AND OTHER SOURCES OF FOREIGN AID.

8. ALL VOLUNTEERS FOR THE FISHERIES PROGRAM SHOULD BE TRAINED UNDER THE SUPERVISION OF DR. H. P. CLEMENS OF THE UNIVERSITY OF OKLAHOMA.

PEACE CORPS FISHERIES PROGRAM OVERVIEW

A. History and Description of Intensive Fisheries

Notable Former Programs -- in Togo

Early in the 1960's, the Peace Corps was requested to establish its first intensive fishculture program in Togo. Unfortunately, staff inexperience regarding Volunteer training requirements and insufficient communication with the Togolese Government regarding Volunteer employment apparently caused the failure of the first two intensive fishculture projects attempted there.

By the mid-1960's, the difficulties seemed to have been worked out and Volunteers were working at five sites in the country. In Dapango, the emphasis was on river fishing, renovating the old fish station and training host country nationals as counterparts to succeed the Volunteers. The annual yield at the Dapango Fish Station increased from 1000 kg./ha. to approximately 15,000 kg./ha. (13, p. 60). At the Sokode Fish Station, Volunteers worked with Togolese officials, raising fish and training the officials as fisheries administrators. Volunteers at Kpewa were charged with constructing a relatively large fish culture station. At Atakpame and Sodo, Volunteers were involved primarily in extension work.

Unfortunately, the later intensive fishculture projects in Togo also suffered from significant problems. Finding and training counterparts was extremely difficult; Volunteers were frustrated in their attempts to work with the local Government; the problem of repeated disappearance of appreciable quantities of fish from the Fish Stations was not remedied. In light of these difficulties, Peace Corps ceased intensive fishculture efforts in Togo in 1968. Nonetheless, the Togo program did set and partially achieve positive goals: Government Fish Stations were constructed and renovated in order to increase yields; the Togolese saw that fish can be raised in their waters by popularizing fish farming at a local level, through the use of demonstration ponds and assignment of advisors and teachers to villages; and Togolese skills in fisheries techniques were improved.

-- in India

Since 1970, more than twenty Volunteers have worked in intensive fishculture programs in the states of Rajasthan, Madhya Pradesh and more recently in Andhra Pradesh. Assignment of Volunteers to fisheries programs ceased when the Peace Corps withdraw from India in 1976. (87)

By 1973, Volunteers had taught or trained 200 local counterparts (79). Progress was made in the reservoir management program in Rajasthan and in the Madhya Pradesh program on fish culture. However, Volunteers in India worked primarily in extension programs and the results of their efforts are, therefore, difficult to measure.

Present Intensive Fishculture Programs -- in Cameroon

The French Colonial Government introduced intensive fishculture in the former East Cameroon with results similar to those in Zaire (related in Calvert Hall's Feasibility Survey). Thus, it is not surprising that the first request for fisheries Volunteers came from the former West Cameroon; the first fisheries Volunteers were assigned to East Cameroon five years later.

Some of the Volunteers work at Government Fish Stations while other are stationed in villages in areas where interest in fishculture runs high. Volunteers at the stations are involved in construction and renovation of facilities, growing fish and fingerlings and training host country counterparts. They do less extension work than the Volunteers who are stationed in villages.

The accomplishments of Volunteers in Cameroon have been notable: more than 1000 farmers have received training in the techniques of pond management; 750 new fishponds have been constructed and 1000 ponds have been renovated; one new Government Fish Station has been built and another renovated. Moreover, the fish production in Cameroon has increased by 500% since their arrival (79).

These achievements are in line with the goals set by the Cameroon Government for the Peace Corps inland fisheries program. These goals are: to raise the national standard of living; to increase the amount of protein in the diets of the Cameroon populace; to increase fish production through better management practices and expansion of areas presently being "cultivated"; and to train Cameroon personnel as fisheries agents to work with fish farmers.

Peace Corps/Cameroon established slightly more specific goals. One set of goals pertains to eastern Cameroon: after two years of service (1976), Volunteers there are expected to have achieved an average production of 1000 kg./ha./yr. in existing ponds; to have renovated and established fish breeding stations as supportive units for local farmers; to have trained counterparts and progressive fish farmers in the basics of intensive fishculture; and to have generated a general public interest in fish farming. By the same time, Volunteers in western Cameroon are to have increased the geographic area practicing fish farming by 50%; to have helped organize fish farmers into a professional society; to have achieved an average production of 1500 kg./ha./yr. in existing ponds; and to have trained counterparts in the more sophisticated aspects of intensive fishculture.

-- in Central African Republic

The first group of five intensive fishculture Volunteers began work in 1974; these Volunteers and their successors have been involved principally in extension work, though they also do some work at the Boda Fish Station.

-- in Zaire

The first fisheries Volunteers arrived in 1973; they began renovation work at the Nzinda Government Fish Station. Most current Volunteers concentrate on extension work. The prime objective of this program is to prove to Zairian farmers that fishculture is economically and nutritionally desirable. The Volunteers are charged with creating a government infrastructure that can carry on intensive fishculture programs after Peace Corps has phased out and with changing old negative attitudes towards fishculture resulting primarily from experiences during the colonial period.

-- in Central and South America

There have been a number of relatively small fisheries programs in Ecuador, Colombia, Chile, El Salvador and Belize. Most of these projects have entailed work in cold water fisheries, where fish farming is capital-intensive. As a result, most of the Volunteers have been requested to concentrate on research rather than extension work. The specific nature of the research varies from such things as a fish marketing survey to an inventory of local fauna and cage culture of a particular species, but much of it is quite sophisticated.

-- in Nepal

The growing intensive fishculture program in Nepal is one of Peace Corps' strongest fisheries programs. The first pilot program there began in 1969 and the first full contingent of fisheries extension Volunteers followed in 1971. Since then, Volunteers have arrived there almost annually. Generally, Volunteers act as expediters of programs and conveyors of information, bringing new ideas and techniques in the areas of fisheries extension, nursery management and reservoir management. More specifically, Volunteers work on government fish farms, specializing in water management; they work on improving fish breeding techniques; they teach a highly technical course for counterparts, more than 1000 of whom have been taught or trained since 1970; and they are producing a nation-wide evaluation of fisheries program impacts.

-- in the Philippines

The inland fisheries program in the Philippines is one of the largest in which Peace Corps has ever participated. Volunteers work on a variety of projects including pond extension, regional economic planning, fisheries research and fingerling production. However, the majority of these Volunteers work in brackishwater rather than freshwater fishculture. The Volunteers have helped local officials coordinate implementation of nationally-set goals for fisheries; they have successfully encouraged government fisheries personnel to make regular visits to individual fish farms for extension purposes; and, as in other countries with Peace Corps fisheries programs, increased fish yields have been recorded on private and government fish farms where Volunteers have worked.

B. Other Areas of Fisheries Work

Several Peace Corps fisheries programs do not fit the definition of "intensive fishculture" set forth in this Manual. Brief descriptions of these programs follow.

Brackishwater Fishculture

As mentioned earlier, many Volunteers in the Philippines work in a brackishwater pond extension program. While the brackishwater and freshwater fisheries programs are similiar, important differences between the two kinds of fish culture should be noted. (1) Brackishwater ponds are located next to natural salt water bodies; they are filled and emptied by tidal movements. (2) The marine fish offspring that are raised in the brackishwater ponds are eaten by the growers or sold. Because marine fish do not breed in captivity new stocks must be obtained from natural breeding grounds near the shorelines. (3) The sources of food for brackishwater fish are different from those needed for freshwater fish. In the Philippines, the milkfish is raised in brackishwater ponds in much the same way as species of Tilapia and carp are raised in fresh warmwater ponds.

Warmwater Lake and River Fisheries

Peace Corps inland fisheries projects in naturally occurring warm freshwater inland fisheries involve research, catching and marketing of river fish, and such activities as working with the government officials to have large barrages (reservoirs and lakes) opened up to public seining so that larger amounts of this protein source will be available more rapidly.

Coldwater Inland Fisheries

The inland fisheries in Latin America are predominantly coldwater lake and stream fisheries where trout, salmon and other native species dominate. Chile has had fisheries development Volunteers periodically since 1966. Since then, Volunteers have (1) trained from 750 to 1000 fisheries counterparts; (2) assisted in the establishment of and overseen production at trout farms; (3) arranged to send Chilean University graduates and government fisheries personnel to graduate and post-graduate programs in their fields; and (4) aided in inland fisheries research such as water quality, fish population and feasibility studies.

Volunteers have served as extension workers and researchers in Ecuador and El Salvador inland fisheries.

Research and Planning Fisheries

In the Philippines, Volunteers have done production-oriented research in both marine and inland fisheries. They have concentrated on two main problem areas: (1) low productivity and declining yield of fish crops and (2) the lack of adequately trained host-country nationals qualified to

serve as fisheries personnel in various capacities. In the Philippines fisheries planning program Volunteers address themselves to the same issues as do the Volunteers doing research.

In Kenya, Volunteers are conducting a water quality study on Lake Nakuru and heading the research section of the Kenya Department of Fisheries station on Lake Baringo where a fish population dynamics study is underway.

In Lesotho, a Volunteer is presently doing research in mountain and highland pools on the environmental impact, especially upon the locally unique specie of fish, the Oreodaimon x, of introducing trout to such ponds for the purpose of game fishing.

Much of the research done by Volunteers in Brazil, Chile, Colombia, El Salvador and Guatemala is directed toward evaluating the potential for developing various kinds of fisheries, whether they are commercial, marine, pondculture, lakes and streams or fishing cooperatives. It is hoped that such research will lead to the development of a fish farming industry which could be a source of employment as well as food.

FISHERIES: TASKS AND PERSONNEL

About This Section

The preceding section briefly summarizes the goals and activities of intensive fishculture programs in countries where Peace Corps Volunteers work. This section concentrates on the tasks necessarily undertaken in attempting to meet the goals. While the job descriptions and task analyses reflect specific roles of Peace Corps Volunteers, they offer useful insights not only for Peace Corps recruiters, placement and and training officers, program planners and evaluators, but also fo. organizers of domestic volunteer programs and others interested in stimulating and/or developing intensive fishculture programs.

Following is a job description and task analysis of the skills requested by host countries desirous of Volunteers to work in fisheries, and the skills actually possessed by applicants for Peace Corps positions in inland fisheries programs. This knowledge will be useful not only for evaluating the feasibility of establishing or enlarging fisheries programs with available resources, but also for determining training needs. Furthermore, it is hoped that careful analyses of the varied tasks will encourage creative use of people with differing degrees of education and experience.

A. Job Description and Task Analyses

Cameroon

Volunteers' jobs can be broken down into seven major areas (68)

1. Survey existing fishing and fisheries facilities. Volunteers record data on the conditions, numbers and productivity of fish ponds and submit it to the government as a basis for measuring progress.

2. Help publicize intensive fishculture programs. Volunteers lead tours and give demonstrations to build both public and government enthusiasm in these programs.

3. Emphasize pond renovation and construction. Poor pond construction is the greatest obstacle to increased fish production. Volunteers check on ponds and give advice about improvements. They also give advice on site selection and planning of new fish ponds, and organize the actual work on the pond.

4. Determine the number and type of fingerlings to be stocked in fishponds. In Cameroon the chief specie is the Tilapia nilotica. In all but the northern provinces, fingerlings are stocked at breeding stations so Volunteers can spend more time on extension work. In the northern provinces, Volunteers may start with breeding and fingerling production.

5. Advise farmers on all aspects of pond management. This task entails frequent visits to private fishponds and often demonstrations especially on the subjects of feeding fish and fertilizing fishponds.

6. Assist in and demonstrate to fish farmers the techniques of harvesting fish. This involves showing farmers the most efficient methods of net cropping and stressing the importance of annual harvests.

7. Teach Cameroonian counterparts who will replace the Volunteers. Training counterparts is one of the most vital tasks of self-help projects. In order to ensure maximum counterpart perseverance after Volunteers depart, local government councils that pay the counterparts are informed of program progress so that they gain a greater sense of counterpart value. It is hoped that this will result in minimumization of counterpart transfers to other program after the Volunteers leave.

Though the specific tasks performed by Volunteers vary, the following table indicates fairly accurately the amount of time that is spent on various tasks.

AVERAGE WORK WEEK TIME BREAKDOWN IN CAMEROON IN 1975 (68).

20 hours/week at breeding station
- 5 hrs/wk - working with fish
- 10 hrs/wk - renovation, construction, supervising labor
- 5 hrs/wk - making nets & procuring equipment for station

20 hours/week extension work with farmers

- 10 hrs/wk - travelling
- 5 hrs/wk - inspecting & advising farmers on ponds
- 5 hrs/wk - socializing with farmers - a cultural prerequisite

15-20 hours/week community relations & obligations; meet with government officials

Following is a task analysis of the intensive fishculture work performed by Volunteers in Cameroon. These tasks are not ranked in order of importance, but the frequency with which they are performed is as good an indicator as any of relative importance of a task to intensive fishculture development. Additionally, the task analysis briefly describes the knowledge or skills that a Volunteer must possess in order to satisfactorily carry out each task.

TABLE 2

TASK ANALYSIS OF CAMEROON INTENSIVE FISHCULTURE PROGRAM*

TASKS	KNOWLEDGE/SKILLS NEEDED	FREQUENCY
Keeping yourself and the farmers interested in fish culture as source of additional food and/or money.	Full technical knowledge of all following points, ability to explain in French and ability to maintain enthusiasm in the face of all difficulties.	All the time - #1 job.
Dealing with local counterparts	Relationship between PCV and counterpart; education, family and ethnic background of counterpart; sensitivity to counterparts skills, interests and working relationships and how they are best employed.	Every day.
Doing extension work.	Effective extension work tactics: to approach, learn from and convince local farmers.	Daily.
Pond management.	Factors that are important for a productive pond - water, vegetation, fertilization, feeding, stocking, harvesting, life signs of a healthy fish, etc.	Every 2-3 days.
Detecting signs of disease and stress early enough to prevent large losses.	Disease symptoms and signs of stress and how these can be treated or alleviated.	Daily.
Distinguishing between tilapia nilotica and tilipia zilei.	The distinguishing body markings and gill rakers of each species.	Daily.
Working within governmental structure.	Understanding government structure on national, provincial and local levels. How and where PCV fits in the structure and how to work within it.	Daily.
Keeping daily log and writing reports to proper authorities.	Items worth noting for good fish culture management, extension work and planning. Importance of keeping authorities informed properly in French.	Daily.

TASKS	KNOWLEDGE/SKILLS NEEDED	FREQUENCY
Doing job with inadequate materials and/or support.	Imagination, self-initiative, creativity, flexibility and patience.	Daily.
Using existing institutions such as cooperatives, local stores, credit unions, banks, post office, etc., advantageously.	Existing institutions, who is in charge of them, how they could provide support.	Daily.
Establishing professional credibility.	Ability to explain in French and demonstrate with visual aids, texts, etc., basic understanding of fish culture.	Every day.
Using local language greetings and gestures with local leaders and farmers.	Local languages and gestures used in your area, how and when to use them.	Daily.
Assessing material needs of your area: i.e., extension equipment, counterpart transportation, fish station needs.	Equipment needed for fish extension work and effective functioning of a fish station.	Daily during first two months.
Getting to know your area through site surveys.	Questions one needs to ask, protocol expected by local officials, how best to approach farmers, where to stay and eat, how long to stay, who to talk to for objective information.	Once every 3-5 days for first 2-3 months.
Selecting good sites for local farmer fish ponds.	Basic surveying skills to measure slope; ability to do simple soil analysis and identify sources/ quality of water, vegetation and drainage; how to find out about abondoned ponds.	Weekly.
Developing fish culture in a rain forest area.	Techniques for site selection, pond construction and pond management in jungle areas.	Varies with Volunteer site; can be daily.
Constructing or renovating a fish pond.	Ability to build or renovate ponds by hand, bulldozer or other methods and to construct drainage systems.	Varies frequently during full 2 yrs.

TASKS	KNOWLEDGE/SKILLS NEEDED	FREQUENCY
Doing construction work using cement and wood.	Sources of supplies, how to mix and pour cement, basic carpentry skills for building molds.	Weekly or monthly.
Using HACH kit.	How to test water quality with a HACH kit.	Weekly.
Repairing and maintaining motorcycle.	How the cycle operates, what its parts are, how to take it apart and put it back together.	Weekly.
Making short and long range plans for fish culture in your area.	Past experiences with fish farming in area (how and where to find out) what is local interest and what is the potential.	Monthly.
Transporting fish fingerlings alive from station to farmer's pond.	Techniques for handling fingerlings, materials available for fingerling transport, and time required.	Monthly.
Using fertilizers and manures.	Types of fertilizers and manures available, rates of application for best results.	Monthly.
Harvesting of tilapia, carp and mud fish.	Different techniques for harvesting.	Every 2-3 months.
Repairing damaged ponds.	Reasons for pond damage, cost factors and methods for repair.	Every 2-3 months.
Constructing netting materials and/or mending nets.	How to make and mend nets using available materials.	Varies.
Using road-dam technique to build ponds.	Road building techniques and how they can be adapted to raising a road to create a barrage pond.	Varies with Vol/site; can be once a month.
Meeting local officials to present papers and explaining Peace Corps presence, purpose, duties and objectives.	Who local govt. officials are, in what order they should be seen, ability to understand and explain oneself in French, presence and self-control.	Once, with follow-up.
Finding out existing govt. budget for fish culture in your area and to whom and how requests for further aid can/should be sent.	Who determines local budget, what govt. budget realities are and how to submit budget requests.	Once every 6 months.

TASKS	KNOWLEDGE/SKILLS NEEDED	FREQUENCY
Seeking foreign (non-Cameroonian govt.) aid.	Sources: how they can be used; how to make requests; potential problems.	Rarely.
Locating local fish food sources.	What non-commercial locally available material can be used for fish food.	Initially, with follow-up.
Starting a local fish culture coop society of farmers.	Nature of cooperatives, their potential value to local farmers and how to start one.	Varies with site.
Making contact and coordinating activities with local school agricultural programs.	Agricultural programs in local primary and secondary schools, who is responsible for them and what Volunteer could do to assist them.	Secondary activity, explore in 2-3 months.
Explaining the use, value and dangers of mixed cultures in fish farming.	Cultures that can be mixed (carp-tilapia; carp-clarius; tilapia-clarius), how to mix, advantages and disadvantages.	Varies.
Exploring value of enlisting women in fish production.	Role of women in your area in terms of marketing and providing food for the family.	Varies with site.

*Source: Peace Corps, "Task Analysis of PCV Fisheries Job in Cameroon." April, 1975, pp. 1-7

As indicated in the task analysis, promoting fishculture, selecting and training counterparts, doing extension work and mastering productive pond management techniques are the tasks receiving the most attention by Volunteers. Establishing rapport with government officials and with outside agencies is especially important in areas where the intensive fishculture programs have not yet proven their worth and therefore may still lack support. These tasks are in accordance with the Cameroonian Government's goals for the intensive fishculture program.

Central African Republic

The job of Volunteers in the C.A.R. is broken down into four basic categories. The first and most frequent job is extension work. The Volunteers make weekly visits to ponds and advise fish farmers on all aspects of pond management such as renovation, proper stocking rates, feeding, fertilizing and detecting and treating diseases of the pond populations. Volunteers are responsible for overseeing fingerling production and for selling the fingerlings to farmers as well as for selling mature fish to local counterparts. The training usually entails having counterparts work side-by-side with the Volunteers. Finally, Volunteers help publicize

the intensive fishculture program in order to alert the population to the merits of intensive fishculture. It is hoped that more people will attempt it, succeed at it, and serve as examples to others who have not yet tried it.

Togo

The responsibilities related to development project goal achievement frequently fall into two major categories: those that rely on technical skills and those of a public relations nature that are required for program promotion. Such was the case with the Togo fishculture program. The technical duties required that Volunteers know:

1. how to calculate the stocking rates of ponds;

2. how to choose from among the six species of Tilapia farmed in Togo the specie that most conformed to the following criteria for good stock fish: low reproduction rate, rapid growth rate, large minimum breeding size, and a high food conversion rate;

3. tne practical maximum holding capacity of ponds;

4. how to inject pituitary extract into Israeli carp to induce the fish to spawn;*

5. methods of feeding the fish, including how to secure both natural foods such as rice, bran, cottonseed and tsukutu wastes and manufactured products that had to be pressed into a form the fish would consume;

6. the percent, by weight, of the expected harvest of fish reproduced in the ponds during the growing season (Volunteers actually took part in stocking and transporting fish, handling the fish minimally yet enough to measure the number and weight of the fish being transported.).

7. harvesting and marketing techniques, including the size of fish desired when harvested, both in terms of minimum marketable size and most economically practical size.

At government fish stations, it was necessary to complete some of the following tasks during the course of any month: repairing crab holes in pond walls; removing dikes to combine small ponds into larger ones; sorting fish and restocking ponds; adding wire baskets to ponds to hold fertilizers added, such as manure or grass; fertilizing ponds with basic phosphate; conducting sample seining to observe fish size and to adjust feeding rates accordingly; building filters for pond inlets to

*Complete instructions for construction of a simple centrifuge that can be used to obtain hormone extract are available from the Peace Corps Information Collection and Exchange, Office of Multilateral and Special Programs.

minimize trash fish and predators; and doing extension work while training counterparts.

The following method of popularizing intensive fishculture was effectively employed (85, p. 7). Presumably a similiar popularization campaign could be conducted by extension workers elsewhere.

1. An area of the country where results can be most immediately observed was chosen for fisheries development.

2. A few ponds were built where fisheries workers were assigned as soon as fish in the first pond spawned.

3. A few trained monitors were chosen to accompany the "experts" visiting the ponds; the monitors pronounced as "successful" fish farming observed.

4. A few more ponds were built and stocked with the goal of rapid spawning so that other, potential fish farmers could see the progress.

5. Farmers were trained in additional aspects of intensive fishculture, such as feeding, fertilizing, disease and predator control programs, etc.

Zaire

The intensive fishculture program job entails six areas of concentration.

1. Identifying and working closely with farmers who show a willingness to participate in intensive fishculture development. Choosing farmers for such a program is a selective process: many express support for the program but few are actually willing to try it.

2. Identifying the best sites for pond construction. Selectivity is particularly important if the negative affects of past haphazard pond building programs are to be avoided.

3. Locating and experimenting with local sources of fish food. This job is complicated by instructing people about feeding fish when many of the people themselves are underfed and undernourished.

4. Working with Zairian counterparts who will assume the responsibilities of the Volunteers when the Volunteers leave.

5. Generating and maintaining a high level of governmental and other organizational interest and involvement in the intensive fishculture program.

6. Continually analyzing the intensive fishculture program - its goals, progress, strengths and weaknesses. These evaluations must then be communicated to others involved with similar programs.

Latin America

Research is the primary activity of fisheries Volunteers in El Salvador, Colombia and Ecuador. Research topics include: water quality; growth rates related to the feeding of crops to certain local species of fish; the raising of different species of Tilapia in cages, pond yield with different combinations of species of carp, Tilapia and indigenous species; food habits; and alternative methods of capturing fish.

India

The three primary areas of fishculture activity in India were extension work and both nursery and reservoir management. The extension work customarily began with surveying the state of local fishculture and making initial contacts with fish farmers. In addition to public relations efforts similiar to those in other countries, extension efforts included giving advice and aid regarding assessing fishpond productivity; proper stocking; fertilizing; feeding; controlling pond weed growth; maintaining equipment; and harvesting the fish crop upon maturation.

Nursery management at government fish stations required the breeding and rearing of either a few or many of the species of local commercial fish like carp or Tilapia. More specifically, this involved selective breeding, upgrading and streamlining methods of disease control, predator control, fertilization, fish handling in general, and in some stations artificial feeding of fish. Reservoir management entailed assessing reservoir fisheries, obtaining and analyzing production figures, improving harvesting and shipping methods, and maintenance and improvement of equipment. Research assessing the feasibility of the extension of fisheries reservoir management addressed such topics as: limnology, fish productivity, population, age and growth determinations, netting efficiency and harvesting methods.

Nepal

Fishculture responsibilities among Volunteers in Nepal can be broken down into nine general categories:

1. extension work
2. building new ponds
3. surveying existing pond sites
4. fish pond renovation
5. fish handling, including breeding, stocking and transporting
6. pond management
7. harvesting and marketing the fish crop
8. care of equipment
9. public relations, including dealing with both supervisors and other government officials, and establishing and maintaining rapport with local fish farmers.

The first eight task categories appear on the following task analysis; the ninth does not. Contacting and convincing farmers to use ponds for intensive fishculture consumes about one-third of an extension workers' time. Another third is spent trying to convince farmers of the merits

of feeding their fish and fertilizing their ponds, while the remaining third is spent on preparation and stocking of fishponds (65).

In the following task analysis, each task is numerically coded for importance, frequency and difficulty. (See the key for the code below.)

KEY

Degree of Importance:	Extremely = 1
	Moderately = 2
	Marginally = 3
Frequency of Performance:	Daily = 1
	Daily to weekly = 2
	Weekly to monthly = 3
	Occasionally = 4
	Seldom = 5
Learning Difficulty:	Extremely = 1
	Very = 2
	Moderately = 3
	Easy = 4

TABLE 3

NEPAL - INTENSIVE FISHCULTURE PROGRAM TASK ANALYSIS*

	Imp.	Freq.	Diff.
I. Extension work			
A. Utilization of resources			
1. Human - DADO, JTA's, FARM, Personnel Pradhan Panchs, PCV's	1	2	2-3
2. Records	1	2	4
a. Farm distribution records			
b. Pond surveys			
c. Land Reform Maps			
d. PCV reports			
3. Field trips (search & stock operations)			
B. Determine economic feasibility of fish culture considering: market demand, renovation or construction cost, total expenses, minimum income	1	2	2
C. Convince pond owners of the feasibility of fish culture using	1	2	2
1. pictures, pamphlets			
2. records of successful projects			
3. field trips to see other projects			

* Source: Peace Corps, "Task Analysis: Nepal 41 - Fisheries." pp. 1-12.

	Imp.	Freq.	Diff.
4. explanations of cost and profit 5. explanation of potential loans from government and other agencies.			
D. Help interested parties obtain use of ponds on a contracted basis from private owners, panchayats, etc. through public and private meetings and with help of other officials.	1	4	3
E. Prepare extension plans for area of responsibility, considering 1. transportation facilities and areas of prime propaganda value 2. time limitations 3. interest of farmers.	1	4	2
F. Maintain owner-JTA relationships by 1. Pond site visits and growth checks 2. Recording of fish growth through charts & records 3. General conversations 4. Bringing farmers to fish farms on individual or organized basis such as "Farmer's Day"	1	1	2
G. Develop and maintain working relationship with local government offices 1. District Agriculture Development Office: vehicles extension expertise, village contacts, JTA assistance, application of authority 2. Agriculture Development Bank: loans 3. Agriculture Marketing Corporation: supplies, waste materials for food 4. Minor Irrigation Dept.: use of facilities for ponds 5. Land Reform and Map Office: loans, maps of area	1	1	2-3
II. Building new ponds			
A. Site selection			
1. Determine adequacy & quality of water supply	1	4	2
2. Recognize suitable soil types for pond construction	1	4	2
3. Determine food/fertilizer/fingerling transport problems	2	4	3
4. Determine profitability of building pond	1	4	3
B. Surveying: use of hand level to determine slope of land	2	5	3
C. Construction plan 1. How will pond be built? a. depth, soil removal, excavation plan b. height & slope of banks, amount of soil to be used, plan for use of extra excavated soil c. location and type of inlet and outlet d. drainage plan	1	4	3

2. Cost Estimate a. amount usually earned from land b. labor costs c. inlet/outlet construction d. maintenance costs e. total expenditure vs. probable minimum income		1	4	3
D. Financing: preparation of cost estimate and technical recommendations for Agriculture Development Bank		2	5	4
E. Pond lay-out: placement of sticks & ropes to outline perimeter 1. length, height, crown, slope of dam 2. varying depths of soil excavation		1	4-5	3
III. Pond site survey				
A. Conduct area survey				
1. Plan systematic program to locate all ponds in survey area		1	4	3
2. Utilize resources to learn pond locations		1	2	4
3. Obtain or devise survey form for collection of desired information		1	4	3
4. Travel to all survey areas to collect information		1	2-3	2
5. Collect desired data, including a. pond size b. condition c. drying out/flooding probability d. Hach kit tests e. farmers' interest in raising fish f. water source		1	2	2-3
6. Compile material for office		1	4	4
7. Choose areas and specific ponds to use in extension work		1	4	3
IV. Fish Pond Renovation				
A. Identify physical characteristics of pond, e.g. faulty banks, predators, weeds, etc.		1	1-2	3
B. Repair banks to prevent flooding 1. Determine cost and amount of soil required for repair 2. Construct inlets and outlets		1	2-3	3
C. Instruct or direct farmers on maintenance and digging operations on pond		1-2	4	4
D. Remove or instruct farmers on removal of aquatic weeds: mechanical, chemical or biological removal		1	3	3

E.	Remove local fish population from ponds which are to be used for intensive fishculture 1. Poison ponds 2. Dry or instruct on draining ponds completely	0-1	1-2	2
F.	Apply or instruct on lime application 1. Determine pond pH 2. Apply proper amount of lime of pond if acidic	1-2	3	3
G.	Regulate or instruct on regulation of pond water supply	1	3	4
V.	Fish Handling			
A.	Stocking			
1.	Determine stocking rates based on pond size and condition, water supply and management program	1	2	2-3
2.	Determine stocking rates for grass, silver common and bighead carp	2	2	3
B.	Transportation			
1.	Properly remove, pack, and transport table fish or breed stock	3	5	3
a.	Pack fingerlings in plastic bags with oxygen and water	2	5	4
b.	Determine the number per bag according to distance, temperature, and mode of transport	1	3	3
C.	Breeding			
1.	Identify sexes of broodstock	2-3	5	1
2.	Properly care for broodstock a. handling b. feeding	2-3	5	3
3.	Separate broodstock by sex into different ponds	3	5	1
4.	Prepare pond for breeding	3	5	4
5.	Construct or provide a sufficient water supply (constant running water into breeding pond)	3	5	4
6.	Place or construct egg attachment substance (grass mats, natural grasses)	3	5	4
7.	Inject fish with hormones if necessary to promote successful breeding a. Determine stage of egg development within female fish b. Determine if fish has reached maturity or not	3	5	1
8.	At the proper time, place brood of fish of both sexes into the breeding pond. a. Time of day. b. Number of males as opposed to females	3	5	3
9.	Properly care for eggs, and fingerlings	3	4	3

		Imp.	Freq.	Diff.
VI.	**Pond Management**			
	(Includes all the worker's responsibilities after a pond is renovated or constructed and stocked until the time of harvesting.)			
A.	Sample fish populations	1	2	2
	1. Throw a cast net and catch a least 10% of the fish population, or pull a drag net to catch said amount			
B.	Keep accurate records of sampling	1	2	2-3
	1. Take length and breadth measurements			
	2. Compute total weight of live fish population			
	3. Compute average individual fish weight			
	4. Keep graphs showing growth of fish population in gms/day of growth			
	5. Compute average increase in gms/day of fish flesh for the period sampled			
	6. Compute the conversion ratio of food to fish flesh produced			
	7. Compare the cost of food and fertilizer to the value of fish produced for that sampling period			
C.	Feeding	1	2	1
	1. Train farmers in the preparation (# of constituents in food, cost etc.) and placement of fish food, along with the amount and time of day to feed fish			
	2. From the results of the sampling calculate the amount of food required for the week following sampling; feeding should be 2-4% of the total weight of the population			
	3. Determine economic feasibility of the feeding procedure in relation to the farmer's status and pond conditions			
D.	Fertilizing	1	2	1
	1. Teach farmers the value of applying fertilizer to a pond			
	2. Instruct pond owners in the application (how, when, where) of fertilizer to a pond			
	3. Advise pond owner, after "eyeballing" the farmer's pond, whether fertility is sufficient or if fertilizer is required and if so in what quantity			
E.	Thinning a pond	1	3	2
	1. Determine whether a pond's fish population has reached capacity for area and inputs of pond			
	2. Prepare a graph showing growth of the fish population (kgs/time) and demonstrate to the farmer progressive fish growth or progressive stunting of the population			

	Imp.	Freq.	Diff.
VII. Harvesting and marketing			
A. Harvesting			
1. Determine the most economical method of removing table fish from pond	1	4	2
2. Determine harvesting time and rate	1	3	3
3. Package and transport the fish to market	2	4	4
B. Marketing			
1. Determine the market that is closest	2	4	4
2. Determine quantity to be marketed	2	4	3
VIII. Care of equipment			
A. Care			
1. Dry and store nylon and cotton nets	1	1	4
2. Storage of fish poisons, weedicides, etc.	1	4	4
3. Clean and operate spraying equipment	1	4	4
B. Use			
1. Cast net	1	1	2
2. Seine net	1-2	3	3
3. Gill net placement and removal	2	5	3
4. Hach kit tests	1	2	3
5. Fish poison	1	2-3	3
6. 2, 4-D Weedicide	1	4	2-3
7. Pumping set	3	4-5	2-3

As with other countries already examined, the dominant tasks in terms of both importance and frequency are related to extension work and pond management. Pond site surveys and renovation of existing ponds are also frequent tasks. With the exception of fish breeding, all of the tasks listed are of primary importance. Fish breeding often requires more time, material and skill than Volunteers could afford to divert from other more important, easily-performed tasks.

The Philippines

Most of the Volunteers in the Philippines inland fisheries program are extension workers. They undertake tasks of a technical nature similar to those of other fisheries extension programs. Volunteers help pond operators increase their yields and profits by helping with:

1. proper pond construction, operation and maintenance;
2. growing natural foods like plankton in ponds and supplying supplemental fish foods;
3. proper fish stocking and harvesting practices;
4. improving control of pond diseases and parasites; and
5. identifying existing market outlets and buyers.

Also, as in other extension programs, many of the Volunteers' duties are in the area of public relations. These include:

1. becoming familiar with the goals set by the government fisheries agency (Bureau of Fisheries and Aquatic Resources) and being able to communicate those goals to others;
2. establishing and maintianing good personal and working relationships with host country supervisors;
3. submitting to supervisors monthly reports on all work undertaken;
4. developing productive working relationships with local farmers, government officials, suppliers of materials and fish marketing dealers;
5. surveying the current status of local fishponds, identifying fish-culture problems associated with those ponds and working with supervisors to set goals based on those problems;
6. developing the means of evaluating program effectiveness;
7. assisting in planning, conducting and evaluating seminars to help operators increase production;
8. identifying resources that can contribute to Philippines fisheries development.

Substantial efforts are devoted to applied research in such areas as: planning and programming fish disease studies; identifying fish parasites, diseases and predators in both brackishwater and freshwater fishponds; establishing a basis for implementing control, prevention and treatment of fish diseases; planning plankton studies, such as plankton taxonomy and ecology; chemical reactions of water and soil upon application of fertilizers; optimal stocking rate with respect to soil and water chemical conditions; and improvement of soil and water management practices.

In 1975 the Philippines asked for regional planners in inland fisheries. Some of the tasks charged to Volunteers filling these positions are: assessing a particular region's fisheries status; assessing the resources available to the Bureau of Fisheries and Aquatic Resources for developing its programs; recommending long and short term goals for Bureau fisheries programs; studying the feasibility of present and future projects; and recommending project modifications.

Conclusion

In most countries where Peace Corps Volunteers are assigned to freshwater fisheries development, goal achievement appears to depend most directly on successful completion of technical and public relations tasks. Peace Corps training includes segments designed to ensure that Volunteers will possess the knowledge and skills necessary for completion of the public relations tasks. The training also includes technical studies, but trainees must have a proven level of competence before they begin Peace Corps training. An examination of the knowledge and skills requested by host countries, and those actually available among Peace Corp Volunteer applicants, follows in the next section.

B. Personnel: Qualifications and Availability

Knowing the kinds of tasks that Volunteers must perform, let us now look at the kinds of backgrounds that host countries request Volunteers to have, and the knowledge and skills actually possessed by Volunteers going into intensive fishculture programs.

Most frequently, individuals with training in either (1) Environmental Science, including fieldwork-oriented specialization such as Conservation, Ecology, Natural Resource Development and Environmental Studies; or (2) Freshwater Fisheries, Freshwater Biology, Aquatic Biology and Limnology, are requested. These backgrounds are believed to provide the most directly applicable experiences for those engaged in Fisheries extension work. General Biology, Zoology, Wildlife, Aquaculture (with experience in culture of marine or freshwater organisms), Fishing, and Marine Biology backgrounds are also requested, although less frequently.

A university Bachelor of Science degree is ordinarily requested because it represents a background that is considered adequate to assure that Peace Corps technical training will be adequately grasped. Because holders of graduate degrees often are interested primarily in research work, they are not generally requested for the extension and production jobs that prevail in freshwater fisheries programs.

In addition to technical background, countries also specify sex and marital status preferences. Often, male Volunteers are expected to be able to gain the respect and cooperation of host country nationals where females cannot. However, it should be noted that women have served quite successfully as fisheries Volunteers when given the opportunity. Single males are often requested for extension work because of the travel involved. It is argued by some Volunteers, however, that the acceptability of traveling while married should be considered a personal decision of the Volunteers involved. Applicants, if adequately informed of the job demands in advance, would enter training only if they are willing to travel as necessary.

Availability of Skills

The major reason that requests are not met is that people with certain skills are not available in sufficient numbers to fill all requests for the particular skill or that a surplus of people with alternate skills are available to perform jobs that can be most adequately filled by people with such alternate skills.

The number of applicants with a Bachelor's degree in Freshwater Fisheries, Freshwater Biology, Aquatic Biology and Limnology is relatively small: smaller, in fact, than the number of requests. The potential pool of people is small since this is the most specific field considered for work in intensive fishculture. However, most requests truly requiring these people are filled. But as many as 60-70% of these requests can be satisfactorily fill with persons who hold a Bachelor's degree in Marine Biology and Fisheries, Wildlife, and Environmental Science and are oriented toward fisheries. For example, holders of degrees in Freshwater Fisheries

have at times been requested to work in fishculture projects for which persons with degrees and/or experience in Marine Biology and Fisheries would surely be just as well qualified. When making requests, program planners should be reminded that the training differences among these fields may be minimal. It should also be remembered that programs that accept general biologists, the most general academic background that is accepted for intensive fishculture programs, almost always fill all requests for workers.

Requests for people with graduate degrees are sometimes hard to fill because there is a very small pool of such people available and interested in volunteer work. As stated previously, people with graduate degrees want to do research rather than extension work. Another reason for the scarcity of graduate level fisheries specialists is that limnology and aquatic biology are more common areas of specialization than "fisheries", although the latter is more applicable to fisheries development programs.

There are more persons with degrees in Marine Biology and Fisheries and Environmental Science available than there are positions requesting these degrees. The potential pool of such people is so large that such applicants are being turned away. It is reasonable to suggest that training could be designed to adequately prepare these people for many jobs that currently request persons with freshwater fisheries degrees.

Conclusion

Given the nature of the technical and more general skills required, highly trained persons with narrow specialities are not necessarily required or desirable. For most fisheries development jobs a good combination of academic and field background, proper motivation and an adequate training program for the jobs to be filled would undoubtedly assure that responsibilities could be adequately met. This is particularly important when searching for counterparts and/or domestic Volunteers who may not have had the opportunities for educational advancement enjoyed by U.S. citizens.

TRAINING

A. Goals in General

The differences in the history, resources, framework and objectives of fish-culture development programs throughout the world require that a variety of fishculture personnel training schemes be devised. This necessity is underlined by the fact that potential fishculture workers, be they local development agents, domestic volunteers, Peace Corps Volunteers, or other development agents, enter training with great differences in their own backgrounds. They may need more or less training in fishculture, extension education, languages and/or cross-cultural communication. However, while each training design will remain in some respects unique, there clearly will be some similiarities: training goals indicate the basic competencies upon which successful fishculture programs necessarily depend.

The following Peace Corps training goals provide a framework for those who must design training programs. The previous section briefly summarizes the backgrounds of the trainees in these programs. The length of time required to meet the objectives set forth depends on the trainees, intensity of the training, and resources available, etc.

1975 Technical Training Goals - Cameroon and Zaire (75)

By the end of their training, Trainees for the Cameroon and Zaire programs were to demonstrate competence in the tasks outlined below.

1. Pond construction
   a. Survey area and determine suitability as pond site
   b. Evaluate water and soil types
   c. Use hand labor, bulldozer or whatever means available to build a pond and drainage system

2. Know life cycle of Tilapia nilotica and Israeli carp
   a. Breeding and spawning habits
   b. Growth rates
   c. Disease, parasite and stress signs
   d. Feeding habits

3. Identify other indigenous species of fish in Central Africa

4. Know good pond management techniques necessary for the following operations
   a. Deciding stocking levels
   b. Using fertilizers
   c. Judging adequate algae blooms
   d. Controlling vegetation and predators
   e. Determining growth rates of fish
   f. Calculating feeding rates
   g. Harvesting with and without nets
   h. Sampling fish populations
   i. Transporting fingerlings and fish
   j. Marketing of both fresh and dried fish

5. Show ability to work with and repair nets

6. Know relative economy of local fish farming with respect to other kinds of agricultural occupations and the cost factors for all aspects of fish farming

7. Know how to transmit technical knowledge competently, e.g., in extension work

8. Be able to ride and repair a motorbike, the primary means of transportation for Volunteers

Technical Training Goals - Togo (29)

Trainees for the Togo intensive fishculture program received instruction and were expected to be knowledgeable in the following areas:

1. Topics in fishculture
   a. Natural spawning
   b. Hormone spawning
   c. Feeding and feeds
   d. Blooms, fertilization and weeds
   e. Liming a pond
   f. Pond sterilization
   g. Parasites and diseases
   h. Water quality
   i. Rice and fish culture
   j. Stocking and production consideration
   k. Keeping pond records
   l. Hybridization of fish
   m. Use of predator species
   n. Combining species

2. Topics in construction
   a. Constructing fish stations
   b. Construction with cement
   c. Net construction

3. Topics in river fishing
   a. Methods
   b. Equipment

Technical Training Goals - India (12, p. 10)

Technical training for the intensive fishculture program in India stressed the uniquely Indian and practical aspects of the following goals:

1. Gain firsthand knowledge on all breeding operations
   a. Seining adults
   b. Checking for maturity

c. Segregating in spawning hoppas
d. Handling and enumerating eggs and hatchlings
e. Feeding
f. Fertilizing ponds
g. Controlling disease
h. Controlling insects and predators
i. Enumerating and shipping fry

2. Be conversant with problems facing pond owners and fish culturalists including acquisition of seed fish, fertilization and weed control in ponds.

3. Learn methods of harvest and types of nets used in India; practice their use.

4. Study organization of both local and national branches of host country government and of fisheries cooperatives.

Technical Training Goals - Nepal (71, p. 11)

The goals outlined below were set for the training program in Nepal in 1972. After training, Volunteers would be capable of:

1. Determining the feasibility of fishculture projects;
2. Renovating old ponds;
3. Constructing new ponds, including water systems;
4. Advising farmers on all aspects of fishculture;
5. Establishing and maintaining sound working relationship with government personnel, village farmers and host country counterparts;
6. Communicating technical advice to villagers on simple terms;
7. Being able to apply extension techniques; and
8. Knowing where and how to get credit from the government.

In the Philippines, 1973 Trainees ranked the areas of technical studies in which they had been trained in the order of importance of the areas of study to job performance. The trainees' evaluation of training priorities follows (45, p. 29).

1 = pond preparation and stocking rates
2 = fertilization and pesticides
3 = pond construction and layout
4 = fry supply, nursery pond management and fingerlings
5 = water quality
6 = weed control
7 = shrimp culture
8 = cooperatives
9 = feasibility study in connection with loans and bank financing
10 = field trips to fish ponds

As can be seen from these five outlines, some training topics and goals are unique to a country or area. Other topics appear to be quite similar,

yet in reality may vary considerably because (1) different species of fish are used; (2) building and maintenance equipment vary; and (3) host country government structures and levels of support differ.

The goals of cross-cultural training and language training are extremely general, although the specific content differs even between regions of the same country. The general goals for cross-cultural training are outlined in the following training program description for India (56).

1. To enable Volunteers to comprehend and become committed to their jobs as designed by the Peace Corps and host country government.

2. To train Volunteers to establish themselves and to function physically in a given situation or location.

3. To train Volunteers to establish themselves and to function socially in a variety of situations previously unfamiliar to them.

4. To train Volunteers to identify and develop human resources or attributes so that they will function effectively and will encourage local persons to do likewise.

5. To provide Volunteers with at least a minimum of culturally specific information.

The goal of language training is simply to gain fluency in the language or languages spoken in the regions to which the Volunteers are assigned. Volunteers' ability to achieve the goals set forth in technical and cross-cultural training depend upon oral language skills. Peace Corps language training has traditionally emphasized oral communication. Extremely intensive training for a relatively brief period has been sufficient to enable Volunteers to begin their field work. Volunteers are encouraged to continue language training while at their job sites.

B. Training Schemes

In the early years of intensive fishculture programs, all of the technical training was conducted by fisheries experts in the U.S. Most training personnel was associated with colleges and universities, including the Universities of Oklahoma, Washington, New Mexico and Humboldt State College.

The primary advantage of U.S. Training (UST) was that it could be offered at a degree of intensity that it was difficult to match elsewhere. The training staffs and facilities were outstanding. However, it was this very degree of intensity in technical training that forced Peace Corps to abandon one of its most valuable intensive fishculture training programs. While technical training was excellent, it was so time consuming that the cross-cultural and language aspects were inadequately covered. Another problem with UST was that Trainees were removed from the cultures in which

they would be operating. Thus, it was harder for them to function in their host country cultures than if they had received training in the host country (ICT). Finally, in some cases, training staffs in UST knew little or nothing about the cultural and economic frameworks within which the Volunteers would be operating and consequently failed to adequately prepare the Volunteers to carry out their tasks in countries with limited resources and technologies. Consequently, training was moved to in-country training (ICT).

Because of the abovementioned deficiencies in UST and for other reasons mentioned below, Peace Corps has gradually shifted all of its intensive fishculture training programs to in-country sites. In the following list are the reasons for changing India's intensive fishculture program training from UST to ICT. They are excellent statements supporting ICT in general.

Reasons for In-Country Training (88)

1. To increase the general relevance of training, i.e., to train Volunteers so than they understand their jobs better.

2. Technical training can be made more relevant in the host country.

3. Trainees are presented with an adequate basis for self-selection; they can truly determine whether or not they fit into the program.

4. A working relationship is established between the U.S. and the host country because of the greater host country involvement in the training. The "Donor-Donee" relationship is thus minimized.

5. ICT gives credibility to intensive fishculture programs; ICT Volunteers appear more as hard-working technicians than "ivory-tower generalists" who come into the host country seemingly knowing all, yet really knowing nothing.

6. The transition from training to the job is easier for Volunteers who have received ICT.

7. Language training can improve with ICT because Trainees have more opportunity to practice their languages and more language instructors are available in the host countries.

8. ICT eliminates the problem of in-country staff members leaving the country to attend UST.

9. ICT eliminates the communication problems between the field and the U.S. training site that plagued programs with UST.

10. ICT gives host country nationals a chance to actively participate in and even direct the training.

11. ICT encourages relationships between Trainees and host country nationals to begin at the commencement of training; each has fewer misconceptions of the other.

12. The cost of ICT is less than the cost of a comparable UST program.

The big disadvantage of ICT is that the intensity of the technical training is not as great as in UST. However, some feel that, considering the limited level of technology at which Volunteers work in the host countries, UST-style, extremely intensive training is not necessary.

Some attempts were made to try and capitalize on the strengths of UCT and ICT by splitting the training into two major segments; the technical training being conducted in the U.S. and the cross-cultural and language training being conducted in-country with occasional technical lessons there too.* However in addition to administration difficulties, split training meant concentrating on technical studies in one place at one time, and subsequently moving to another place and time period to concentrate on cross-cultural and language studies. Thus, integration of studies, an important aspect of effective training, was extremely difficult to achieve.* Moreover, after the U.S. phase of training ended, there was a week or two before studies began again in-country. As a result, material learned in the first part of training was de-emphasized if not forgotten.

From the descriptions of the three training schemes - UST, ICT and split training - it is apparent that they all have strengths and weaknesses. The choice of a training scheme must be made in consideration of program needs, available resources, including training personnel, and backgrounds of trainees, etc.

C. Logistics

Successful training requires adequate material and personnel to accommodate the Trainees' needs as articulated by program planners and those responsible for the training design. The most important physical factor is a site well suited to the carrying out of training activities. Training should be held in areas where most of the operations peculiar to the ultimate job sites can be demonstrated. Training sites ought to have class meeting areas and living quarters either at the sites or near them. Breeding, hatching and rearing of local species should be carried on at the sites so Trainees can gather firsthand experience in these aspects of fishculture.

Another vital factor is adequate supplies at least similiar to those that will be necessary in executing tasks that Volunteers will be called upon to perform in the field at their jobs. The following list is a combination of equipment lists recommended for Togo and Nepal intensive fishculture

* The need to integrate studies should, of course, be considered in context. In the 1972 Nepal ICT, for instance, Trainees completed a full month of language training before moving to a fish farm for technical and cross-cultural training. This format was chosen because it was mandatory that Trainees learn to communicate in the local language before having information thrust at them in that language.

training programs (83; 13, p. 54). The quantity of each item required will depend on the number of trainees, the operations at the training site, etc.

Supplies Necessary for Fisheries Training

1. Fish poison
2. Drag nets
3. Formalin
4. Nylon cork, string (preparation of cast nets, drag nets, and repair)
5. Plankton nets
6. Cast nets
7. Scales (fish spring scales)
8. Plastic buckets
9. Nylon hoppa
10. 50-100' tape measures
11. 5' carpenter's tape measure
12. Hach kits
13. Transit, handlevel, portable rod
14. Thermometers (pocket)
15. 2-4-D Herbicide
16. Fish feed
17. Fertilizer
18. Bamboo, rope
19. Graph paper notebooks
20. Cement, bricks
21. Soil auger
22. 3-ringed notebooks
23. Pituitary glands, whole - not powdered!
24. $CuSO_4$
25. $KMnO_4$
26. MS222 - Quinaldine Sulphate
27. Oxygen Cylinder
28. Fingerlings
29. Sprayer
30. Knives
31. Technical hand-outs, tech. books: Hickling's Fish Culture, Fisheries Manual (Rajasthan), 2nd Report on Fish Farming (US Dept. of the Interior, Fish and Wildlife Service, Stuggart, Arkansas)
32. Dissection kits
33. Fish farm ponds for pond management
34. Bicycles or motorbikes
35. Boats, motors and trailers
36. Laboratory troughs and aquaria
37. Surveying and drafting equipment
38. Tool kits

A third prerequisite for a meaningful training program is qualified personnel. The important qualification in determining program directors and instructors is that they all have had firsthand field experience in fishculture to ensure that they have an understanding of what the Trainees will face after training is completed.

D. Feedback on Training Programs

Training must be constantly evaluated and updated to assure that, insofar as possible, it will enable workers to perform the duties expected of them satisfactorily. The best method of evaluating training program effectiveness is to elicit feedback from persons who completed such training and were subsequently placed in intensive fishculture programs. They should have a clear picture of which training topics were helpful, which were not and what topics were not covered in training but did arise on the job. They should enable program planners and trainers to set, and refine, their priorities. Having followed their training with successful field work, they also may be invaluable members of future training teams.

Evaluation questions should address all substantive aspects of training, e.g., technical, cross-cultural, language, etc. The training design and methodology, e.g., the time schedule, sequence of lessons, teaching method, etc., should be considered. Both specific and general questions will elicit valuable information, especially if a variety of responses, e.g., very useful to useless continuum, agree/disagree, open-ended, etc. is encouraged.

Evaluation of Intensive Fishculture Programs

After having established an intensive fishculture program, it should be evaluated periodically to determine how it can be improved, whether or not it should be expanded or maintained at its present level, how it may be most effectively integrated with other development efforts, etc. Such an evaluation should be initiated by the sponsoring agency; the evaluation criteria will vary significantly among programs. The following "project success criteria" established in Nepal by Peace Corps are only a single example of one kind of questions that might usefully be posed.

Project Success Criteria (31)

1. How many fingerlings are distributed from breeding centers in the project area?
2. How many kg/ha of fish are produced?
3. How many new farmers request fingerlings from breeding station owners?
4. How many new areas have been introduced to fishculture as a result of extension work?
5. How many existing ponds are being used for fishculture and how many new ponds are being built?
6. What kind of support can/does the local government give to development workers in fishculture programs?
7. How many private farmers are able to carry on alone after one year of advice and assistance from a development worker? After two years?
8. What do fishculture development workers think of their jobs?
9. Are the answers to questions 1-7 available?

VI. PROGRAM SUPPORT SOURCES

In order to be truly successful (see "Project Success Criteria", p. 58) an intensive fishculture project must receive support, whether it be human resources, equipment, or money, etc., either from domestic sources, primarily government and non-government agencies - or from other, international sources. Peace Corps involvement in fisheries programs has depended upon the support of a large variety of agencies and individuals. The following summary of some of these sources of support provides guidelines and suggestions for those who are considering commencing or expanding fisheries development projects.

A. Host Country Government Support

The most conspicuous sources of freshwater fisheries program support are host country governments. In Cameroon, the government offices directly concerned with intensive fishculture programs and workers include those of the: Director and Assistant Director of Forests, Water and Wildlife; Director of Fish/Wildlife; Sub-Director of Fisheries, National, Provincial, and Divisional Chiefs of Services for Fisheries, Forests, Water and Wildlife; and Fisheries Demonstrators. Also, the National Fund for Forestry and Fish-Culture, a semi-public agency, has been spending substantial sums of money on developing fishculture in Cameroon.

In Zaire Volunteers are ultimately responsible to the Department of Agriculture of Zaire. On a regional level they are responsible to the Division of Agriculture, Section of Waters and Forests in the regional capital of Bandundu. Local level support comes from the Agronomist of the Sub-Region; Agronomist of the Zone; and the Agronomist of the Collectivity.

In Latin America, support for Peace Corps projects came from the marine fisheries-oriented Central American Fisheries Project. The government agencies of the six participating countries follow.

LATIN AMERICA - HOST GOVERNMENT AID (31)
(Mº = Ministerio)

Guatemala:

Mº de Agricultura
División de Fauna

El Salvador:

Mº de Economía
Sección de Pesca y Caza Marítima

CENTA, the agricultural extension and research arm of the Ministerio de Agricultura (MAG)

Honduras:

Mº de Recursos Naturales
Depto. Caza y Pesca Marítima

Nicaragua:

Instituto de Fomento Nacional (INFONAC)
Sección de Pesca

Costa Rica:

Mº de Agricultura y Ganadería
Sección de Pesca y Vida Silvestre

Panamá:

* Mº de Agricultura, Comercio y Industrias
Depto. de Pesca e Industrias Conexas

* being restructured

In Nepal, most government support for programs and workers is filtered down from the national level through various agencies for distribution at the local level. The government sector responsible for fishculture development is the Department of Agriculture: Director General for Agriculture. On the local level, support comes from (81) the following:

> The District Agricultural Development Office insures the availability of vehicles, extension expertise, village contacts, counterpart assistance, and application of authority.
>
> The Agriculture Development Bank helps in obtaining loans for farmers. The Land Reform and Map Office facilitates receiving maps of areas, and sometimes loans.
>
> The Minor Irrigation Department facilitates fishponds; Agriculture Marketing Corp. facilitates the obtaining of supplies and wastes for use as fish feed.

Volunteers in the Philippines, particularly those doing extension work, are assigned to the Bureau of Fisheries provincial offices. Volunteers are are immediately responsible to their Provincial Program Officer who is a designated extension worker supervisor.

B. Other In-Country Support

In addition to government support, intensive fishculture programs receive support from "outside" aid--international organizations and from governments abroad. This section cites some of those outside sources of support.

The intensive fishculture program in Cameroon is really a cooperative venture among the Cameroonian Department of Agriculture, Peace Corps, OXFAM (an English philanthropic organization), local councils in Cameroon and more recently, the U.S. Self-Help Fund. OXFAM and the U.S. Self-Help Fund provide equipment such as Landrovers, bulldozers and nets; those things that are hard to get from any other source. The local councils provide tools, machine parts and houses for Peace Corps Volunteers. The Department of Agriculture provides all necessary petrol and some spare parts for machinery, vehicles and other equipment, as well as government structure and an officially accepted role.

Niger, with its very small fisheries projects, has international organizations--CARE and Church World Service--financing and outfitting their projects.

In Latin America, FAO plays a substantial role in the development of inland fisheries. A counterpart organization to FAO in Central America is the CCDC (Central American Fisheries Development Commission) which hopes to assume the role in fisheries that FAO now plays.

In India, United Nations organizations have played substantial roles in fisheries development. UNICEF, in 1969, supplied motors, boats and weed cutting equipment for lakes and ponds in which fish were raised. In the

state of Rajasthan, a cooperative group, ANP (Applied Nutrition Project), composed of the Indian government, FAO, WHO and UNICEF works on fish-culture development. Fish stations taken over by this group were funded and staffed by the member agencies.

A wealth of information exists on program support sources in the Philippines. In addition to the government and universities in the Philippines, sources of support include the following.

International Fishculture Program Participants - Philippines (33)

USAID - funding pond projects
UNDP (United Nations Development Program) - working in pond production
FAO - working in pond production
JOCV (Japanese Overseas Cooperative Volunteers)
Danish Government - cooperative program with Philippine Government

Philippines Technical Resources (46)

1. Technical Staff from Fisheries Regional Office

2. Western Visayas Demonstration Fish Farm

3. Personnel from other govt. agencies
   a. Bureau of Agricultural Extension
   b. Bureau of Soil
   c. Bureau of Agricultural Economics
   d. Bureau of Lands
   e. Agricultural Credit Administration
   f. Bureau of Forestry Development

4. Fry Dealers

5. Personnel from Banks that can grant loans

6. Fish Wholesalers & Middlemen

7. Government Officials

8. National Inland Fisheries Project
   a. Brackishwater Fisheries Research Station
      NSDB Inland Fisheries Project (#2-235)
      College of Fisheries
      Univ. of the Philippines
      Leganes, Iloilo
      SEAFDEC Project
   b. Personnel
      IFP Director (U. of Phil.)
      IFP Asst. Director (U. of Phil.)
      Advisor to IFP (U. of Phil.)
      USAID: Ramon Magsaysay Ctr.
      1680 Roxas Blvd.
      Manila, Philippines

9. Philippine Research Society on Fish Culture (PHILRESOF)
   345 Huervana St., La Paz
   Iloilo City

10. Resource Agencies
    a. American Fisheries
       5410 Grosvenor Lane
       Bethesda, Md. USA
    b. Biology Branch
       (any UN FAO literature)
       Fisheries Division, FAO
       Via delle Terme
       di Caracalla
       Rome, Italy
    c. Coast & Geodetic Survey
       (tidetable & free maps to PCV's)
       421 Barraca St.
       Manila, Philippines

11. Local fertilizer and chemical companies

C. U.S.-Based Support

A vast group exists in the USA that can and does provide support (financial, equipment, information, etc.) to developing intensive fishculture programs. Support is available from the government, colleges and universities, and the private sector.

On the federal level, support is available from the Agency for International Development, U.S. Departments of Agriculture and Interior and, of course, Peace Corps. Other Government agencies that provide support include the State Commissions and offices that are responsible for Fish and Game, Conservation, Wildlife, Natural Resources, etc. Regional Fisheries Commissions (Gulf States, North Pacific, Pacific, etc.) and agencies also exist.

Information about and the addresses of US Government offices and other potential sources of support may be obtained from the US Embassy and/or US Information Agency.

Special mention should be given to two educational institutions which have been of special help to the Peace Corps in intensive fishculture programs. For several years most of the intensive fishculture Volunteers underwent training at the University of Oklahoma in Norman, Oklahoma, Dr. Howard Clemens of the Department of Zoology usually was in charge of the training. Presently, Dr. Clemens and a number of former Volunteers who trained under him are at Oklahoma. A wealth of material is there from training programs, evaluation trips to countries with fishculture programs and research on fishculture.

In 1975, intensive fishculture program Trainees attended a Cameroon, CAR and Zaire fisheries staging at Auburn University in Auburn, Alabama. Auburn has an excellent fishculture program. The Fisheries Department personnel includes a number of Returned Volunteers.

Under contract with USAID, the Auburn University Agricultural Experiment Station is working on a world-wide international fisheries project entitled "Increasing Fish Production by Improved Fishcultures". Services provided by Auburn under this program include:

1. Surveys to evaluate problems and operation development plans in order to increase fish production in developing countries.
2. Planning of pondculture research stations, including cost estimates.
3. Providing assistance to cooperating host countries Fisheries Departments that are developing aquaculture research programs.
4. Conducting short courses in host countries to inform fisheries research and extension personnel of the latest advances in aquaculture and to help them develop their competence in areas of particular need.

5. Training of personnel at BS, MS and PhD levels at Auburn University in academic subjects and research methods under USAID and Foundation scholoarships.

6. Assisting cooperating Fisheries Departments in host countries to publish research results and extension leaflets on aquaculture methods.

7. Providing developing countries with short-term visits from experts from Auburn University and other institutions to help solve special problems as they arise.

8. Providing a limited number of trained personnel for two-year tours of duty in host countries.

Auburn University also participates in the International Center for Aquaculture.

A group of American universities has formed a consortium to provide aid to countries in Latin America in the area of agriculture, including fisheries. Members of the Consortium are: New York State University, College of Environmental Science and Forestry, Syracuse, N.Y.; University of Idaho, College of Forestry, Moscow, Idaho; University of Arizona, Department of Watershed Management, Tucson, Arizona; Colorado State University, College of Forestry and Natural Resources, Fort Collins, Colorado; and the University of Massachusetts, Department of Landscape Architecture and Regional Planning, Amherst, Mass. Some services rendered by the consortium in countries with Peace Corps inland fisheries programs have included sending books to Volunteers in fisheries projects, visiting and evaluating Peace Corps inland fisheries programs.

VITA (Volunteers in Technical Assistance) is a U.S.-based organization that assists people the world over with problems of a technical nature. VITA has a contract with Peace Corps: when Volunteers give a detailed description of a technical problem to VITA listing previous attempts to solve it, VITA will refer the "case" to one or more of its Volunteers. These VITA Volunteers then reply, through VITA, to the person making the original inquiry. If further correspondence is necessary, VITA puts the inquirer in direct touch with the VITA Volunteer. VITA has helped Peace Corps Volunteers with such problems as: inadequacy of fish nets in West Cameroon fishculture programs; synthesizing of poisons from local plants to kill garbage fish in Indian fishponds; availability of machines to process and pelletize fish feed; and building of a methane converter to eat sewage sludge and help promote fishpond algae bloom growth. VITA's address is: 3706 Rhode Island Ave., Mt. Ranier, Maryland 20822.

A few of the many private sources of material aid and advice for Peace Corps intensive fishculture programs are:

for nets:
Delta Net and Twine Co.
P.O. Box 356
Greenville, Mississippi 38701

for chemicals and equipment:
McCrary's Farm Supply
114 Park St.
Lonoke, Arkansas 72086

for equipment:
VWR Scientific Co.
P. O. Box 8603
Baltimore, Maryland 21204

D. At-Large International Sources of Aid to Fisheries Programs

FAO -- aid must be requested by host-country governments.

Fisheries Resources Division
Food and Agriculture Organization
of the United Nations
Via delle Terme di Caracalla
Rome, Italy 00100

Librarian, Fisheries Branch Library
FAO
Via delle Terme di Caracalla
Rome, Italy 00100

OXFAM
274 Banbury Road
Oxford, England OXZ 7DZ

World Neighbors (Vecinos Mundiales)
5116 North Portland Ave.
Oklahoma City, Oklahoma 73112

- has printed matter and files on fish farming, both in English & Spanish.

UNDP
866 United Nations Plaza
New York, N.Y. 10017

Centre Technique Forestier Tropical
45 Avenue de la Belle Gabrielle
94130 Nogent-Sur-Marne, France

- has published manual on tr pical fishculture.

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Since 1961 when the Peace Corps was created, more than 80,000 U.S. citizens have served as Volunteers in developing countries, living and working among the people of the Third World as colleagues and co-workers. Today 6000 PCVs are involved in programs designed to help strengthen local capacity to address such fundamental concerns as food production, water supply, energy development, nutrition and health education and reforestation.

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