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FISHCULTURE EXTENSION PROJECT - BRAZIL

December 1, 1972 - June 20, 1973

Submitted by

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USAID - Auburn University
Task Order No. 8
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Introduction

Major progress towards implementing a self-sufficient extension service within the DNOCS Directorate of Fisheries and Fishculture was made during the second semester of the present contract. The most meaningful advance was the naming of a permanent, trained DNOCS fishculturist to head the fishculture extension service. Other developments include the initiation of fish pond construction on a private farm, and contact and discussion with the Banco do Nordeste Brasileiro (Bank of the Brazilian Northeast) concerning loans for private farmers for investment in intensive fishculture. This progress has brought the USAID fishculture extension assistance project closer to the contract goal of developing an efficient and independent fishculture extension service within the DNOCS.

Political Changes

On January 1, 1973, the DNOCS' fisheries services were politically advanced to a full directorship under the DNOCS organizational structure. Previously, the fisheries division was under the administration of the directorate of irrigation which was far-removed from fisheries. The new directorate of fisheries and fishculture is now directly responsible to the DNOCS general director. This change has brought about a renewed sense

of organization, prestige, and morale within the directorate to the benefit of all fisheries projects.

Counterpart

Directly benefiting from this political change was the fishculture extension service. In the reorganization, Antonio Carneiro Sobrinho, formerly a fishculturist at the Fishculture Experiment Station in Pentecoste, Ceara, was named leader of the fishculture extension service. This resolved the counterpart problem cited in the author's first semester.

To augment the small extension staff, DNOCS has been encouraged and is presently in the process of formulating an agreement with the State Agricultural Extension Service (ANCAR-CE) to train two to three of their extensionists in intensive fishculture. After being trained they will work strictly as fishculture extensionists within DNOCS for an as yet undetermined period.

Intensive Fishculture Extension

DNOCS irrigation projects

At the time of the last report, plans were being formulated for the implementation of intensive fishculture in the DNOCS' pilot irrigation project at Morada Nova, Ceara. Further planning was postponed for two reasons: (1) the CR\$200,000 allocated for intensive fishculture in irrigation projects has not been turned over to the DNOCS, although the funds have been liberated for some time. (2) The fish to be used in the project (Tilapia hybrid) is being tested more thoroughly so that more precise technical and economic data are known before giving the fish to colonist-farmers. This data is needed

to assure a "success" in this first demonstration project among colonists .

The experiment with the tilapia hybrid that is expected to give more conformational evidence of the fish's intensive culture feasibility is being terminated in June, 1973. These research results, when combined with the awaited funds, should provide the resources needed to implant intensive fishculture in Morada Nova.

private farmers

Numerous private farmers have expressed interest in intensive fishculture. Presently, one farmer has begun pond construction and a project is being studied for another.

Pond construction was started on a private farm near Paracuru, Ceara. This farm situated on the coast has an excellent supply of freshwater--a characteristic not common in most regions of the Northeast. The one great difficulty encountered, however, is the sandy soil. Ponds will not hold water unless clay is brought in to line the ponds. If this problem can be surmounted, intensive fishculture may prove to be a productive enterprise for this farmer. To begin the tilapia hybrid will be raised. Freshwater shrimp (Macrobrachium sp.) will also be tested for culture potential. Juvenile freshwater shrimp for stocking purposes are abundant in local streams.

A fishculture project is being studied for another farmer in the same region. In contrast to the coastal farm, the soil is more suitable for pond construction but the water supply is limited. A project stressing water usage and conservation will be outlined. Work on this project is temporarily

interrupted due to the exceptionally heavy rains that have impeded transportation to the area.

Semi-Intensive Fishculture Extension

More roadside "borrow-pits" were stocked, continuing the effort of providing fish protein to peasant families (see annex 1). In March, nearly 4,000 Tilapia hornorum and Tilapia rendalli were stocked into 31 hectares of water along the highway BR-222. In temporary ponds (that dry during the dry season) large numbers of fish were stocked so that a reasonably high production can be obtained in a short period. Reproduction was not considered important in this case as it will have little affect on total production in such a short time. However, in the case of more orless permanent bodies of water, fewer fish were stocked so that reproduction would provide the bulk of the total production.

Semi-intensive fishculture work with reservoirs in Umirim, Ceara has progressed well. The Reservoir Umirim, of 2.5 hectares, was stocked with T. hornorum at a density of 500/hectare in October, 1972. Fishing was suspended until April, 1973. On April 11, fishing was liberated and a creel census was initiated. All fish caught are recorded by species, weights, and capture methods. The study will have a duration of one year. Changes in species composition and average weekly production will be followed so that better production methods can be introduced into other similar bodies of water. The data should also demonstrate the valuable potential of this type of pond.

During May, production in Umirm Reservoir was 57.77 kilos, 10% of which was tilapia. In July, T. nilotica will be stocked to register its production potential. It is interesting to note that people in Umirim are of such a low economic level, that many cannot afford hooks and line. As an incentive to bring in fish for registration, one hook or line is given for a certain number of fish registered. For those who initially have neither hook or line, they are given them free. As a result of this incentive, large numbers of people have begun fishing to supplement their meager food supply. People claim they have never seen as many fish caught in the reservoir, this large production is probably due to the hook and line incentives.

Another creel census will be started in July in Croata, Ceara. Croata is very similiar to Umirum. The majority of the population is composed of peasant farmers. An approximately 7 hectare temporary lake is situated within the city. One thousand Tilapia rendalli and 475 Tilapia hornorum were stocked in April as the lake was rising during the rainy season. No other fish were found in the lake as it dried completely in 1972. The tilapia stocked in April reproduced well and are now dominating the lake's other fish species that entered when it overflowed.

When the creel census is initiated in July, total production can be studied from the onset until the next dry season when all fish will be harvested as the water recedes. An accurate value for production will be obtained for this type of temporary body of water, while in Umirum, a value for production will be found for semi-permanent reservoirs.

Loans - Banco do Nordeste Brasileiro

In May and June, contacts were made with the Banco do Nordeste

Brasileiro to investigate possibilities of collaboration with DNOCS and private farmers in financing fishculture demonstrations on private farms in the Northeast. Bank authorities have made two visits to the Fishculture Experiment Station in Pentecoste to observe DNOCS work; one visit being accompanied by interested farmers.

The bank is obviously impressed with the objectivity of the tilapia hybrid experimentation. They have offered their help in writing feasibility studies for private fishculture enterprises. Loans, with easy terms to farmers, have been suggested by bank officials to promote implantation of demonstration-type ponds on private lands. This bank support will be invaluable to the development of commercial intensive fishculture in the Northeast. Contacts will be maintained and hopefully loans procured during the next semester.

Fishculture Manual

A simple, comprehensive, fishculture manual is in the process of completion. A final draft is nearly ready and publication is being arranged by the DNOCS. The lack of the SUDENE/SUBIN funds will be the only item delaying this much-needed publication. The author believes that the first printing should be September, 1973 depending upon the funds.

Other Activities

1. A 1973 work plan for the fishculture extension service was completed by the author and his counterpart Antonio Carneiro Sobrinho (see annex 2).
2. A trip was made to Penedo, Alagoas, on the Sao Francisco River to observe intensive fishculture operations on farms of

that region (see Panedo Report, annex 3).

3. The author organized two flights for taking aerial photos of the Pentecoste Intensive Fishculture Experiment Station in December, 1972. The photos are currently being used as public relations and technical material by the DNOCS.
4. A visit to the Araras Reservoir Fishing Cooperative was made in February. The author was asked by DNOCS to give ideas and suggestions concerning the cooperative's future (see Araras Report, annex 4).
5. To become familiar with educational levels of the farmers who will be the primary benefactors of the fishculture manual, a visit was made to Morada Nova in January to attend a meeting of the colonist's agriculture cooperative. The DNOCS requested that the author give his impressions of the meeting (see Morada Nova Report, annex 5).
6. A trip to Brasilia in May involved meetings with USAID/ARDO, the Ministry of the Interior, and the Secretary of Agriculture of the Federal District. Accompanying the Chief of Party, Dr. Leonard Lovshin, the director of the Directorate of Fisheries and Fishculture, Dr. Raimundo Adhemar Braga, and a DNOCS limnologist, Helio Resende Melo, the author attended a meeting with USAID/ARDO personnel to discuss project goals and participant training; with the Ministry of the Interior to present and discuss part history and future plans of the Directorate of Fisheries and Fishculture; and with the Federal District's Secretary of Agri-

culture to discuss training of their fishery personnel by DNOCS technologists.

Priorities for the Period June 21, 1973 - December 30, 1973

1. Continue creel census in Umirim. Make one population sample in September.
2. Initiate creel census in Croata, Ceara.
3. Stock roadside "borrow-pits" and encourage the raising of T. nilotica and T. hornorum at DNOCS fish hatcheries so that they may also stock fish into small, temporary bodies of water.
4. Publish fishculture manual.
5. Continue work with private farmers who have a desire to raise fish.
6. Assist the Banco do Nordeste Brasileiro with feasibility studies and projects for financing demonstration ponds on private lands.

ANNEX 1

JORNAL DO DNOCS

ANO 1

ABRIL DE 1973

PISCICULTURA

Pequenas coleções de água (barreiros, poços, açudecos) poderão ser aproveitadas na produção de peixe de água doce, através da estocagem de Tilapia hornorum ou Tilapia rendalli.

O técnico norte-americano, J. Jensen, ora a serviço do DNOCS, iniciou programa de estocagem de milhares de alevinos de Tilapia, em pequenos açudes as margens da BR-222, de Boqueirão até São Miguel, e em dois açudecos, em Umirim.

Assim, dentro de 6 a 8 meses, as pessoas que moram nas proximidades daqueles pequenos açudes, poderão contar com os peixes ali colocados.

Este tipo de trabalho, visa, também, despertar as populações rurais para a fácil e objetiva criação do peixe de água doce, em regime semi-intensivo.

ANNEX 2

PROJETO DE EXTENSÃO DA SEÇÃO TÉCNICA EXPERIMENTAL DO CENTRO DE PESQUISAS ICTIOLÓGICAS, PARA O ANO DE 1973

- 1 Titulo do projeto: EXTENSÃO DE PISCICULTURA INTENSIVA E SEMI-INTENSIVA
- 2 Orgão executor: SEÇÃO TÉCNICA EXPERIMENTAL
- 3 Justificativas do Projeto

O projeto de extensão, responsável pela implantação de novas técnicas oriundas da experimentação, visa levar informações, assistência técnica, e novos métodos ao piscicultor. Desta maneira a implantação e aperfeiçoamento de piscicultura intensiva e semi-intensiva na região nordestina justificam a existência do projeto de extensão pelas seguintes razões:

 - a) Carência de proteína animal nas dietas do povo nordestino;
 - b) baixo poder aquisitivo;
 - c) o aproveitamento de pequenos reservatórios e limitado em termos de produção piscícola;
 - d) demanda maior que a oferta nos mercados consumidores;
 - e) pessoas interessadas na criação de peixes;
 - f) a piscicultura intensiva existente atualmente em algumas áreas (Penedo - AL, por exemplo) é bastante rudimentar, precisando de maior assistência técnica; e
 - g) resultados promissores de experimentos com peixes aclimatados pela Seção Técnica Experimental.
- 4 Objetivos:
 - a) fomentar a piscicultura intensiva e semi-intensiva;
 - b) levar assistência técnica ao piscicultor;
 - c) divulgar informações e métodos modernos oriundo da experimentação e
 - d) procurar resolver os problemas correlatos à piscicultura.
- 5 Sub-Projetos da Extensão:

Sub-Projeto I - Piscicultura Intensiva
Sub-Projeto II - Piscicultura Semi-Intensiva

 - 5.1 - Titulo do Sub-Projeto I - Extensão de Piscicultura Intensiva
 - 5.1.1 - Extensionistas responsáveis: John W. Jensen e Antonio Carneiro Sobrinho

5.1.2 - Objetivos: a) fomentar;
 b) dar assistência técnica;
 c) divulgar informações através de demonstrações; estágios, cartilhas, contato pessoal, etc;
 d) criar inter-ligação entre a experimentação e o piscicultor e
 e) criar fonte de informações disponíveis ao piscicultor.

5.1.3 - Métodos: a) demonstrações de piscicultura intensiva;
 b) publicações de manuais, cartilhas, publicações científicas etc.
 c) filmes, slides, fotografias e
 d) cursos a curto prazo.

5.1.4 - Material: a) veículo motorizado;
 b) material de impressos;
 c) projetores de slides e de filmes;
 d) filmes e máquina fotográfica;
 e) aparelho medidor de oxigênio e temperatura
 f) aparelho para determinar pH e
 g) três ou mais espécies de peixes (reprodutores)

5.1.5 - Pessoal: a) Extensionistas (2)
 b) Motorista (1)

5.1.6 - Início: mês de abril de 1973

5.1.7 - Duração provável: indefinitiva

5.2 - Título do Sub-Projeto II - Extensão de Piscicultura Semi-Intensiva

5.2.1 - Extensionistas responsáveis: John W. Jensen e
 Antonio Carneiro Sobrinho

5.2.2 - Objetivos: Utilizar algumas espécies de peixes já existentes na Seção Técnica Experimental que se adaptem a este tipo de criação semi-intensiva, como também aproveitar os pequenos açudes e barreiros que acumulam águas durante a época das chuvas, podendo serem perfeitamente utilizados nos meses escassos de chuvas no decorrer de cada ano, para a exploração pesqueira.

5.2.3 - Métodos: Ao iniciar os trabalhos, serão escolhidas duas ou mais áreas povoadas com espécies de peixes semelhantes as demais já distribuídas. Uma avaliação deste tipo de piscicultura será feita, levando-se em consideração: estocagem, alimentação, crescimento e produção comercial e não comercial, num período de aproximadamente um ano, com amostragens em intervalos variados.

- 5.2.4 - Material:
- a) galões de malhas variadas;
 - b) redes de arrasto;
 - c) puçás;
 - d) balança;
 - e) baldes de plásticos;
 - f) mesa de pesagem;
 - g) veículo motorizado;
 - h) impressos e
 - i) três ou mais espécies de peixes.

5.2.5 - Pessoal: Idem ao do Sub-Projeto I.

5.2.6 - Início: mês de outubro de 1972

5.2.7 - Duração da avaliação: agosto de 1974

6. Utilização dos resultados: Tendo em vista a importância que tem o peixe como produto alimentício, dado o seu alto teor em proteína e considerando o baixo consumo de peixes per capita, notadamente com as espécies de água doce, não resta dúvida que o projeto em apreço será um grande passo para o desenvolvimento da piscicultura e conseqüentemente da região, tão carente de recursos como é o Nordeste Brasileiro.

ANNEX 3

PRELIMINARY REPORT ON FISHCULTURE IN THE PENEDO, ALAGOAS REGION OF THE SAO FRANCISCO RIVER VALLEY

by
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Convenio SUDENE/DNOCS/USAID
Fortaleza, Ceara, Brazil

INTRODUCTION

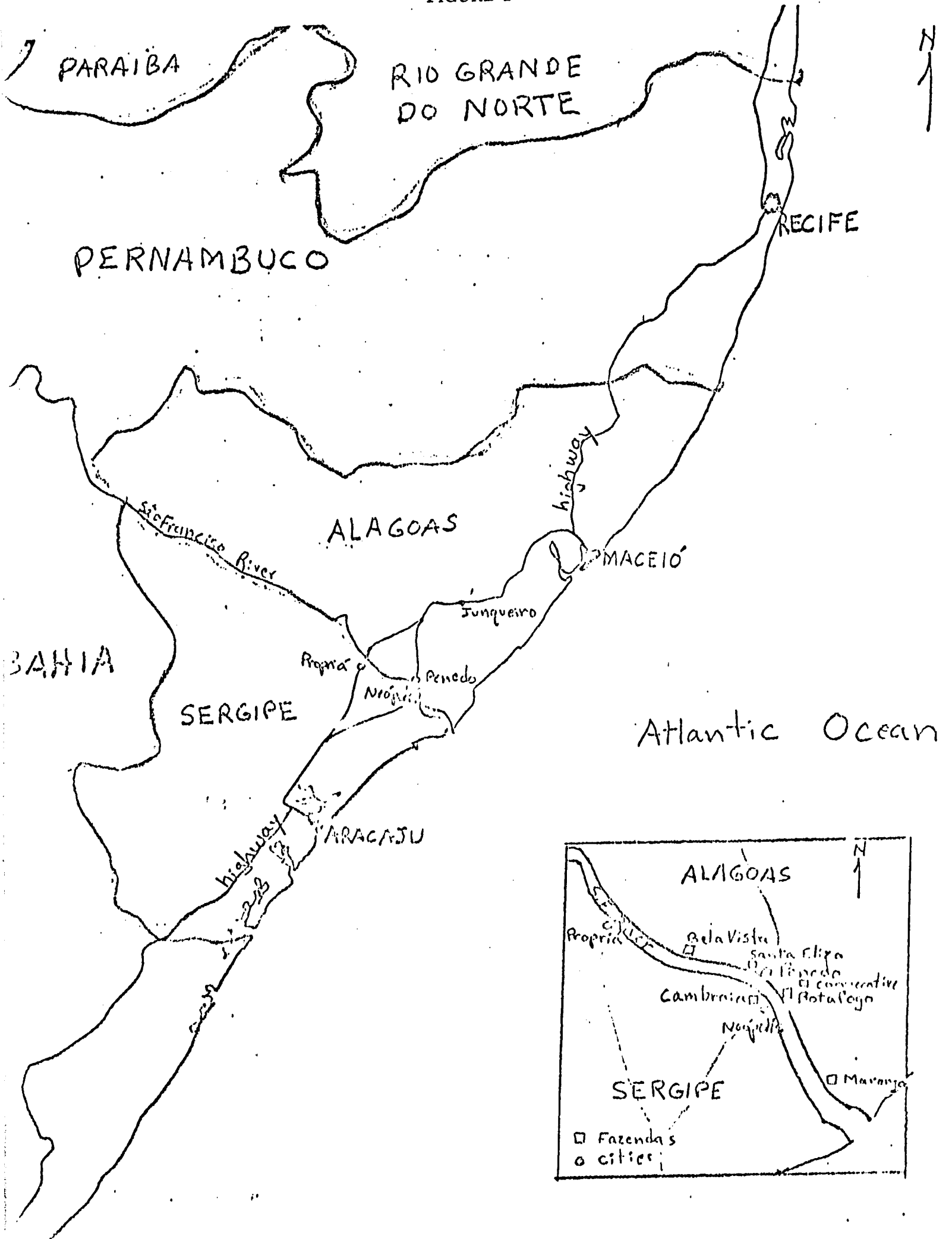
A survey was made of intensive fishculture operations in the Penedo, Alagoas region of the Sao Francisco River Valley by the author from April 23 to April 27, 1973. In Brazil there exist no comparable intensive fishculture enterprises; thus, it was important that contacts be made with farmers to learn about their fishculture activities, exchange technical information and investigate possibilities of extending to them technical assistance from the DNOCS Directorate of Fisheries and Fishculture (Directoria de Pesca e Piscicultura).

GEOGRAPHY

The majority of the region's fish farmers are located from estuarine waters to a point 80 kilometers upstream in the Sao Francisco River Valley. The local commercial center and largest city of the region is Penedo, in the state of Alagoas (see map, Fig. 1). Two other less important cities, Propria and Neopolis, are situated on the River's southern bank in the state of Sergipe. Penedo, 42 kilometers from the River's mouth, is 15 meters above sea level. River tides of 50 centimeters reach Penedo.

Throughout the downstream regions of the valley, large lateral lakes predominate the topography. An unlimited water supply, flat land and rich

FIGURE 1



alluvial soils lend themselves well to the planting of rice which is the principal agricultural practice of the region.

For nearly its entire length, the Sao Francisco River passes through the Northeast's "Drought Polygon" characterized by a climate subject to periodic droughts. The Penedo region is no exception although being closer to the Atlantic Coast, the influence of the ocean is felt through the increase in relative humidity and rainfall.

The climate of the Penedo region, as well as a large part of the Northeast within the river's drainage basin, has little effect on the river's volume. Most of the flow originates in its upper reaches where rain is more plentiful and numerous large river effluents enter. In fact, during the Penedo region's dry season, the river attains its highest level. This unusual climatic condition where the dry season corresponds with high river levels (caused by the rainy season upstream) influences to great advantage the planting of rice and raising of fish.

HISTORY

For many years fish have been harvested from lateral lakes throughout the valley. Adult fish enter the lakes at high water to apparently feed on the large food supply created by the flooding of the rich alluvial soils. As the level of the river recedes, the lakes drain and the fish, sensing the change in water level, escape from the lakes to the river. In leaving they are easily caught in traps. The larger fish are sold and until recently, the 20 to 50-gram fingerlings were either destroyed or returned to the water.

Jonas Sampaio dos Santos began in 1965 as the first apparent farmer

to raise fish in the region. After an early, unsuccessful three-year experience of raising Tilapia melanopleura and common carp, Cyprinus carpio (small size of tilapia and consumer acceptability were major problems), he turned his efforts to native species, principally curimata pacu (Prochilodus sp.), piau verdadeiro (Leporinus piau), and mandi amarelo (Pimeleodus maculatus).

From this beginning, over eight years ago, with one four-hectare pond on the edge of a rice field, his operation has grown to seven fish ponds totaling 70 hectares of water. His economic success has given incentive to a number of other regional rice farmers to diversify into fish farming. Currently there exist approximately 10 farmers engaged in fishculture activities.

It may be interesting to note at this point that these farmers have had no technical assistance whatsoever in raising fish. No books have been available to them; their techniques were learned strictly by observation, trial and error.

FARMS VISITED AND OWNERS

The following farms were visited and the farm operators were interviewed.

Fazenda Cambraia--Jonas Sampaio dos Santos

Fazenda Santa Eliza--Jonas Sampaio dos Santos

Cooperativa Agricola de Maracuja

Fazenda Maranga--Dr. Silvio

Fazenda Botafogo--Geraldo Lobo

Fazenda Bela Vista--Iv. Lessa

Fazenda Cambraia

The Fazenda Cambraiai, owned by Jonas Sampaio, has the most land

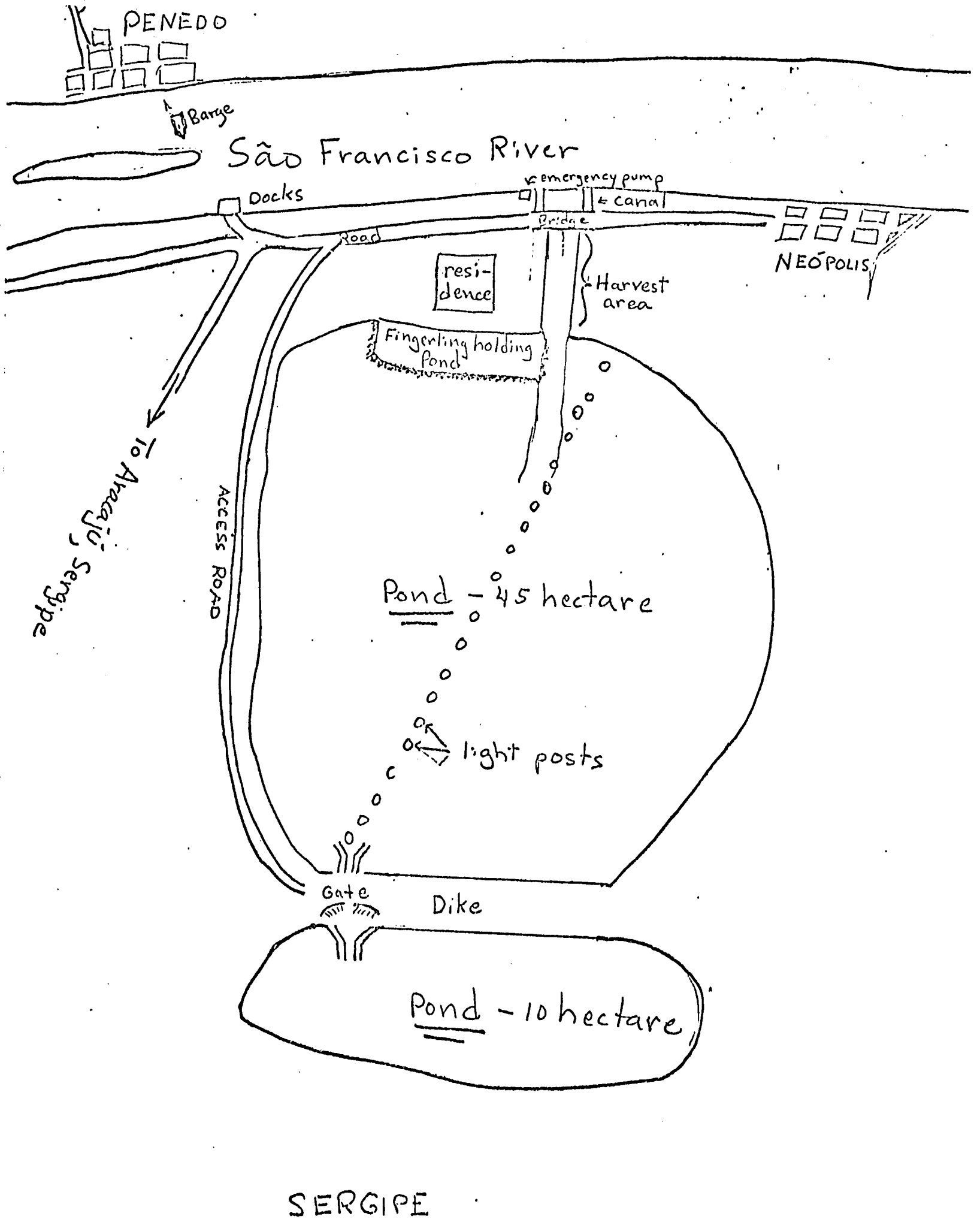
devoted to fishculture and the most developed system in the valley (Fig. 2). The ponds consist of one large 45-hectare pond (formerly a lateral lake) connected directly to the river by a canal, a 10-hectare pond in series with the large pond and a one-hectare fingerling holding pond. The maximum depth in the ponds reaches two meters. The larger ponds are separated by a large dike 200 meters long and 5 meters wide. An elaborate gate and spillway control water levels in the upper pond. Water from the river enters by gravity through a concrete-lined canal and a pair of gates that divide his harvest area within the canal. The river maintains a sufficient level throughout the year to fill the pond to capacity by simply opening the gates. A 15,000 liter/min. emergency pump, installed at the river's edge, is used if the river is too low to supply water by gravity flow.

As the level of the river lowers in May, lateral lakes are drained gradually and rice is planted behind the receding water. During this period the Fazenda Cambraia often supplies equipment to suppliers for capturing and holding fingerlings. Fish are picked up and transported in barrels to the one hectare pond where they are held approximately 120 days. Cr \$0.10 (US \$0.017) is paid for each fingerling of piau verdadeiro and curimata while mandi amarelo demands a price of Cr \$0.15 (US \$0.025) each.

Fingerlings are usually stocked in September and October; the time determined by the desire to coordinate the harvest of about one kilo fish with Easter week, 18 months later when the demand for fish is greatest.

Twenty to fifty-gram fish are stocked at a density of 900/hectare. Of this number, 700 are curimata and piau verdadeiro, while mandi amarelo makes up the balance. Stocking rates have been determined by more or less

FIGURE 2



trial and error. To Jonas Sampaio, stocking densities are "trade secrets" although it appears that other farmers use approximately the same stocking rate.

Although feeding of fish is not regimented, the farmers are conscious of the need to provide a sufficient natural food supply. To do this they defend vigorously their practice of maintaining approximately one-half the pond surface in aquatic vegetation. They contend that the water hyacinth roots, lily pads and other diverse types of vegetation provide a surface for "aufwuchs" and filamentous algae to collect. Curimata, a grazer on these plants, prefers this food to any other. The author observed curimata "sucking" on the aquatic vegetation while feeding on the "aufwuchs" and filamentous algae. Jonas Sampaio also claims that as the water hyacinth leaves die and fall into the water, the fish eat them. To confine vegetation to one-half the pond area, water levels are raised and lowered periodically to control overabundant plants.

Fertilizers are used sparingly probably because reasons for fertilizing water are poorly understood. As a matter of fact, algal blooms created by fertilizing would probably be detrimental to production of "aufwuchs" and filamentous algae. On the Fazenda Cambraia, just one metric ton of organic fertilizer (cow manure) is used per hectare of water in one application four months before harvest. The belief, likely correct, is that this causes the fish to develop fatty tissues preferred by the consumer. During the time that ponds are dry the soil is turned over by discing.

Included in the aquatic vegetation around the pond margins is an aquatic grass that is eaten by the piau verdadeiro, a herbivorous fish.

Mandi amarelo appears to be primarily insectivorous. Observing this,

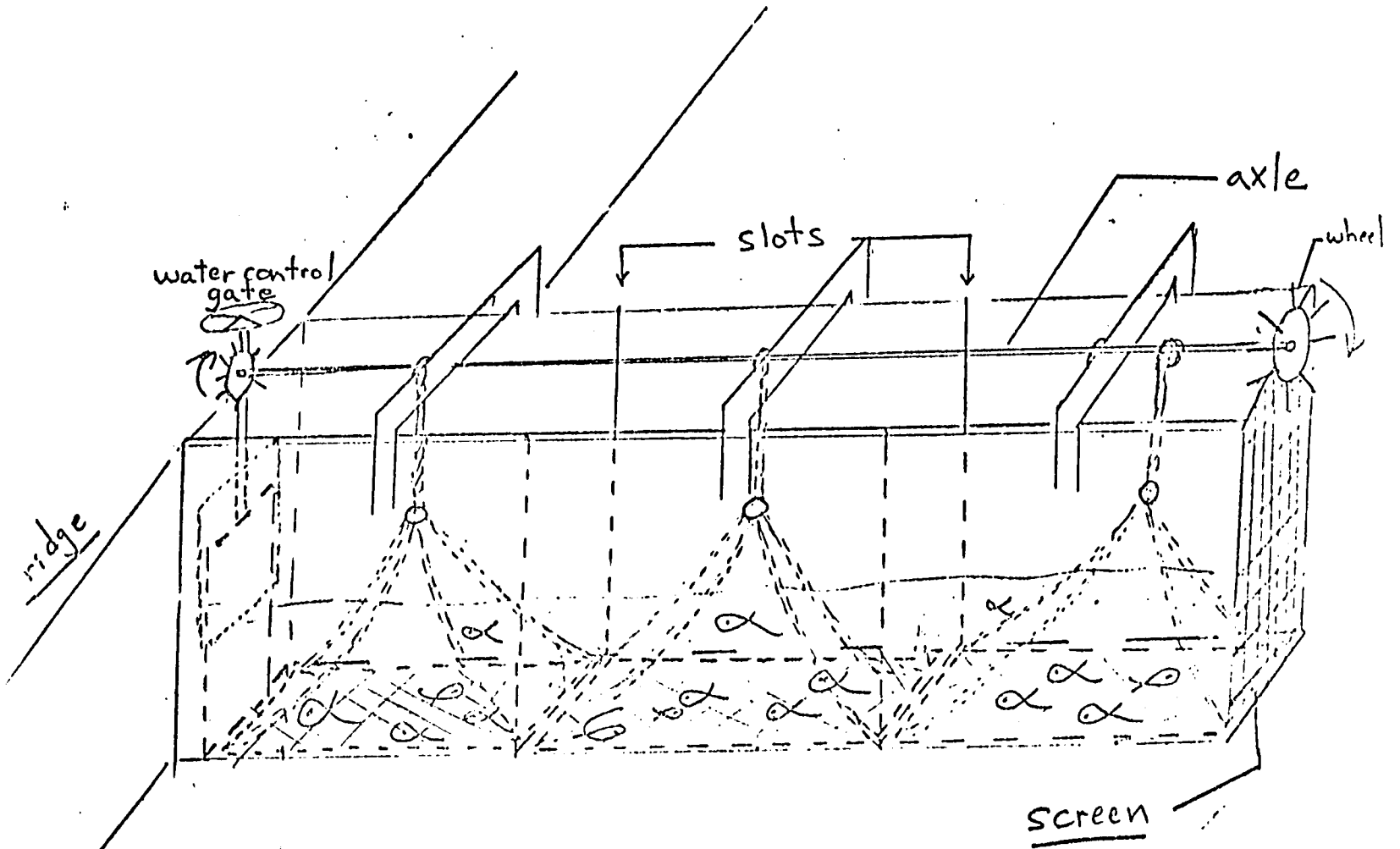
Jonas Sampaio has recently installed a series of 10 light posts through the center of the 45-hectare pond to attract insects at night. This is a new innovation in the region and he is very optimistic about increasing his mandi production because the price for mandi is greater than for other species raised.

A unique method of supplemental feeding was developed by Jonas Sampaio. In January and February, the markets of the Penedo region are flooded with an overabundance of mangos. During this time, approximately 60 days before harvesting fish, the Fazenda Cambraia buys part of this production for feeding the fish, especially the curimata. Numerous women are employed to peel the mangos and place the fruit in the pond. It is a general belief that the curimata eat the mango and retain the fruit's yellow color in their meat--the color preferred by the consumer.

The Fazenda Cambraia has had no problems with water quality until this year when 15,000 fish were lost due to an apparent oxygen depletion and possible temperature shock when the gates from the Sao Francisco River were opened to let in a great volume of much colder river water to solve the oxygen problem. The oxygen problem originated during two weeks of exceptionally hot weather when the ponds were nearly clogged with aquatic vegetation.

Methods of harvest rely on the fact that the cultured indigenous species enter lateral lakes naturally during rising waters and exit as the water recedes. Because of this characteristic, harvesting fish is rather simplified. In the case of the Fazenda Cambraia, a rather elaborate and inventive "harvesting device" was constructed (Fig. 3). The canal connecting the river to the ponds is divided in the middle by two water control gates. Between the gates, the canal has vertical walls. This section is slotted in two locations to divide it into

FIGURE 3



Fish Harvesting Device

three equal compartments.

To affect a harvest, three equal-size metal screens with steel rod margins are lowered into the canal to fit horizontally in the bottom of each of the three compartments. Both gates are opened (the one nearest the river being covered with a screen) to drain the pond. As the fish descend and collect in the canal, both gates are closed, trapping the fish. Two metal screen dividers are then inserted into slots, dividing the number of fish to facilitate the harvest.

Mounted above the canal is an axle to which a wheel is connected for turning the axle. Ropes from the axle are tied to the metal screens on the bottom, one compartment at a time. The fish are then simply lifted out by winding the rope on the axle. The reason for the three compartments is to divide the number of fish to be sold on the market. One compartment is harvested each day while the others are left for marketing on the following days. In this way, opening the gates takes place only every three days. This same process is carried out over a period of 60 days, the fish always arriving fresh at the market daily.

Penedo, the principal market for farm-produced fish, is only 42 kilometers from the Atlantic Ocean where saltwater fish are readily available. But due to habit and tradition, only freshwater fish are accepted on the local market. The author visited a local fish market where the commercial river fishermen sell their catch and was amazed at the elevated prices obtained for tiny 50 to 150-gram curimata and piau.

Demand is extremely high for freshwater fish and prices of Cr\$5.00 to Cr\$6.00 (US\$0.84 to US\$1.00)/kilo (nearly those of beef) were the prices of the day for these extremely small fish. It should be noted that local commercial fishermen do not satisfy the demand. Fishing appears to be on the decline with

few catches of individual fish weighing more than a kilo being registered.

The Fazenda Cambraia has its own retail market in Neopolis, Sergipe, (across the river from Penedo). A large part of the harvest is sold there and the rest is taken to Penedo to be sold at its other retail outlet. Fish arrive at the market shortly after harvest. The size averages approximately one kilo for all fish; the weight obtained after 18 months in the ponds.

To prevent saturating the demand, harvesting is carried on over a two-month period. Highest demand for fish is during Easter week. Jonas Sampaio claims that he has sold as much as 6,000 kilos per day during this period.

The investment in dikes, canals, pumps, etc, on the Fazenda Cambraia has been Cr\$96,000 (US\$16,000). Profit after expenses during the last 18-month period was reported to be Cr\$70,000 (US\$11,667) approximately US\$212/hectare--an excellent sum for a Brazilian farmer.

Fazenda Santa Eliza

The Fazenda Santa Eliza, also owned by Jonas Sampaio, is situated approximately 12 kilometers upriver from Penedo in the state of Alagoas (Fig. 1). It includes a large lateral lake used for rice farming. On one arm of the lake there are four ponds totaling 16 hectares in size. These were constructed more than eight years ago for the first experience in fishculture.

The four ponds of varying sizes are constructed in a series; one pond draining into the other, the last one draining into the lake (Fig. 4). Each is connected by a sloped spillway fitted with a screen to prevent escape of fish. Separations are made by large dikes that protect against flooding.

The two lower ponds are easily filled by gravity from the lake when the river floods. The two upper ponds depend entirely upon rainwater that enters

São Francisco
entrance

FIGURE 4

Lateral
Lake

wire fencing

Fingerling
capture

dikes

spillway
screen

Pond -
4 ha.

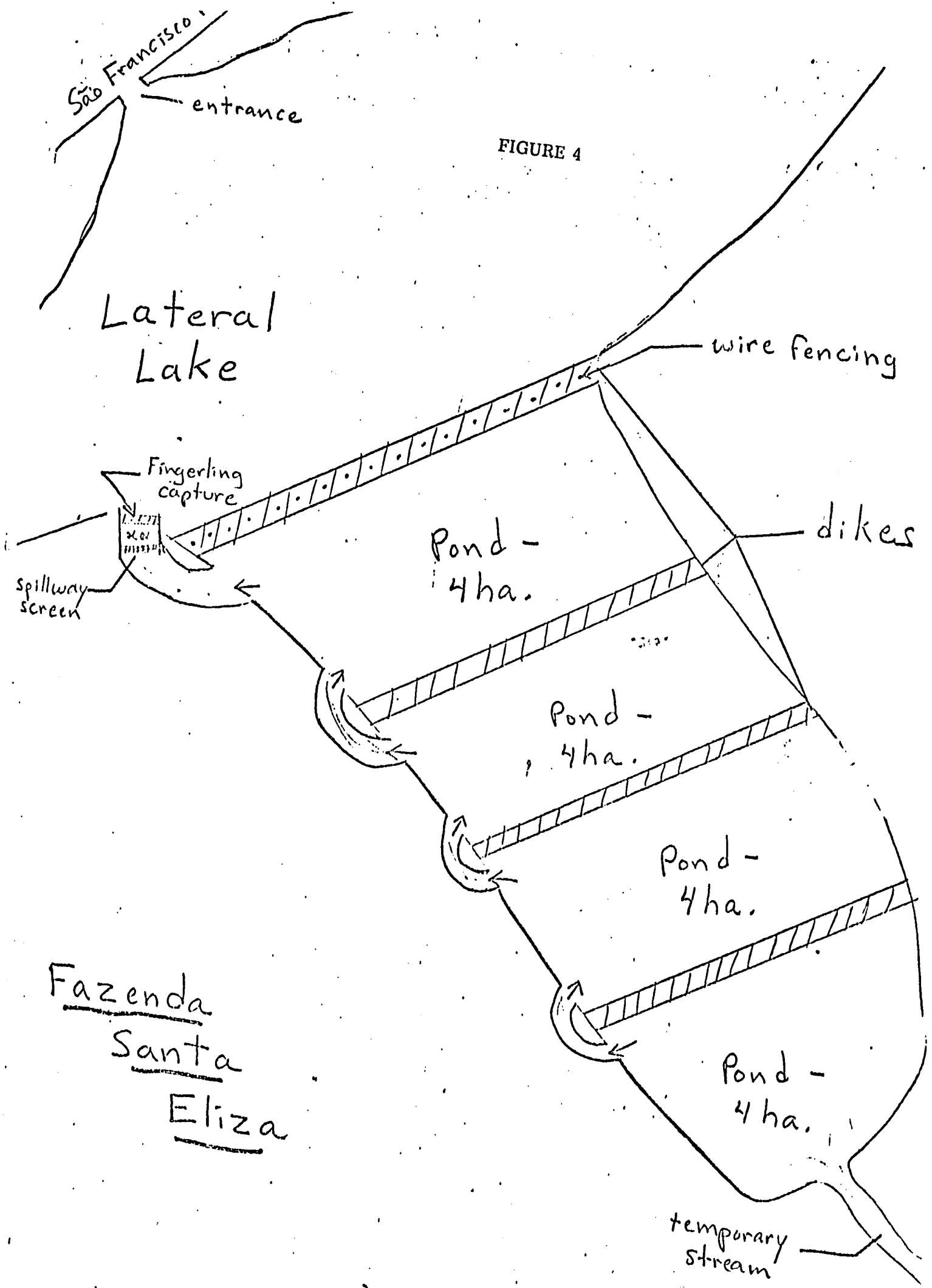
Pond -
4 ha.

Pond -
4 ha.

Fazenda
Santa
Eliza

Pond -
4 ha.

temporary
stream



by way of a temporary feeder stream. Never have there been any water quality problems, which is fortunate because three of the four ponds have no dependable source of fresh water in an emergency. During the dry season, ponds maintain their levels well and rarely need refilling.

The fingerling supply comes from the lateral lake. During September, when the ponds are stocked, it is raining and flowing water passes through all the ponds to the lake. Here, fish from the lake try to move up the small stream but are blocked by the first screen. As the fish collect below the spillway another wire screen is placed behind them. They are then easily captured; large fish being sold and fingerlings stocked in the ponds. Mandi amarelo are also captured in traps placed in the lake.

Stocking densities and sizes are the same as for the Fazenda Cambraia. Stocking is done in September so that an 18-month growing period coordinates with higher prices and large demand for fish during Easter week. Feeding and fertilizing are done by the same methods as the Fazenda Cambraia--organic fertilizer is placed in the pond a couple months before harvest along with mangos.

Water quality has never been a problem in these ponds. The only serious problems until now have been flooding and poachers. One year most of the fish escaped from the lower pond when the lake rose over the dike during exceptionally high water (Fig. 4). It occurred once thereafter but by placing wire fencing on the top of the first dike, losses were prevented. To solve the poaching problem, a guard is maintained and certain types of emergent vegetation are permitted to grow along the margins to prevent effective use of nets.

Harvest is carried out by eight to ten men in approximately two weeks. Ponds are drained; starting with the upper one. Since each pond will not drain completely, they must be harvested by seine nets. Remaining water is divided into four areas by bamboo separations to facilitate harvest by limiting the area to be seined. This prevents the disturbance of the entire bottom which could give rise to oxygen problems. One to two sections are harvested each day depending on the quantity of fish needed for the market. A large-mesh seine is used to capture the fish.

All fish are marketed fresh in the farm's private outlet in Penedo. In the 18-month period, a net profit of Cr\$25,000 (US\$4,166) was realized. Per hectare return was US\$260. The investment that has been made in this enterprise approximates Cr\$30,000 (US\$5,000) at 1965 prices.

Cooperativa Agricola de Maracuja

A passion fruit cooperative near Penedo has four ponds that total 22 hectares in area and at one time were used for raising fish. The ponds, built on a permanent stream that flows into the Sao Francisco River, were constructed under the leadership of Jonas Sampaio. Very poor production was obtained raising curimata and piau because of low fertility. Water continually flows through these deep ponds preventing nutrient build-ups.

Construction of the ponds is very elaborate and costly. The natural valley makes up the pond bottoms with large dikes being used for division. Each pond has a concrete spillway for passage of overflow. Metal screens are provided to prevent the escape of fish. To drain the ponds completely, each dike is fitted with a gate-controlled concrete culvert.

All four ponds have been abandoned. The only manner in which the

ponds could be used for fish production would be to completely divert the stream around the ponds or use rations for supplemental feeding of fish.

Fazenda Maranga

The owner of the Fazenda Maranga, Dr. Sivio, is just beginning to raise fish. The operation is based on that of Jonas Sampaio.

One pond of approximately 10 hectares was made from a lateral lake. Curimata and piau will be stocked. The pond is linked to Sao Francisco River by a canal. Tides provide a good supply of fresh water to the pond. (The land being just seven kilometers from the ocean receives a considerable tidal affect.)

The supply of fingerlings for stocking comes from a nearby lateral lake. The same capture methods will be used as described previously.

To supply the pond with a continual source of organic fertilizer, a feedlot for cattle was built within 50 meters of the pond.

Fazenda Bela Vista

The Fazenda Bela Vista owned by Ivan Lessa is also working with fish but in a much more rudimentary way. At a cost of Cr\$100,000 (US\$16,667), a 45-hectare reservoir was built to hold water for rice irrigation. Rice is planted in a 400-hectare lateral lake; the reservoir is an arm of this lake.

During March and April, the gates of the reservoir are opened to fill the reservoir by gravity. The reservoir could be filled in a matter of days but to permit the maximum number of fish enter, water is allowed to enter slowly over a period of two months. Frequent observations are made so that the gates are shut to prevent the escape of fish if the lake's water level drops below that of the reservoir. Fish are held in the reservoir until water is needed

for rice irrigation in July through September. At this time, fish are harvested as the water recedes.

Harvesting is accomplished with a metal screen seine. Fish are marketed directly to the consumer in Penedo. Ivan Lessa claims that this is the best profit-making venture existing. Last year his costs were nearly zero for producing 13,000 kilos fish that sold for Cr\$40,000 (US\$6,650)--a profit of US\$148/hectare/year. This profit covered the losses endured by the rice crop last year.

During the months that the reservoir is dry, he places cattle in it to eat the vegetation and fertilize the bottom.

Fazenda Botafogo

The Fazenda Botafogo, owned by Geraldo Lobo, works primarily as a fingerling supplier. Within the farm there is a 100-hectare lateral lake that is planted in rice. As the water is drained in preparation to plant rice, fish are captured; the larger fish are sold to middlemen and the fingerlings are placed in two ponds on either side of the drainage canal. Each pond is approximately 0.2 hectares. Fingerlings are held in these ponds from rice planting in May until they are purchased for stocking in September. As mentioned before, prices for fingerlings of curimata and piau are Cr\$0.10 and Cr\$0.15 for mandi.

From people connected with the Fazenda Botafogo, the author learned of other farmers that raise fish from fingerlings. Unfortunately, there was not time to visit them but plans for the next trip include these new contacts. Four of the farmers live on the Sergipe side of the river and one is situated on a small river near Junquero, Alagoas.

FUTURE PROSPECTS

The possibilities for expanding fishculture in the lower Sao Francisco River Valley are unlimited. Climate and water supply favor its expansion. Local markets may become over-supplied but many others exist at relatively short distances. What hinders expansion at this time is the lack of technical assistance provided by trained fisheries extensionists. Farmers have reached a level where improving their methods to obtain higher productions depends entirely upon outside technical support.

A part of the Penedo region falls under the responsibility of the DNOCS (National Department for Works Against the Drought). Ideally DNOCS, through its fisheries development program, should provide direct assistance to the farmers of the Penedo region. But because of distance from the DNOCS' headquarters in Fortaleza (1500 kms) and the shortage of trained personnel involved in fisheries work, direct involvement with the farmers is hardly feasible at this time.

The agency responsible for the development of the Sao Francisco River Valley is SUVALE (Superintendency for the Development of the Sao Francisco River Valley). Through an agreement, the ANCAR-Alagoas (Agriculture Extension Service) and SUVALE are collaborating on an extension project with rice farmers. The author made contact with both these agencies at their Penedo offices and found them receptive to the idea of DNOCS training one or more extensionists to work with the fish farmers. At present, an agreement is still pending but the author is optimistic that through further contacts between DNOCS, SUVALE, and ANCAR it may be possible in the future to train extensionists in fishculture. A relatively small investment could have great influence on the development of this fishculture potential.

CONCLUSION

The fishculture in Penedo is unique to Northeast Brazil. Farmers there are leading the way for its expansion to other regions. With the impetus provided by their initiative, an effective extension program could build upon the already existing fishculture base, implanting similar enterprises not only throughout the Sao Francisco River Valley but in other areas of the Northeast as well. The potential exists, extension is the key to further development.

ANNEX 4

RELATÓRIO DE VIAGEM AO AÇUDE "ARARAS" (RERIUTABA, CE), VISANDO CONHECER AS ATIVIDADES DA COOPERATIVA DE PESCADORES.

Nos dias 7 a 9 de fevereiro estive em Araras, conhecendo as atividades da Cooperativa de Pesca do Açude "Araras". Por causa da experiência que tive em cooperativas de pesca, principalmente no Estado de Minas Gerais, tive muito interesse em conhecer a Cooperativa de Araras.

No tempo da fundação da Cooperativa de Araras, aparentemente, faltou diversos trabalhos preliminares que poderiam ter garantido o êxito, ou pelo menos, um melhor andamento da Cooperativa atual. Os trabalhos fundamentais que não foram realizados são os de estudos de viabilidade socio-econômica e orientação básica do pescador em termos de cooperativismo.

A Cooperativa teve que enfrentar do principio alta incidência de pescadores analfabetos. Existe apenas o presidente que possui alfabetização adequada. Além dele há semi ou não alfabetizados. Não existem outros capazes de liderar o movimento cooperativista. Acrescento que o Presidente se acha em condições de saúde fraca e de idade avançada, não podendo mais cumprir o trabalho dinâmico que exige aquela posição. Se o estudo de viabilidade socio-econômica tivesse reconhecido estes problemas no principio, a cooperativa não teria sido inaugurada sem o treinamento do pessoal (Diretoria) e alfabetização. A Cooperativa se acha em condições precárias atualmente devido a falta destas exigências fundamentais.

Se todas as exigências acima tivessem sido cumpridas, economicamente, a Cooperativa possivelmente seria viável, mas somente através da participação

de maiores números de pescadores, para que possa produzir um grande volume de pescado, compensando assim a margem de lucro pequena entre o peixe atacado e o varejo. A produção atual da cooperativa é muito baixa por falta de maiores números de sócios ativos, que vem entregando seu pescado na mesma. O preço da praça, em Fortaleza, para peixe de água doce é relativamente baixo. O mercado de Fortaleza é atualmente o que oferece melhores condições de peixe entregue na cooperativa ela poderá ser autônoma (sem paternalismo do DNOCS - SUDENE) - pagando gerente e empregados além das despesas diversas que atualmente paga.

A Cooperativa poderá obter mais sócios ativos através de educação cooperativista. Do princípio faltou esta educação básica de cooperativismo. Antes de tudo deveria ter sido feito um trabalho de extensão cooperativista junto ao pescador para que ele compreendesse a ideia de cooperativismo. Isso possivelmente levaria dois ou três anos, contando com a organização de um programa de alfabetização antes de fundada a cooperativa. Através desta base colida o pescador poderia partir para a inauguração da Cooperativa.

Quais são as saídas agora?

1. O DNOCS poderia dar mais apoio a Cooperativa através de um programa intensivo de educação cooperativista e alfabetização. Além de continuar a fornecer o gerente e outros empregados, poderia empregar um a dois técnicos para fazer um trabalho desta natureza. Após dois a quatro anos, dependendo da intensidade do trabalho e aceitação do pescador, a cooperativa podia começar a funcionar sem o paternalismo do DNOCS e SUDENE. Infelizmente é uma ideia que acredito não ter muita esperança pois o pescador atualmente está muito supersticioso e desconfiado quanto a cooperativa. Seria

difícil convence-lo quanto aos benefícios depois de ter visto e acompanhado o fracasso.

2. O DNOCS podia continuar o paternalismo gastando um dinheiro infinito sem ver um retorno no melhoramento da vida do pescador e a pesca do açude.

3. O DNOCS podia retirar seus empregados da cooperativa logo e deixar funcionar sozinha. É uma saída fácil para o DNOCS mas drasticamente destrutivo para o futuro de cooperativas de qualquer natureza na região.

4. Em Araras, eu ouvi muita conversa sobre o "Termo Aditivo" que faria a cooperativa controlar a pesca do açude e obrigava o pescador associar-se a mesma. Este termo provavelmente resolveria os problemas financeiros da cooperativa e da exploração do pescador por intermediários, mas estaria contra um dos direitos principais da lei e espírito de cooperativismo que é a livre entrada e saída da cooperativa. Além das exigências legais nada se pode colocar no lugar de educação cooperativista para que o pescador compreenda a ideia de cooperativismo e participe junto a ela voluntariamente.

5. A melhor saída que vejo no momento para a Cooperativa de Araras é que suas atividades sejam encerradas e que se procure fundar uma colônia de pesca ou associação através da qual, orientação cooperativista e ensino básico possam ser prestados aos pescadores até que eles mesmos pudessem ter a capacidade de fundar e administrar a sua Cooperativa. É possível que um programa tal levaria anos para desempenhar, mas a longo prazo valeria o esforço para garantir o sucesso da futura Cooperativa.

ANNEX 5

RELATÓRIO DE VIAGEM A MORADA NOVA, VISANDO ASSISTIR A REUNIÃO DA COOPERATIVA DOS COLONOS

Estou atualmente escrevendo um manual de piscicultura intensiva dirigido principalmente aos colonos dos projetos de irrigação do DNOCS. Com o objetivo de conhecer o nível de educação e conhecimento dos colonos, para que o manual seja aproximadamente do mesmo nível técnico dos colonos, fui ao projeto de irrigação de Morada Nova dia 13 de fevereiro de 1973, para assistir uma assembleia geral da "Cooperativa dos Colonos".

Fiquei muito impressionada com a presença na assembleia de 95% dos cooperados, presença tal que vem sendo realizada por causa de um trabalho básico de orientação cooperativista criando interesse no cooperado. A reunião foi dirigida pelos próprios cooperados, com pouca direção e assistência requeridas dos dois assistentes sociais presenciando a assembleia. Isto já é um indicativo que a maioria dos cooperados compreendem o que é uma cooperativa e como deve ser a sua participação junto à cooperativa.

Na reunião foi discutido com franqueza entre os colonos-cooperados diversos problemas que existem atualmente no projeto. De conversa dos cooperados era obvio de que Morada Nova está com bastante problemas a serem resolvidos, mas, sinceramente, tenho toda fé que com a boa vontade que eu vi na parte dos assistentes sociais do DNOCS como a dos colonos-cooperados para resolver os problemas cooperativamente, acredito que a cooperativa vai poder resolver muitos destes problemas.

A chave do sucesso a longo prazo de uma cooperativa, não é tanto o dinheiro, nem tanto o gerente - e a compreensão do cooperado que a

cooperativa trabalha para ele e somente com sua participação que haverá
êxito. Esta participação, cooperação e interesse do cooperado, somente vem
com orientação básica contínua.

A minha viagem foi muito útil no sentido que tenha conhecido o tipo
da pessoa que será o beneficiário do manual de piscicultura. Também o
encontro me deu a oportunidade de ver uma cooperativa sendo aparentemente
bem montada da maneira mais certa.