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CONSUMPTION/NUTRITION IMPACT EVALUATION COMPONENT
PANAMA MANAGED FISH PRODUCTION PROJECT

BACKGROUND

At the request of the Panama Mission, DS/N's Nutrition Economics RSSA arranged for Dr. Judith McGuire -- a nutrition planner experienced in community level nutrition planning and nutrition and dietary surveys in Central America -- to spend a month in Panama in November 1979 advising the Mission on its proposed Managed Fish Production project. McGuire had two objectives (1) to determine whether the analysis of the consumption impact of the project, contemplated in the PID, was feasible and, if she determined it was feasible, (2) to prepare a scope of work for the analysis which included requirements for base-line and follow-up data collection. To gain the information necessary to make such a determination, McGuire visited 13 fishponds in the Veraguas region during her TDY and interviewed numberous participants and potential participants in community fish ponds projects.

This is to be a pilot project, so finances will be provided for the construction of only 30 demonstration ponds in nutritionally at risk villages. Because the project is expected to provide a basis for evaluating the need for and feasibility of a much larger fish program, much emphasis is to be placed on project evaluation. Thus, according to the PID, the project will be designed to provide detailed information on changes in food consumption patterns resulting from the development of ponds, as well as information on pond construction and operating costs and whatever other data is necessary to evaluate any remaining questions about the economic, technical and social feasibility of managed fish ponds in Panama.

McGuire's report (attached) focuses primarily on the questions of feasibility--can the consumption impact of the project be measured -- and methodology -- what is the best way to measure that impact. Her report also includes suggested criteria for selecting demonstration villages (pp. 40-41) and comments on operational problems she observed which, if not dealt with satisfactorily during the project's design and/or implementation stages, could interfere with the accomplishment of the project's nutrition objectives (pp. 42-46). At the end of her report (p. 46), McGuire posed an even more fundamental question: under prospective conditions, do village fish ponds represent the most cost-effective means of increasing protein intake among the nutritionally at risk segments of Panama's village population? This question is equally, if not more, relevant to village fish ponds as a means of increasing caloric intake.

EVALUATION FEASIBILITY AND METHODOLOGY

McGuire concludes that the fish pond project can be expected to have a positive nutritional impact if (1) the communities where the fish ponds are constructed are in areas dependent on rice and tubers and (2) if the fish ponds are harvested weekly or ways are found to preserve the fish for more than the ten days that they can be safely stored now.

McGuire recommends using changes in protein intake as the major indicator of the project's nutritional impact. Since fish produced, can also be sold, bartered and/or given away and other food purchased/received, McGuire also recommends collecting information on all food consumed by the household and household food and non-food expenditures. The PID's stated goal is "to improve the nutritional status of the rural poor in Panama." DAEC reviewers have questioned how the Mission expected this goal to be achieved -- whether through increases in on-site fish consumption or as a result of the increases in incomes obtained through selling the fish -- and recommended that the strategy contemplated be clearly spelled out in the project paper. If information on household food consumption patterns and expenditures is collected, as McGuire recommends, the indirect (i.e. through income increases) as well as direct impacts of the project should be measurable, allbeit at a higher cost than if changes in protein consumption alone were measured. McGuire also recommends against trying to use changes in biochemical measures, height and weight, morbidity and infant mortality, etc. as measures of project success, due to the many factors which influence malnutrition and the complexity of the relationships among them.

Four alternative evaluation methodologies are presented in the attached papers. McGuire developed two and Jon Hitchings (an agricultural economist with DS/N's Nutrition Economics RSSA) developed the other two using McGuire's report as a basis. All four alternatives (1) involve much the same survey preparations (McGuire, p. 22), (2) take cognizance of probable seasonal differences in levels/patterns of consumption between the pre-harvest/low food availability period of June to August and the post/harvest period of January to March and (3) provide a bsis for estimating the extent to which fish is substituted for other foods, fish ponds affect participant's income/employment opportunities, etc.

A brief summary of the four evaluation methods follows:

Option A: Uses the individual household as its own control and determines fish pond impact by using paired tests. This option necessitates making several observations of one-day consumption and expenditures in each household within each round of interviews. (McGuire p. 21).

Option B: Uses community-level data to compare average intake by season before and after the fish pond intervention. Since population averages would be used, only one observation per household would be necessary each round. (McGuire p. 21).

Option C: Modifies Option A by (1) confining the survey to a sample of the affected villages, (2) interviewing a random sample of only half the households in villages of more than 40 households, (3) including a measure of time since pond-harvest, and (4) adding a "village" and a "co-op" survey form to be used in those villages falling in the sample survey. The village survey form would be used to record the more stable features of the village such as location with respect to roads and markets, access to advice from fish pond extension agents, the number of households, the proximity to non-agricultural employment possibilities, fixed factors that may affect pond productivity such as altitude or temperature, the fish pond size, etc. The co-op survey form, on the other hand, would be used to obtain information from co-op managers about village participation, fish feed inputs into the pond, harvest frequency, yields, distribution method, etc. (Hitchings, p. 21).

Option D: Modifies Option C by including all villages in order to provide a sample large enough at the village level to extrapolate from the survey findings to other possible fish pond projects. (Hitchings, p. 13).

Option B, because it provides for only one observation of food consumption per household per round, would provide no basis for determining the effects of the fish ponds on different types of households in the village. While this would not seriously impair its use for overall evaluation of the costs and benefits of the project, lack of adequate household data would preclude estimates of the fish pond's impacts on the poorer village households -- those likely to be at greatest nutritional risk. To minimize the impact of large day-to-day variations in intake, information on household food consumption will be collected for three consecutive days in Options A, C and D. In Options C and D the three day periods would be spread accross the harvest cycle by design, so that some households would be observed during, just after, long after and midway between harvests. Options C and D also provide for follow-up interviews during the fifth year of the project in order to capture its longer-term impacts. All four options envision the collection of data on household incomes and expenditures in addition to food consumption, although Hitchings questions whether such data will be worth the extra cost.

Neither McGuire nor Hitchings attempted to estimate the total costs of their respective alternative methods. In a partial cost budget, McGuire calculated the variable costs of Option A at $43,500 and Option B at $20,800 (McGuire, p. 34). On a comparable basis, the costs of Option C are estimated at $45,000 and Option D at $66,000. (Hitchings, pp. 16-17).

RECOMMENDATIONS

The Nutrition Economics Group's recommendation to the Panama Mission is to build the consumption/nutrition impact evaluation component along the lines of Option D. If the added costs of collecting information in the additional villages, information needed to guide the future expansion of the project, cannot be accomodated, our recommendation is to shift to Option C. Option C, like Option A, will provide an adequate basis for evaluating the project's impact at the household level. However, for very little additional cost, Option C will also provide additional data on the village and the co-op operations which can be used to enrich the household level evaluation. Option C also includes provisions for evaluating the longer-term impact of the project.

The expenses entailed in carrying out the type impact evaluation envisioned will not be warranted unless the probability is high that there will be an impact to evaluate, i.e. that the ponds are constructed and operated effectively and that sufficient fish are produced and distributed. McGuire's comments about project management, content, allocation of funds, etc., although not directly concerned with the impact evaluation component of the project, are relevant therefore and should be considered by the Mission during the development of the project paper.

A METHODOLOGY FOR EVALUATING THE NUTRITIONAL IMPACT OF THE USAID PANAMA MANAGED FISHPOND PROJECT

A REPORT TO THE USDA NUTRITION ECONOMICS GROUP
UNDER CONTRACT NO. 53-319r-0-45

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Under RSSA 3-77 (Economic Analysis of Agricultural Policies) with the Office of Nutrition, Development Support Bureau, AID

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Introduction

The contractor was requested to review the managed fishpond project of USAID and the National Directorate of Aquaculture (DINAAC) in Panama. In Panama, from 26 November 1979 to 15 Demcember1979, she reviewed project documents and other relevant materials, met with representatives of pertinent organizations (Appendix IV), visited a number of fishpond projects in Veraguas Province (Appendix V) and interviewed participants and potential participants in community fishpond projects. The following report summarizes: (d) findings from interviews in the field and (b) options for evaluating the nutritional impact of the program-including a detailed scope of work for the evaluation.

The report indicates that:

(a) The managed fishpond program can have an impact on populations which are remote and subsist mostly on rice and tubers if and only if adequate amounts of fish are harvested weekly to be distributed to every family. The amount of fish depends on the targets set and the size of the pond depends on amounts of fish needed to be harvested weekly.

(b) The evaluation of the 30 demonstration ponds should be by interview carried out in all homes (15-30 families per community) which eliits information on consumption, expenses and income. Interviews will take place during the preharvest (June-August) and postharvest (January-March) periods both before and after the fishpond is functioning. Impact will be measured as a change in protein intake per consumption unit and income and expenditures per capita.

(1) In Option A, individual households are the focus of the evaluation. Each household's one-day consumption and expenditure will be obtained three times in each pre-and post-harvest season. Households will be used as their own controls and paired tests (2 way analysis of variance) will be used to test whether consumption changed.

(2) In Option B, communities are the focuse and each household need only be evaluated once. Group data, using communities as their own controls, will be used to test differences in consumption by season due to the fishpond.

(3) Option A is preferred because it overcomes the problems of large inter- and intra-household variations, it is a more powerful statistical tool, and it allows investigation of intervening variables.

(4) Regression analysis will be used in Option A to evaluate the realtionship between expenditures and consumption. In both options, regression analysis will be used to relate income expenditure and consumption across all villages using season and fishpond function as dummy variables.

(c) Target levels of change must be set based on baseline data and those levels in turn should determine size and harvesting of fishponds. They must take into account maximum frequency of fish eating desired.

(d) The non-nutritional impacts of the program may be just as important as the nutritional ones in improving the quality of life in the target communities.

DRAFT
J. McGuire
12/11/79

Chapter 1. Reconnaissance

Between 5 and 7 December 1979, three communities in Veraguas were visited. In each place the investigator interviewed several villagers about family composition, morbidity, food habits, breast-feeding and weaning practices, agriculture, seasonal changes, income and expenditures and use of fish. The communities are described below. (Appendix I)

I. Description of the Communities

A. Rincon de las Palmas -- 5 December

The village is located on a moderately good dirt road, about 20 minutes' driving time from the Pan American Highway; about 1 hour from Santiago, the provincial capital. In 1970 the population was 230 in 51 households, all Latinos. While several families live at a distance from the central compound, most reside close together along the dirt road. In spite of the fact that some government services have reached Rincon (primary school, potable water system), the residents are isolated from the health and market systems. The nearest health centers are about an hour away (one is reached on foot, and the other can be reached by local transport at a charge of $0.40). Except for semi-weekly sales of fish by outside entrepreneurs, there is no regular participation in the regional market system (centered in Santiago).

Houses are primarily of adobe brick walls with corrugated metal roofs but many people live in mud and wattle homes with thatched roofs. Most households have latrines.

While practically all residents engage in subsistence agriculture, they also earn an income from cutting sugar cane near Santiago during several months of the year. Other local employment in agriculture is also available intermittently.

Rincon is touted by the extension agents as one of the most well-organized communities in the fishpond project. Thirty-one people -- a little over one-third of the households -- are members of the fishpond cooperative. Their last harvest, in mid-October, yielded 530 pounds of fish, all of which was sold to pay for concentrated fish food. Members bought fish at $0.20/lb. and non-members at $0.40/lb.

B. Buenos Aires - 6 December

To reach Buenos Aires one must travel about 30 km. over a very poor dirt road that is often impassable in the rainy season. In a 4-wheel vehicle it took 2-1/2-3-1/2 hours to traverse the distance between the Pan American Highway and the village. On foot, it takes 6-8 hours. Commercial goods, fresh foods, and meat rarely reach the village from outside.

The community, composed of indigenous Guaymi people, has only recently been centralized. The overall population of Buenos Aires is 150 but the dispersed population of 20 surrounding communities, each with populations ranging from 60 to 100 people, are within the sphere of influence of the cacique (mayor) of Buenos Aires. Buenos Aires has benefited from several government programs, especially those focussed on the indigenous populations. A hand pump provides water for the population year-round and there

is a health post in the village intermittently served by practicantes (medical students). The major bottleneck in provision of health services seems to be lack of medicines, mostly due to the village's isolation. There are also two schools in the town - an elementary school and a ciclo basico.*

Housing is primarily of the mud and wattle variety but a few homes have metal roofs (the remainder being of straw). Many of the households have latrines.

As in other parts of Veraguas the soil is poor there and the residents complained of low productivity of the soil. The local crops are tubers, corn and rice. The cooperative owns 120 head of cattle of which some are sold three times a year.

During the sugar harvest men migrate to Santiago for 2-4 weeks at a time to cut cane. This provides the major influx of money to the village.

Buenos Aires is the showcase of the fish pond experiment. It has been visited by all the major Panamanian leaders and by U.S. Senator Long (the small local airfield has made such visits possible). All of the residents of Buenos Aires are members of the fish pond cooperative.

The 4 fish ponds are stocked with several varieties of fish and the offspring of the Tilapia are harvested weekly. Fecal matter from a pig raising project fertilizes the fish pond (no other fish food is added) and the costs of maintaining the pigs is covered by profits from selling them. The animals are marketed by the DINAAC personnel who also purchase

*This is an educational program for rural junior high school aged children which teaches them fundamentals of agriculture, mechanics, and household maintenance in addition to the basic educational curriculum. The school planned for this village has been built but the government has delayed putting the program into operation.

pig feed and carry it to the village.

Runoff from one of the ponds and the fertile bottom soil are added to the two gardens in which grows cabbage, beans, cucumbers, tomatoes, lettuce, spinach, green pepper, chives and eggplant.

The last harvest from the fish ponds had taken place 10 days before, at which time the pond was emptied in order to clean out the sediment which had built up. None of the other ponds was in weekly use at the time of the visit.

C. Peru -- 7 December

The town of Peru, located about 1 mile from the Pan American Highway, belongs to an asentimiento* which provides employment for many of the residents. The population -- 89 people in 17 households according to the 1970 census - lives in mud and wattle houses with metal or straw roofs. The government has provided the residents with a hand-pumped water system but the nearest school and health center are several miles away.

Due to their proximity to the Pan American Highway, the residents have access to commercial markets and transportation which enables the men to work in nearby towns of Divisa and Santiago. Little or none of the land is cultivated privately by Peruanos and the economy is nearly entirely a cash economy.

*A government project relocating rural farmers and utilizing them in higher technology, commercial agriculture. The men are paid daily wages but not usually given subsistence agricultural plots.

There is no fish pond in Peru but the people have organized a cooperative to request that technical assistance be given them to construct a pond.

The town of Peru was only briefly visited because most of the women had gone to the elementary schools a few miles distant to observe the Mother's Day presentations of their children. The women were interviewed at the school.

II. Findings from Preliminary Reconnaisance of Food System

Not all questions in the format (Appendix I) were asked of every subject and frequently male and female heads of household were simultaneously interviewed. The "24-hour recall" was of total food consumption by the household. Questions were also asked about food given to preschool children, if present in the household.

Difficulty was encountered in obtaining accurate estimates of non-meal eating (numerous bananas and oranges were consumed and parents could not say how much fruit their children had eaten). As such, it is probable that energy but not protein was underestimated in this inquest.

While quantitative data will be presented, the reader must keep in mind that the measurements were not precise (no leftovers were available to be weighed) and estimates had to be made of weights of tubers used since the weighing scale was inadequate to weigh the 6-8 pound roots.

The sampling was not scientific either. The investigator requested of DINAAC that she be taken to one village that had recently harvested fish, to one that had a fish pond but had not recently harvested fish, and to one that had no fish pond. In each village, houses were chosen at random without any criteria for selection except that they were within

walking distance. The women from Peru, interviewed at the elementary school, were self-selected. In spite of these limitations the investigation provided good information about food patterns and about probable difficulties that will be encountered in future, more precise, investigations.

A. Demographics

Four women were interviewed in each village. Of the 12 women interviewed, 4 were in their 20's, 4 were in their 30's and 4 above 40 years old. All of them had children living at home, but only eight women had preschool children in the home (a total of 17 preschool children; some being grandchildren of the subjects). The 12 women had born 79 children, of whom 13 had died. Three women had had miscarrages.

All women were united or married, although the men with whom they lived intermittently migrated to work or study. None of the women worked for wages. All of the subjects interviewed had cedulas* for themselves and their children.

B. Food Consumption

The diet of the rural people is largely composed of rice, yuca** and name**, which are consumed daily by most people. These foods plus bananas provide the bulk of the energy intake but all are of low protein quality and quantity.

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* birth certification

**tuberous roots; name = Dioscorea otoe = taro root

High quality protein foods are consumed infrequently. The figures on meat consumption (beef, pork and chicken) were markedly higher in Peru, which has easy access to the marketing system, than in Rincon and Buenos Aires (10.5 days per month and 3.7 days per month, respectively). By the same token, fish consumption was much higher in Buenos Aires, which has weekly fish harvests, than it was in the other two villages (14 days per month and 6.2 days per month, respectively). The worst off community was Rincon which had neither regular meat supplies nor regular fish catches. It should be noted here that in Buenos Aires and Rincon fish and large shrimp (1/4 lb) were trapped in the rivers from time to time.

Analysis of the previous day's consumption indicated that energy and protein were lacking in the diets of these ($1334^{\pm}$ 445 kcal and $43.6^{\pm}$ 18.7 gm. protein per consumption unit or 67% and 73% of recommended values, respectively) people. It must be mentioned, however, that the quality of the protein is extremely low and that in two villages (Buenos Aires and Peru) the observed meat consumption was a typically high for their own stated frequencies of eating meat. For instance, the observed frequency of consuming beef would mean they ate meat 7.5 days per month but they estimated that they ate meat once a month. Only fish consumption of all the protein foods occurred less frequently in this investigation than would have been expected from their estimated frequency of eating it. The slaughter of cattle in Buenos Aires is infrequent so the arrival of the investigator the day after a cow had been slaughtered was an unfortunate piece of luck. For the aforementioned reasons, it is assumed that quality of the diets (in terms of high quality protein consumption) is even lower than that observed.

The protein density of the diets (gm. protein per 100 kcal.) was 2.5 overall which would be adequate for most age groups (requirements range from 2.0 - 3.3 gm. protein/100 kcal.) if the protein quality were high (which it is not). Taking the usual diets, however, (i.e. those without meat) the protein density is 2.1 gm/100 kcal (barely adequate) and the worst diets (those without meat, milk or beans) had a protein density of 1.6 gm/100 Kcal, both of which indicate insufficiency of protein, especially high quality protein.

If the nutrient density of the usual foods were examined (Table 1), it is clear that the rural population maximizes bulk and energy intake (given the predominance of rice and tubers) and minimizes cost. They also choose the protein sources of least density (either in terms of bulk or energy) because those foods are locally available. Where bulky high carbohydrate foods like these predominate in the diet, small chidren suffer nutritionally because their stomachs are too small to eat enough volume of food to achieve protein sufficiency. The protein density of fish makes it an excellent substitute for any component of the present diet (volume for volume or calorie for calorie).

Data on food expenditures and food consumption for the previous week were difficult to obtain. With probing such data might be obtainable but great interest was not shown in household accounting. This applies equally well to income estimates which were difficult to pin down even for limited time spans (e.g. how many weeks did the man work cutting cane in the last dry season).

The seasonality of food consumption was related to outside income and to agricultural seasons (Figure 1). The worst time of year is June-August, when neither income nor food are available, and abundance is during the harvest months (January-March) when men earn an outside income.

Other seasonal factors such as rain, the school year, and holidays were not mentioned as affecting either income or food availablility.

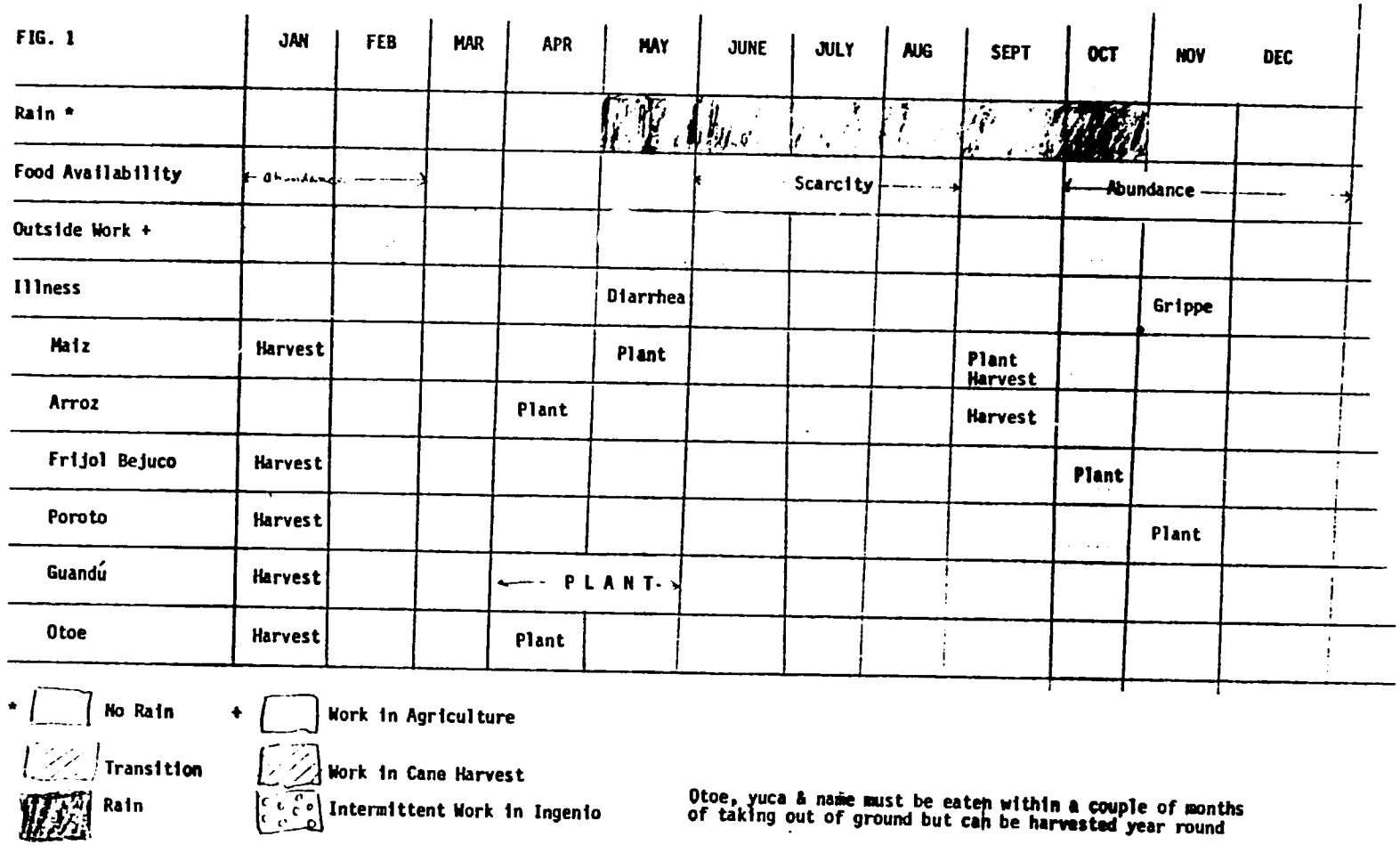
TABLE 1

Nutrient Density (From INCAP Food Component Tables)

(Assume all grains + beans cooked; 1 gm dry rice or corn = 2g. cooked; 1 g. dry bean = 3.6g. cooked)

	gm protein/100 cal	gm protein/100 gm	Cal/100 gm	Price/lb.
Rice	2.0	3.6	180	$ .20
Corn	1.9	3.6	190	$ .10
Name	1.9	1.9	100	Subsistence
Yuca	0.5	0.8	150	Subsistence
Banana	1.2	1.2	100	Subsistence
Fish	20.1	20.0	100	$ .40
Beef	18.0	21.0	110	$ .30
Chicken	10.6	18.0	170	$ .80
Beans	6.6	7.8	180	$.35 - .40
Otoe	1.2	1.5	130	Subsistence

FIG. 1 - SEASONAL FACTORS IN NUTRITION



Children are breastfed for 1-2 years and outside foods are given to them are early as 4 months. Apparently no special foods are either prescribed or proscribed for the nursing infant or weanling. Table foods are the most common first foods of babies. When subjects were asked if they gave fish to children, including nursing infants, the responses were positive in all cases and usually implied that of course fish was given to children.

Regarding distribution of food within the household, responses showed that children were allocated at least their share and in some cases given preference over the parents because an adult "knows how to withstand hunger" ("uno sabe aguantar hambre"). Since the littlest child often eats from its mother's plate it would be difficult to measure the child's consumption in order to prove or disprove this point.

C. Morbidity

The change of seasons (April-May; November-December) was cited by most people as a time of increased incidence of illness (diarrhea in the spring and colds in the fall) but the rainy season was thought to be a time of higher overall incidence of disease.

The morbidity of the week prior to this interview was moderate (15 out of 59 people became ill for 87 of 413 person days) and entirely comprised of upper respiratory infections (supporting their assessment of typology of seasonal illness). All in all the local people felt their children were not sick frequently but perceptions of illness (especially diarrhea) are relative to the "normal" level of illness. Several people did mention that the children suffered from parasites but this investigator noted few children with the "bloated belly" look which often accompanies serious parasitic infection.

D. Agriculture Production

Data on agricultural production were difficult to obtain because:

(a) people do not know the size of their plots (they measure in hectares).

(b) many people only casually measure their production, and

(c) the root crops are not harvested all at once but continuously. After the roots are removed from the ground, the proportions sold and kept for home use vary from month to month.

(d) agricultural plots are frequently shared with sons and brothers so it is difficult to gauge the food flows to each individual household that works the unit of land.

In general, rice, corn, tubers and beans are planted. Beans - guandu, poroto, and frijol de bejuco* - are minor crops of which the yield is usually consumed in the household and does not last for the year.

In Rincon the farmers said they were currently planting more corn than they had in the past because they could get a better price whereas formerly more rice was planted. Otherwise the subjects did not mention any changes in cropping patterns in recent years.

E. Income and Expenditures

As mentioned above, data on income and expenditures were difficult to obtain. Men cut cane and work in the sugar mill from January to March. They may also obtain employment in May and June after they have planted their crops but on the whole the work was intermittent and short term.

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*guandu = pigeon peas; poroto = kideny beans; frijol de bejuco? (small red bean)

Local cattle owners employ some men to fix fences but the extent of locally available work was not investigated. Several families also received regular income from older children who were working in the city.

Women and men engaged in small-scale crafts production (straw hats and woven bags) but larger scale entrepreneurial ventures were not encountered. None of the children or women were employed in the formal labor sector.

Expenditures were largely on food (ranging from 22-63% of the previous week's expenditures). Although food was scarcest in the preharvest season, people stated that they always ate the same types of food, although it had to be purchased during the worst months. When asked whether they ever owed money to the local stores, most people said they sometimes owed money but preferred to pay it off as fast as possible. Others said they would rather go hungry than owe money for food. This leads one to question how, given the indicated employment patterns, people pay for food in the preharvest period.

In all communities pumped water was available at central locations (although the water system in Rincon was in temporary disrepair) and latrines were found at most houses. The use of pumped water and latrines undoubtedly contributes to lower gastrointestinal morbidity.

F. Fish Ponds and Fish Utilization

The fish ponds were universally accepted as a source of food. Reasons for participation varied from food need and curiosity to the perceived advantages of working cooperatively. Those who did not have a fish pond (Peru) looked forward to the communal effort as well as to the fish as food.

In Rincon most of the population is not associated with the fish pond project. When asked why, members claimed it was because the non-members did not have enough time, they were lazy, or they were not "joiners" ("no se meten en nada"). The non-members claimed they were not members because there had been conflicts among members (some having withdrawn) and between members and teachers in the school. Others said they were not members because they had no time.

Without fail the women in each village were the initiators and active participants in the fish pond projects. They helped run the organizations and were outspoken participants at all levels. Not coincidentally, the fish pond projects (at least in the Latin areas) usually evolve from the Clubs de Amas de Casa (Housewives Clubs) and one of the strongest and most effective community organizers on the DINAAC staff is a woman.

Fish harvested from the ponds is handled in two ways in the home - it is used immediately (in soup, fried, or stewed) or it is salted and dried in the sun. The dried fish lasts about a week before becoming "putrid" or "rancid", according to the subjects. As a result, fish lasts no more than 10 days after it is harvested and most people used up their allotments in 2-4 days.

In Rincon, even the members of the fish pond cooperative must buy fish from one pond (albeit, at half-price, $0.20/lb.) but they are allowed to buy as much as they want. Selling the fish is necessary to pay for the fish food concentrate which is purchased and brought to Rincon by DINAAC extension agents. One man bought 17 lbs. for his family (he owns a refrigerator). The fish pond is completely harvested every 3-4 months and restocked. It is clear that non-members benefit from the increased

availability of fish (although at the same price as commercial fish) because it is readily available and very fresh.

In Buenos Aires, fish are allocated to members on the basis of work contributions. Most families received 8 pounds at the last harvest (which emptied the pond). Usual weekly catches averaged 50-70 pounds or about 1/3 lb. of fish per person per week. It was not clear whether fish was sold in the surrounding communities.

People of Buenos Aires are also given portions of the vegetable crop from the garden. While this may be an intermittent source of vitamins (which are probably lacking, at least seasonally, in the diet), the garden also serves to introduce people to vegetables which were previously uncommon, which may in turn encourage people to plant vegetables on their own.

As mentioned above, where there were rivers people were accustomed to catching and trapping fish and shrimp. While this is a source of high quality protein, the amounts are neither sufficiently large nor sufficiently frequent to cause major changes in nutritional status.

III. Conclusions from Interviews

The reconnaisance trip in the field brought to light several points which are important to the evaluation of the nutritional impact of the fish pond project:

1) Energy as well as protein is limited in the diet of the rural population because of
   a) Inaccessibility
   b) Cropping patterns
   c) Low agricultural productivity

d) Low income

e) Low market access

2) Protein intake is low in quantity as well as quality because of

a) Predominance of tubers and bananas in diet

b) Low intake of beans, meat, fowl, pork, and fish

c) Low complementarity of proteins in diet

3) High quality protein foods are infrequently consumed because of

a) Low local production

b) Communities not reached by markets

c) Low income

4) Seasonal variations in food consumption are prominent, and are influenced by

a) Agricultural production cycles

b) Agricultural productivity

c) Seasonal income and employment patterns

5) Fish ponds can comprise a significant contribution toward improving the quality of protein in the diets if and only if fish can be consumed regularly and frequently by all members of the family.

Chapter 2. Evaluating Impacts of the Managed Fishpond Project

I. Measurement of Consumption, Expenses, and Income

A. Justification

The purpose of the managed fishpond project is to improve protein nutrition. While surveys have indicated that protein energy malnutrition is probably serious /e.g. 1/4 of preschool population has 2nd or 3rd degree malnutrition and there is a high infant mortality from nutrition-related diseases (1-3)/, the cause of the problem has not been clearly defined. Evidence from the preliminary reconnasisance described here indicates that the problems may be due in part to low availability of protein-rich foods. The fishpond program was designed to address the nutrition problem through increasing consumption of fish.

The project currently under consideration is the construction of 30 demonstration ponds in high risk villages* through introduction of pig raising to the fishpond scheme and use of fertile tilapia fish Weekly harvests of fish will thus increase local protein consumption.

Each village will be composed of 15-30 households (according to Dr. Pretto) which makes it possible and desirable to study the effect of the fish ponds on all families in the village** The villages have distinct matrices of environmental and socio-economic factors which impinge

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1. INCAP survey 1967
2. MOH survey 1975
3. Poynor report 1979

* See below for suggestions about criteria for selecting villages.

** See below for analytical methods

on human ecology (including nutrition) which make them individuals. Grouping disimilar communities together for the sake of analysis (i.e. grouping all data from pretest and posttest) is likely to conceal important differences rather than allow for more decisive conclusions in spite of the fact that the "n" will be quite large.

It is not likely that any effect will be seen in biochemical measures (such as blood albumen), in weight or height of the children relative to standards, or in morbidity. Blood albumen changes, for instance, are usually noted only in severe malnutrition. While growth rates may change, on the other hand, the small sample size within each village, the fact that the energy and vitamins are also insufficient, and that a myriad of other factors influence growth rates argue against anthropometry to evaluate this program. Furthermore, there is no evidence that improved protein quality or quantity, in and of itself, will improve growth performance relative to standards.

Morbidity is already low - as would be expected from areas that have potable water and latrines - although seasonal changes bring about short term increases in incidence of diarrhea and upper respiratory infections. Given relatively low incidence of disease, small sample size, and multiple etiologies of disease, it would be difficult to establish any causal relationship between an increase in high quality protein intakes and decreased morbidity.

Equally difficult to use would be infant mortality figures which are subject to large errors when calculated for small populations. The impact of nonnutritional factors on morbidity and mortality further limits the utility of these variables as monitoring or evaluation tools for this program.

Probably the best indicator of the nutritional effect of the fishpond project is consumption, particularly that of protein. Energy intake, food expenditures, and non-food expenditures may also be affected by the introduction of low-cost or free fish into the diet so those variables should be monitored as well. Since expenditures are related to income, it should also monitored.

While a cross-sectional survey of one day's intake provides sufficient information to estimate average intake of a population, it is not adequate to describe the usual individual intakes. To estimate usual individual* intakes, at least 3 days' intake are needed.

Option A will use the individual household as its own control and the impact of a fishpond will be tested using paired tests (see analysis). This option necessitates making several observations of one-day consumption and expenditure in each household within each round of interviews.

Option B uses community level data to compare average intake by season before and after intervention. Since population averages would be used, only one observation per household would be necessary each round.

The third Option (Appendix 3) considers the use of anthropometry to measure the impact of the fishponds on growth performance of preschool children.

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*The individual in this case is the consumption unit, be it a human being or a household

Seasonal factors are very important - food availability, household income, and food expenditures apparently exhibit marked seasonal fluctuations. The period of June to August, the preharvest period, is considered to be the time of low income, low food availability, and high food expenditures. The converse is true in the period from January to March. Therefore it is recommended that interviews be carried out in both of these 3-month periods in all villages. In that manner, consumption in each season will be compared before intervention and after intervention.

The effect of the fish pond on seasonal fluctuations should also be examined. Care must be taken to ensure that the fish ponds function normally during those seasons (It was found that some ponds are drained or lowered during the dry season, affecting harvesting schedules and yields).

B. Advance work required

Before the surveys take place, the communities should be censused and households enumerated. These data should be entered into a computer and household forms taken to the field and revised every time the survey crew carries out a round of interviews. It could take several days to census each community because dwellings are dispersed and heads of households may be difficult to locate. Each resident's name, sex, age, verification of birth date and location of residence should be requested. Identification of residence locations may require drafting a map of the area.

Prior to collection of data, the survey personnel will have to be trained by an experienced interviewer. It should require 3 days to train the teams in interviewing techniques, use of scales, familiarization with forms, and the scientific method. If possible, training should also

include practice sessions in the field.

C. Methods

In each household the following questions will be asked.

1. Who was present at each of the meals of the prior day (use census to prompt)
2. What was eaten the day before
   (a) Weigh as many items as possible.
   (b) "Recipes" used by the women (i.e. ask how each thing was made).
   (c) Prompt for easily forgotten items
      (1) Bananas
      (2) Sugar, oil, sauces
      (3) Fruits, especially those in season which are eaten continually.
      (4) Common drinks and gruels (chicheme, chicha, "crema" (of corn), coffee).
   (d) What foods preschoolers were allowed to eat.
   (e) If rice, yuca* or name**did not appear in previous day's diet, ask about whether they were used.
3. What was purchased the day before
   (a) Food (including salt, sugar, coffee, spices, soda, snack foods).
   (b) Clothing
   (c) Medicine
   (d) Medical/dental care

*Yuca = Manihot Spp. (cassava)
**Name = Dioscorea spp. (yam)

(e) Transportation

(f) Gifts or money transfers

(g) Rent

(h) Installment payments

(i) Fuel

(j) Soap

(k) Utilities

(l) Other

4. Were any gifts received the day before, including food?

5. Sources of income the week before

(a) Type of employment, total income

(b) Local casual labor

(c) Handicraft sales

(d) Sales of agricultural production

(e) Remittances from children or relatives

(f) Food for work (peones, juntas, etc.)

6. Local food prices of subsistence foods (ask of 1 of 5 families)

(a) Rice

(b) Corn

(c) Beans

(d) Eggs

(e) Chicken

(f) Yuca

(g) Name

(h) Sugar

The interviewers will be responsible for filling out the following forms:

Form 1: Household composition and attendance at meals of day before

Name Code Sex Age Breakfast Lunch Dinner

Form 2: Household food composition of day before (date)

Food Code Amount(converted to std. unit) Preschoolers given that food
ID No. 1 ID No. 2 ID No. 3

Form 3: Household expenses of week before (from (date) to (date))

Type Code Amount

Form 4: Household income of week before (from /date/ to /date/)

Type	Code	Amount
Formal sector		
Local/casual day labor		
Sales of agricultural production		
Handicrafts		
Remittances		
Food/work exchanges		Value of goods at current prices

Form 5: Current prices (requested from 1 of every 5 families)

Rice price/lb. milled _____ manotada _____

Corn price/lb. on ear _____ dried & milled _____

Sugar price/lb.

Beans price/lb. green _____ dried _____

Eggs price/egg

Chicken price per lb. on the hoof _____

Only the dietary interviews (Q. 2, Form 2) and the previous day's expenses (Q. 3, Form 3) will be enquired 3 times during each round of interviews in each village under Option A. Only one interview will be

made under Option B.

The coders will be responsible for checking the veracity of the forms, calculating the total consumption units (see Annex II), encoding the forms, and rechecking the codes, sending the cards to be punched, and verifying punched data.

D. Targets

The targets of the project should be not only to effect a statistically significant change in protein consumption and to investigate interrelationships between income, expenditures, seasonal factors, and fishpond production, but also to bring about a predetermined change in protein intake.

Nutritional objectives can be set but people will only eat so much fish, regardless of how much they like it. Thus there is a upper limit on the effectiveness of fishponds in "curing" the malnutrition problem.

A modest expectation might be that total protein consumption will increase 5% over baseline values (yet to be determined). The protein intake observed here was approximately 43.6 g. per consumption unit. In a community of 25 households comprised of an average of 4 consumption units each, a 10% increase (4.4 gm/consumption unit/day) would mean production of 160,600 gms. of protein per year or 2,091 lbs. of fish (at 4.8 gm. protein per ounce whole fish (INCAP)) or 40 pounds of fish per week harvested from the fish pond. Since a Buenos Aires fishpond averaged 50-70 pounds/week, a 10% increase in protein may not be unreasonable. (Note also that the base figure used, 43.6 grm, includes two villages having ponds, so the actual base may be lower.) Calculations like these should be used to determine the size and stocking of the pond necessary to obtain the objectives. If the pond becomes impossibly large, target levels will have to be lowered appropriately.

An argument can also be made for establishing qualitative protein intake objectives. One could set the target of protein intake deriving from animal sources (meat, eggs, fish, and milk) at 20%. From the reconnaissance it was found that on meat eating days, 65% of the protein was contributed by animal proteins; on fish eating days, 14% of the protein was contributed by fish; and on the remainder of the days 7.3% of the protein was contributed by animal proteins (milk and eggs). If meat is eaten 5 days per month, fish 4 days, and no animal flesh the remaining 21 days per month, before intervention animal protein would contribute 18% of the protein. If the subjects ate fish 13 times a month after the pond was built (just over twice a week more than they presently consume fish), they could raise the value to 20% protein intake from animal sources.

One could also set targets of minimum consumption -- i.e. with the objective that at no point in the year should protein intake fall below 40 gm per consumption unit per day or, alternatively, at no point should the proportion of total protein intake contributed from animal sources fall below 10%.

Although these "targets" may allow the project manager to establish criteria for pond size, to keep track of progress toward goals, and to calculate costs per unit of nutritional improvement, the above targets have no functional meaning. It is not known if raising protein intake from 40 to 41 or 42 gms. has any physical significance. By the same token, no physical meaning can be attributed to raising the quality of protein in the diet from 15% to 20% animal sources. It is known that extremely low dietary protein quality and quantity have negative effects on populations but moderate deficiences have less measurable impact.

While it may be useful to set quantitative targets, these targets can only serve as milestones not as indicators of improved nutrition. There is no equivalent of litmus paper in evaluation of nutrition projects ... nothing that detects small functional effects of levels of moderate malnutrition.

E. Analysis

Consumption varies greatly not only among individuals but also from day to day for each individual. Thus, the standard deviation on a population is expected to be large - probably larger than the expected net increase in protein consumption resulting from the fishpond. Using the average intake (of 3 days, for instance) and pairing households before and after the intervention (in the appropriate season) enables the investigator to compensate for both inter- and intra-individual variations.

The paired comparison is also a more powerful test than a grouped comparison and using 3-day average individual data allows the investigator to compensate for non-normal distributions of consumption within the population. Finally, the paired comparison yields data on absolute levels of change in each household and across populations which makes it easier to statistically test whether targets have been reached.

The disadvantage of the paired comparisons -- aside from requiring three times as many interviews -- is that households must be interviewed in all four phases to be included in the analysis. Migration, marriage, births and deaths all affect the number and composition of households. To overcome this latter problem it would be wise to identify households by one major established family member (probably the female head of household*) and compare consumption based on weighted nutritional needs,

*This makes sense for several reasons: (1) seasonal migration of men; (2) women's keeping custody of children if a marriage dissolves; (3) women are the household representative to be interviewed.

for instance expressing the results in terms of nutrients per consumption unit in the household.*

Two-way analysis of variance using 3-day average intake of the household before and after the fishpond within both seasons will test the following hypothesis (at a predetermined confidence level):

Hyp. 1 - Presence of a fish pond increases protein (or energy) consumption per consumption unit.

Hyp. 1.a. - in summer (June-August)

Hyp. 1.b. - in winter (January-March)

Hyp. 1.c. - overall (aggregating prepond and postpond)

If the paired control design is not used (Option B), then the group's average consumption per consumption unit will be used with one-way analysis of variance to test differences within season, prepond and postpond.

Because the project is to be implemented in three successive years in 10 villages per year, it will be possible to gauge qualitatively the impact of macroeconomic trends on the results. If during one period real income decreases in rural Panama, it should impact on all villages in that phase of the study. Trends can be taken into account in data analysis by factoring in the time period.

Analysis of expenditures (in terms of expenditure per capita) would also be calculated on an individual household basis under Option A and on a community basis under Option B and analyzed as food consumption was analyzed (supra). Under Option A the relationship between expenditures

*See Appendix II

and protein (or energy) intake could be tested by regression analysis, using season and fishpond function as dummy variables.

Income (per capita) and price data would have to be examined on a community basis regardless of the option chosen except in the unlikely case that it can be shown that income always lasts for one and only one week.

To tie all of the variables together, regression analysis should be done using protein (or energy) intake per consumption unit as the dependent variable and expenses (per cap), food prices (or some weighted function thereof), and income (per cap) as independent variables. Data on each community should be included as one data point for each combination of season and fishpond function. The investigators will then be able to determine how the relationship between income, expenses, and protein (or energy) intake is differentially affected by season and fishpond function.

There are other quite interesting statistical manipulations that could be done (for instance investigating the relationship between food consumption and medical expenses and among different expenses of the household). However these questions are peripheral to the evaluation of the nutritional impact of the fishpond and are only mentioned here to indicate the utility of the kinds of data to be gathered.

F. Criteria for a "complete" intervention

It is not enough to assume that the mere existence of a fish pond in a village is sufficient to cause a change in consumption. The intervention will be assumed to be "complete" (functioning at capacity) when weekly fish catches are possible. The postpond interview must be made when the pond is being harvested at least that frequently.

Many fish ponds currently in use are harvested only once every 3-4 months and fish consumption under those conditions is unlikely to have any impact on nutritional status of the community since consumption patterns are affected for only a short period after each harvest (within 10 days all fresh or dried and salted fish is consumed).

The project team may also wish to consider that the fishpond is not completely functioning unless or until all fish do not have to be sold to cover the costs of the pig-fish-garden scheme. The objectives of the fish pond project have not been clearly stated in this regard. If fish ponds are intended to provide an abundant source of fish at very low expense to the village, then one criterion of completion would be that most of the fish is not sold. It is possible that some small proportion must be sold to cover costs of restocking, just as vegetables may be sold to cover the costs of seeds. However, if the community must buy the fish, then the project may not reach the target population (i.e. the poorest groups in the villages) or it may have the least impact when nutritional need is greatest (i.e. when income and food stocks are lowest). Many ponds currently operating must sell all of the harvest to cover costs of feeding the fish. In the present project, the pig scheme was designed to obviate the feeding of the fish but it creates the problem of feeding the pigs. DINAAC and AID should finance or underwrite feeding the pigs until sales of pigs are sufficient to cover the costs of raising them.

In summary, the completion of the intervention - that time after which the effects of the project on consumption can be measured - will be achieved when

1) Weekly fish catches are possible
2) Most of the fish can be distributed free of charge to members of the cooperative.

G. Budget (See Table 2)

It was assumed that each interviewer could make 6 interviews per day - allowing for time necessary to reach a dispersed population - and it was assumed that about 1/2 day would be required to reach the community (or return therefrom).

Time for coding was calculated based on the belief that coding should be done very soon after interviews (assuming it is not advisable to wait until the interviewers are free to employ them in coding, even if the skills were present) and under the assumption that one person can correct, code, recheck, and verify 10 interviews per day. It is hoped that the cost of the data analyst and project director can be partially written off on other projects.

Option A calls for 3 interviews per household per season. Option B requires only one interview per household per season. If Option A is too expensive, it would probably be better if followed at random or stratified sample of households within a village or to evaluate fewer communities. Option A is more capable of detecting small changes at the household level and therefore is preferable.

TABLE 2: BUDGET

		OPTION "A"	OPTION "B"
	Censuses+	90 person days (1 person)	90 person days (1 person)
1980	Interviewers	150 person days (3 people)	50 person days (1 person)
	Drivers	50 person days (1 person)	50 person days (1 person)
	Cars*	50 car days (1 car)	50 car - days (1 car)
	Per Diem	200 days	100 days
	Equipment**	3 sets	1 set
	Coding, etc.***	80 person days (1 person)	30 person days (1 person)
1981	Interviewers	300 person days (3 people)	100 person days (1 person)
	Drivers	100 person days (1 person)	100 person days (1 person)
	Cars	100 car days (1 car)	100 car days (1 car)
	Per Diem	400 days	200 days
	Equipment	3 sets	1 set
	Coding, etc.	160 person days (1 person)	60 person days (1 person)
1982	Interviewers	600 person days (6 people)	200 person days (2 people)
	Drivers	200 person days (2 people)	200 person days (2 people)
	Cars	200 car days (2 cars)	200 car days (2 cars)
	Per Diem	800 days	400 days
	Equipment	6 sets	2 sets
	Coding, etc.	320 person days (2 people)	120 person days (1 person)
1983	Interviewers	450 person days(Max.6 people)	150 person days(Max.2 people)
	Drivers	150 person days(Max.2 people)	150 person days(Max.2 people)
	Cars	150 car days (Max. 2 cars)	150 car days (Max. 2 cars)
	Per diem	600 days	300 days
	Equipment	6 sets	2 sets
	Coding, etc.	240 person days(Max.2 people)	90 person days (4 persons)
1984	Interviewers	300 person days (3 people)	100 person days (1 person)
	Drivers	100 person days (1 person)	100 person days (1 person)
	Cars	100 car days (1 car)	100 car days (1 car)
	Per Diem	400 days	200 days
	Equipment	3 sets	1 set
	Coding, etc.	160 person days (1 person)	60 person days (1 person)

+ Assumes 3 days enumerating per community.

* Does not include the probable need for horses which will have to be rented on site.

** Interview forms, scales, stationery & supplies.

*** Assumes coders can review, code, punch and verify 10 interviews per day.

Total

Interviewers	1,800 person days (Max. 6 people)	600 person days (Max. 2 people)
Drivers	600 person days (Max. 2 people)	600 person days (Max. 2 people)
Cars	600 car-days (Max. 2 cars)	600 car-days (Max. 2 cars)
Per Diem	2,400 days	1,200 days
Equipment	Max. 6 sets	Max. 2 sets
Coders, etc.	960 person days (Max. 2 people)	360 person days (1 person)

Fixed Costs (Regardless of Option)

Trainer for Interviewers: (Lcda. Viodeldia Gomez? $20/day plus per diem)

1 week per team; 2 teams (1980, 1981) = 2 weeks.

Computer Time — INCAP food analysis tables program; Calculation of diets & consumption units; Analysis — rough guess $5 K

Data Analyst - 1/2 time for 4 years.

Project Director - Full time for 4 years.

Preparation of Report: two weeks writing
one week full time, typing

Photocopying: copies of report to responsible agencies

Travel costs: biweekly travel during 90 weeks of data collection Panama/ Santiago (or whereever the field work is being done)

Lcda. Viodeldia Gomez (Regional Nutritionist, Veraguas; Complementary Food Program, Ministry of Health; Santiago) not only knows how to run field teams of dietary interviewers but also trains them. She says current salaries of her village health workers is $165/month and when they do interviews they pay an extra $5-10 per diem. Using these figures, the following costs for interviews were calculated (excluding costs of cars and gasoline):

Option A: $43,500
Option B: $20,800

These costs do not include any of the "Fixed Costs" mentioned above.

H. Timetable (Figure 2)

Regardless of the Option selected, the diagrammed interview schedule (Figure 2) is valid.

A timetable of interviews has been drawn up on the assumption that the project is approved and ready to begin by spring 1980. That is to say, money has been allocated, communities have been selected and organized, earthmovers have been obtained and field teams chosen and trained. A census of the target villages (supra) should be completed at least one month before the first interview, or by May, 1980. As mentioned in the research protocol each community will be examined once during January-March and once during June-August, both before and after fishpond function is complete.

If funding is delayed, evaluations will have to be adjusted accordingly. If necessary, the winter interview round can take place in October to December. The summer interviews must be during the period of June-August.

Since it requires at least 3-4 months for the fishponds to "mature" (reach the point at which weekly fish catches are possible), it was assumed that the first post-pond interviews could not take place until the year after the fishpond is constructed. It is possible that a fishpond constructed in January could reach maturity in May, but unless all of the ponds are able to do so, the interviews will be out of phase and the project may be faced with the necessity of a third team.

It has also been assumed (on the basis of discussions with extension agents) that fishponds can only be constructed during the dry period (January to March). If ponds can be constructed at other times of the year, it would be to the advantage of the evaluation because:

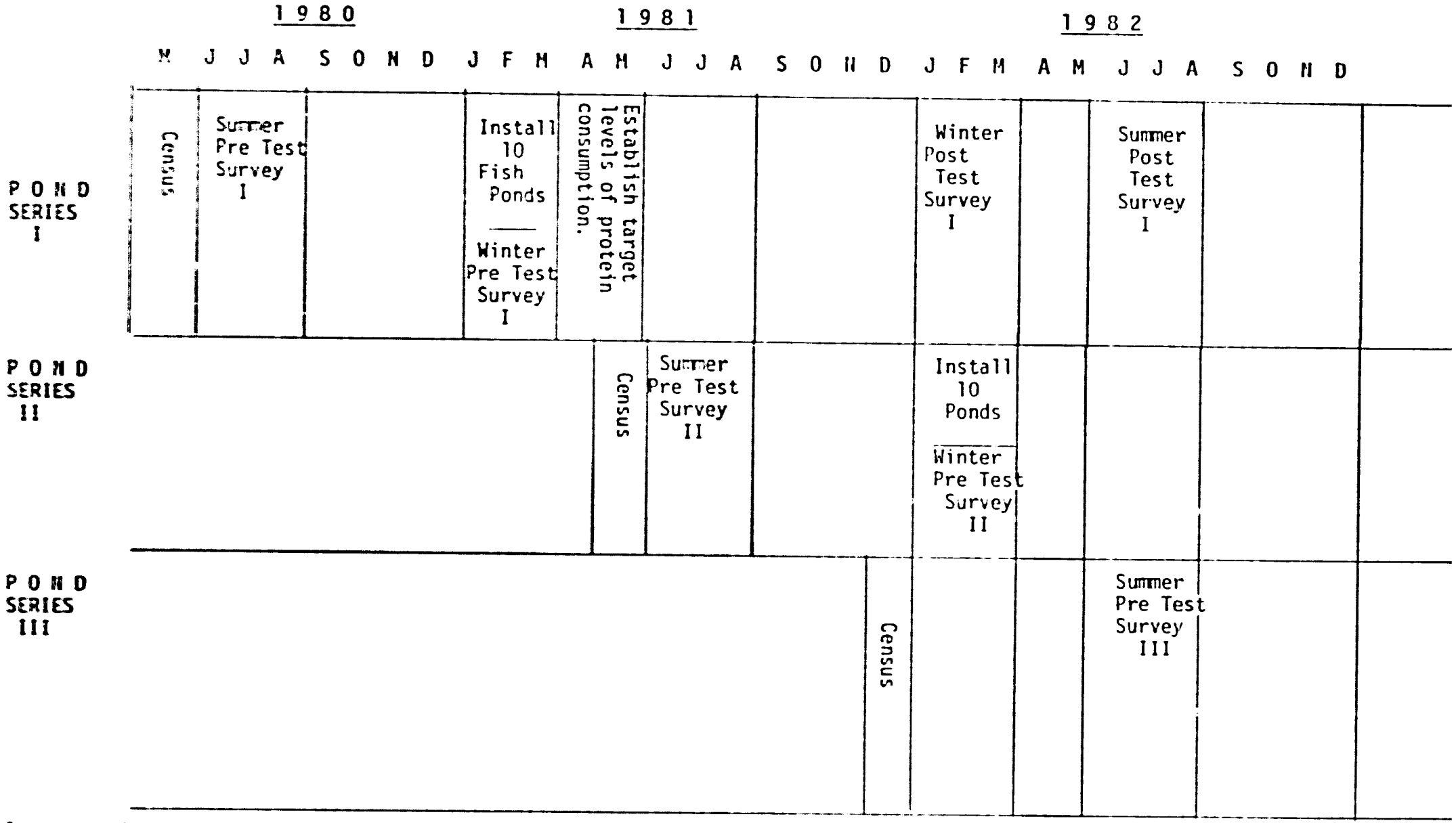
a) it would allow greater flexibility in the timetable

b) it would obviate the problem caused by the impact of pond construction on local labor supply, migration, employment, and (therefore) income in January-March.

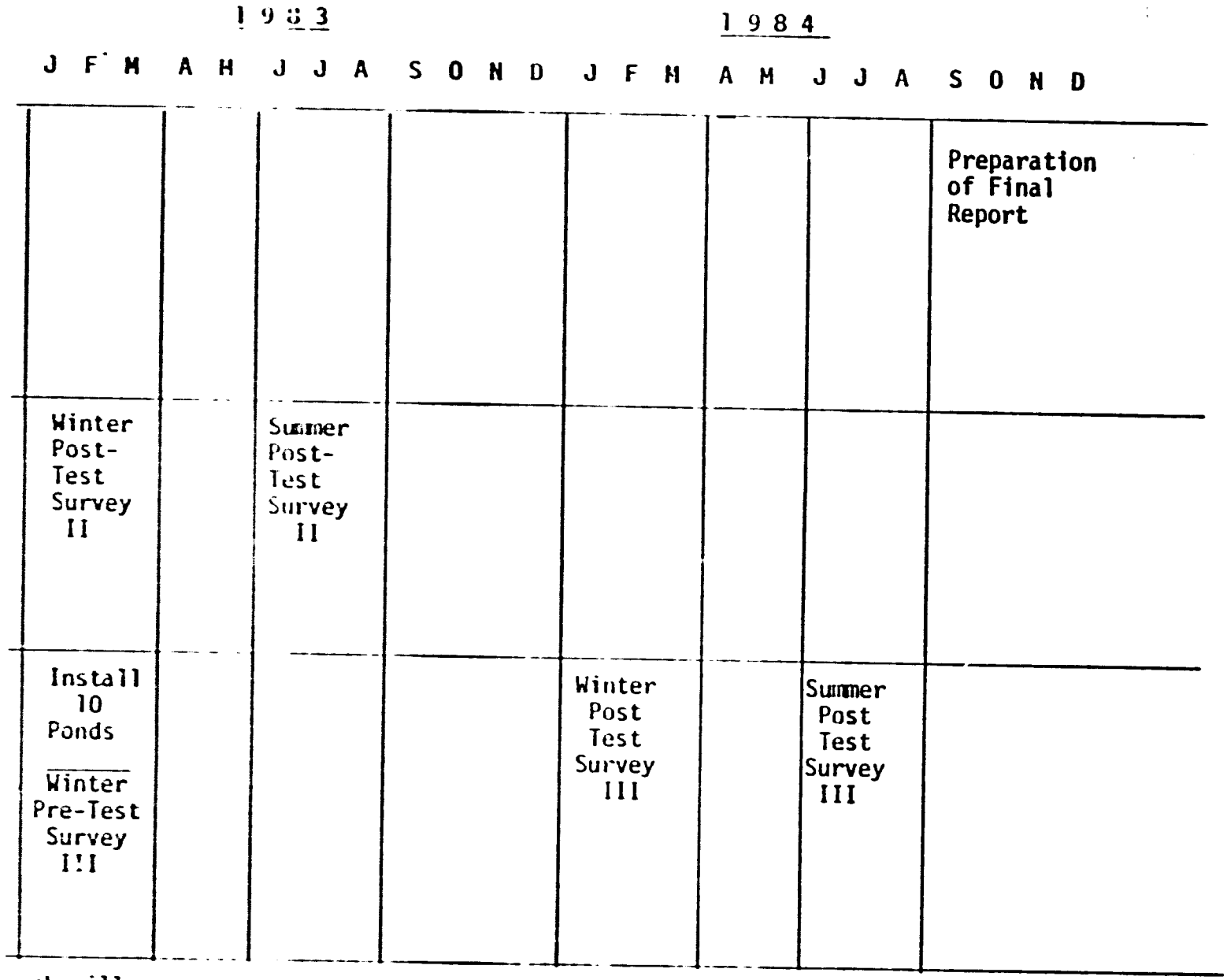
If the ponds are constructed on the January to March period, the interviews will take place when none of the community has worked on the fishpond in the previous week.

The reader should note that the evaluation will begin 9 months before the first ponds are built and will continue at least 18 months after the last ponds are built.

Figure 2: Timetable



Assumes prior census in each villagd with enumeration (1980) or concurrent census & enumeration with first pre-test survey in
Assumes Fish ponds can be dug only in January-March.
Assumes 10 fish ponds will be built each year for 3 years starting January 1981.
Assumes Fish ponds require 3-4 months to reach capacity production (minimum requirement for post-test is weekly fish harvests)



each village.

I. Logistical Problems

Undoubtedly difficulties will be encountered by the interviewers in:

a) obtaining lodging and meals*

b) locating and reaching all the community members within one week

c) getting to the villages during the rainy season (June-August).

It may be necessary to carry all the necessities with the team (food and shelter) although living in that manner for 10 weeks requires strength of character. It may also be necessary to equip the teams with rain gear, horses, and packs to enable them to carry out their duties. The problems of reaching the villages in the summer cannot be underestimated - the dirt roads are very poor and rainfall is heavy. The equipment needs will have to be reassessed once the demonstration sites have been chosen.

It is probable that the fish pond construction and stocking will fall behind schedule. Not only are there too few extension agents to cover this project in addition to the rest of the DINAAC ponds, but also community organizing can be a slow process, earthmoving machines are scarce and in high demand, weather can interrupt or delay implementation, and numerous social, political and economic factors can alter the planned timetable. Regardless of delays, baseline data and post-intervention data can still be fruitfully compared to indicate the impact of fish ponds on protein nutrition if several years do not pass between pre- and post-test interviews.

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* It is assumed they will stay in or near the villages where they are interviewing because of the excessive time lost and gasoline used in carrying teams to and from rural settlements.

The more serious logistical problem will be locating adequate field personnel. They will be employed only 20 weeks per year, they will have to be trained in interviewing techniques and dietary consumption recall, they will have to be highly motivated and capable of working under adverse conditions with the rural poor, and they will probably have to be women (to talk with the female head-of-household). It is assumed they will be Panamanian. While educational qualifications are probably not difficult to fulfill, the personal motivation, particularly among women, may be the most limiting factor.

The intermittent short term use of 4-wheel drive vehicles and their drivers may also be a limiting factor. Those vehicles to be given to DINAAC by the grant cannot be counted on for the exclusive use of interviewers 20 weeks per year. While it is possible that cars and drivers could take the interviewers out on Monday morning and return for them Friday afternoon, in remote places with dispersed settlements, the cars may be required to carry out interviews and to enable the interviewers to return to their lodgings in the evening. The need for cars will have to be re-evaluated once the fish pond sites have been selected.

Project management may be difficult to carry out from Panama City so ample time should be allocated for frequent trips to the field to oversee progress of the ponds, to maintain quality of the nutrition evaluation work, and communicate with and encourage the field team. If the Project Manager has excessive demands on his/her time, inadequate oversight may jeopardize the outcome of the project and the evaluation.

J. Factors Influencing Selection of Communities for Demonstration Projects.

From my reading and from my short visits to several fish ponds and to other communities in rural Veraguas (including conducting interviews about the food systems in three communities), I have concluded that the following factors significantly contribute to the nutritional problem:

1) Cropping patterns - predominance of tubers
2) Low agricultural productivity
3) Inadequate market system
4) Insufficient communications system (particularly roads)
5) Seasonal factors (environmental, agricultural, economic)
6) Low availability of paid employment

These negative factors are somewhat offset by the following positive conditions:

a) Widely available potable water
b) Frequent presence of latrines
c) High literacy of the population
d) Extended breastfeeding of infants

These factors should be taken into account when selecting the demonstration communities. To maximize nutritional impact the fish ponds should be located in areas where,

a) Fresh produce (especially beef) is not usually available.
b) Local agriculture is primarily of the subsistence type - probably tubers, rice and corn.
c) Local employment opportunities are scarce.

Criteria (a) and (c) relate in large part to the community's distance from good roads. I would suggest that villages be selected that are more than commuting distance from the Pan American Highway (e.g. 5-10 miles). The further one gets from the main road, of course, the more logistical problems are encountered in fishpond construction and maintenance and in interviewing.

During the selection process, several households in each candidate community could be interviewed about cropping patterns, frequency of eating high quality protein foods, and employment of family members. This should be useful in ranking potential locations for fish ponds.

As demonstrated in the Poynor Report[1]; there are a plethora of nutrition-related programs in rural Panama, especially Veraguas. While it would be difficult to control for the type or presence of other nutrition interventions in the demonstration villages (especially given the complete lack of coordination among the responsible agencies, voluntary organizations, institutes, ministries and sub-ministries), care should be taken to avoid multiple-intervention villages.

It would be unwise to compare villages having potable water with those that do not have it because intestinal parasites are very important factors in nutritional status. Since potable water is likely to enhance the impact of the fish pond projects, I would suggest that all demonstration villages have safe water sources. Since the Government is committed to bringing potable water to the population, this is the more relevant situation to study.

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[1]Poynor International, Inc. A Multi-sectorial analysis of the nutrition problem in Panama. June 22, 1979.

II. Comments on the DINAAC Managed Fish Pond Project

The fishpond project is focused on increasing fish intake by rural Panamanians. DINAAC is also involved in the fish hatchery (including several research activities relative to crossbreeding and upproduction of food fish), commercial fish production, and dissemination of the technical findings emanating from the fish hatchery, but I do not know the relative budgetary weights of these programs within DINAAC. The community fishpond project is "limping along" at best. Their effectiveness is sub-optional due to lack of equipment (they need 4-wheel drive vehicles and a landmover) and due to some uninspired field workers who hold back their colleagues. Their modus operandi is to send 2-person teams out to work in the communities - one is the technical advisor, one is the community organizer. Since the technical aspects are not difficult to learn, it is possible that the community organizer could handle both aspects. There is a real shortage of staff who know how to handle the organizational aspects which comprise the more difficult problem. One staff person (the Sra. de Santa Coloma) is not only very capable in the communities but also has a radio program (temporarily taken off the air due to lack of money) devoted entirely to fishponds, which educates and motivates the listeners and passes on information from one community to the other. She interviews people participating in fish projects and has them explain how their projects are going, how they have solved problems, and how they use the fish. Few in DINAAC, except for Dr. Pretto, match her enthusiasm.

Although the project has an obvious nutritional focus, Dr. Pretto does not believe any nutritional impact will be noted and furthermore he

sees the current grant as institution building not as a nutrition intervention. This latter point is apparent from the allocations of funds in the PID (25% to pond construction, vehicles and nutrition studies; 75% to hatchery ponds, technical assistance, hatchery equipment and laboratory, fellowships for study in the US and educational materials).

I would argue that the Community Fishpond project is more a rural development effort than a nutrition intervention. Most importantly, it involves organization of communities to work cooperatively in improving their well-being. It also exposes the residents to new ideas, it may provide employment and increased exposure to the market system, and it enables people to take an active role in development.

It is clear to me that the fishpond project also addresses the protein availability problem. Its impact on nutrition could be further enhanced by use of the radio to teach fish preservation techniques and to encourage parents to give fish to their youngest children*.

I would like to comment on one area of the fishpond project that disturbs me - the dependence of the villagers on the extension agents. I have seen approximately thirteen fishponds communitées in all. They are all dependent on DINAAC to:

a) bring them processed fish food (for which the community must pay) or,

b) buy and sell the hogs and buy the pigfeed (using DINAAC as the lending agent).

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*Sra. de Santa Coloma is most eager to do this and asked to interview me for her radio program - the interview never came to be due to logistical problems, however I have passed on to her the information I thought necessary to convey the nutritional message.

Not only are the extension agents burdened down by these marketing functions but also the financial responsibilities are high. For the project to succeed, they must be good bookkeepers and completely honest. Needless to say, if the program were expanded greatly on a regional or national scale, the potential would be high for inadequate service to the communities, overworking of agents, abuse of power, and mismanagement of funds. Small scale fish ponds do not provide enough production to affect long-term nutritional status yet only the smaller ponds, in the present scheme, are manageable on a local scale.

I would like to see if smaller animals (chickens or ducks) could be used to fertilize the ponds or if local resources could be channelled to feeding pigs (e.g. feeding them fish, grains, vegetation and tubers) or fish. The zealous fervor which has been focussed on fish should perhaps be accompanied by equally serious consideration of the rest of the fauna involved in these ponds. This applies equally well to veterinary problems which extension agents are insufficiently trained to diagnose. The expansion of the pig production side of the Community Fishpond project will not - as far as I can tell - be matched by increasing veterinary skills of the agents. Since pig raising is not widely practiced in this area, there is probably little common sense knowledge about pigs presently available in the communities.

I question the need to send 6 students to the United States to receive Masters Degrees in aquaculture. While I am sure they will enhance the staff at the hatchery, I do not see any benefit in terms of improving the outreach to communites. The technology exists for making fishponds; it is qualified field staff who have the ability and enthusiasm to organize and guide groups which are lacking.

DINAAC can not move fast without an earthmoving machine either. I would like to see one earthmover substituted for the 6 fellowships. The earthmover could serve double duty - creating fishponds and improving the roads into the fishponds, which in turn would improve community access to the marketing system (although it would also confound the evaluation design). DINAAC also lacks nets to harvest fish (they have only one at present).

The proposal mentioned that 17 new extension agents will be added to the staff but these people can do nothing without cars. The fish tank trucks may serve double duty as extension vehicles, but I sense that they will reside at the fish hatchery in Divisa which is at some distance from the DINAAC offices in Santiago. The numbers are inadequate for 17 agents anyway.

The addition of 17 new extension agents calls to mind the management problems again. At present there is very little surveillance of the work of the agents - that and political pull have allowed the ineffective agents to remain at DINAAC. To ensure that new employees are qualified to carry out the extension activities, careful selection criteria must be used and their work must be closely supervised in the field. Dr. Pretto is over-extended at present and cannot assume such a task so a supervisor (or several) should be appointed. The supervisor must be familiar with the communities and have had long experience working with community groups. It is necessary to build up supervisory capacity before new extension agents are employed. This function will not be served by the people receiving Masters Degrees in the US (if in fact this was intended to be their function). Students, who have paper credentials and no experience working in the communities, may well frustrate the older more experienced extension workers.

The best way to improve the community fishpond program, in my mind, would be to obtain the equipment they need (4-wheel drive vehicles, earth-movers, and hatchery equipment) and to increase their field staff. A commitment to community development rather than the present objectives of institution building (Dr. Pretto) and nutrition (AID) would go a long way to making an impact on the rural environment.

One must also question what other mechanisms might be used to address the protein problem. Increased planting of legumes would go far to improve protein quantity and quality in the diet since bean and rice proteins are complementary. Other agricultural interventions - introduction of fertilizer and irrigation, for instance - coupled with an improved marketing system might also alleviate the nutritional problem.

One can also make a good argument that the provision of good year-round roads would be sufficient to increase consumption both by improving employment prospects and by facilitating marketing of food.

It is when considering alternatives to the fishpond project that one can appreciate the non-nutritional impacts of the program.

APPENDIX I

FORMAT FOR FIELD INQUESTS -- 5/12 to 7/12

J. McGuire

1. Name of community _____

2. Name of woman interviewed _____ Nature of marital rel'n_____
   Age (cedula?)
   Time lived in town
   Reproductive history (live births; abortos; preschool children dead and of what causes)

3. Family data
   Members, ages (cedulas?), relationship to her
   Morbidity during last two weeks

4. Dietary/Consumotion data

   A. 24 hour recall

      1) receipes

   B. Weekly food pattern -- last week
   C. Weekly food purchases

      1) last week amounts
      2) where purchased

   D. Food frequencies -- protein foods

      res puerco pollo/gallina frijol queso/ leche pescado huevos.

   E. Seasonality

      1) Best season: months, diet
      2) Worst season: months, diet
      3) Children's morbidity seasonality: what diseases in what months

   F. BF and weaning practices

      1) First non-maternal-milk food/drink
      2) When introduced
      3) Age of weaning
      4) Weaning foods

Name	Sugar
Otoe	oil
Chicheme	spices
Masamorra	fruits
salsas	drinks
	spreads

5. Household income/expenditures

A. Agricultural production

1) Crop -- acreage -- yield -- sold -- consumed
2) Land tenancy
3) Trends over time -- planting and yields

B. Outside income

1) Him -- type of work, months, weekly income
2) Her -- type of work, months, weekly income
3) Kids
4) Best and worst months for income?

C. Food budget

1) Best season (months)
2) Worst season (months)

D. Expenses -- per week (last week)

1) Food
2) Medicine and medical care
3) School and education
4) Transportation
5) Clothing
6) Services
7) Personal hygiene
8) Installments

E. Socioeconomic data

1) Subjective description of household
2) Literacy him _____ her _____
3) Pumped water (potable) _____ _____

a) distance to nearest water source
b) seasonality of water
c) type of water source

4) Letrina? Servicio

other type of sanitary waste disposal _____

6. Participation in fish pond

IF SOCIOS

A. Why members?

B. Why others aren't members?

C. How often fish harvested.

D. How much did they get at last harvest? (when)

1) How much free? How much bought?
2) How did they use fish?
3) How did they prepare it?
4) How did they store it?
5) How long did it last?
6) Who ate it? How much? Prepared how?

E. How much work on fishpond by (kinds, days)

1) Him?
2) Her?
3) Kids?

F. How does coop decide how much to sell and how much to keep?

G. Who decides on stocking.

H. Did they earn any income from fishpond? How much?

IF NOT SOCIOS

A. Why not?

B. What are costs of belonging? Benefits? Benefits of not belonging?

C. Did they buy fish at last harvest?

1) How much? At What price?
2) How was fish prepared? Stored?
3) How long did it last?
4) Who ate it? How much? Prepared how?
5) Did they give fish to criaturas?

IF FISH POND NOT AVAILABLE

A. Would they like fish pond?

1) Advantages?
2) Disadvantages?

B. Do they eat fish now?

1) How many times a year? When?
2) Where do they get it?
3) When and where did they last purchase fish?
4) At what price? How much?
5) How did they prepare it?
6) How long did it last?
7) Did they give it to the criaturas?

COMMUNITY DATA NEEDED ____ FIELD INQUESTS 5/12 - 7/12

1. Community data

   A. Distance to nearest paved road?
   B. Distance to nearest health center?
   C. Total population

      1) Population in fish cooperative

   D. Population of nearby towns (sphere of influence)
   E. Nearest market -- distance/time
   F. Community organizations
   G. Prices in local stores of basic commodities

2. Fishpond data

   A. Size (m^2)
   B. Age
   C. Stocking pattern
   D. Auxiliary production (pigs? garden?) Yields, income, expenditures.
   E. Harvests of fish, dates, sizes, income and expenditures

      1) Percent sold to socios -- at what price? Percent given to socios?
      2) Percent sold to non-socios

         a) How sold? Who sold?

      3) Uses of income

         a) Expenditures for fishpond? pigs? garden?
         b) Amount returned to socios?

APPENDIX II - CONSUMPTION UNITS FOR ENERGY AND PROTEIN*

	ENERGY 1 unit = 2,000 kcal Consumption Units	PROTEIN 1 unit = 60 gm protein Consumption Units
7-12 mo.**	0.5**	0.4**
1-3 yr.**	0.6**	0.4**
4-6 yrs.	0.8	0.5
7-9 yrs.	1.0	0.7
10-12 yr.	1.2	0.8
13-15 yr.	1.5	1.2
16-19 yr.	1.6	1.3
10-12 yr.	1.1	0.8
13-15 yr.	1.2	1.2
16-19 yr.	1.0	1.2
Man	1.4	1.1
Woman	1	1
Preg. Trim. 2-3	1.1	1.2
Lactating	1.4	1.4

n.b. Each meal missed should reduce the person's consumption unit 33% of original value

* From INCAP/ICNND. National Evaluation of the Population of Central America and Panama. 1965 - 1967. Regional Summary. DHEW Publication No. 72-8120, Washington, DC: GPO 1972.

** Some adjustment will have to be made for nursing infants - i.e. 1/2 consumption units allocated.

APPENDIX III

Option C - Anthropometry

In Option C all preschool children in each community are weighed and measured in summer and winter, both before and after fishpond construction. The number of children falling above and below 75% standard weight for age (NCAP growth charts) would be compared by Chi-squared analysis.

The people will have to be notified ahead of time in a general assembly of the community or through house-to-house contact (which would entail at least a day of field work). Due to self-selection bias (probably excluding the most malnourished children), it might be necessary to carry the scales to the homes of people who do not voluntarily bring in their children to be weighed. This search-and-weigh procedure could take several days.

While weights have a more tangible nutritional meaning to policy makers, this option is not likely to find significant results because

a) Growth performance is influenced by many factors other than protein quality and quantity (e.g. energy in-sufficiency, parasitic load, overall morbidity, activity levels, vitamin deficiencies and physiological status (viz rapid growth phase).

b) The probability of finding second and third degree malnourished children (i.e. under 75% weight for age) is only 1:4. If all preschoolers are weighed then the numbers should be adequately large for statistical tests. If, on the other hand, only children from 6-36 months are measured (since these are the ages when growth is most rapid and weight is a good indicator of growth velocity), then the expected numbers of malnourished children is less with lower probability of finding a difference in prevalence large enough to be significant in a chi squared test.

c) In serious malnutrition, the weight response to refeeding (i.e. catch-up-growth) is marked only in the first few months after refeeding. This poses a problem for scheduling and is superimposed upon expected seasonal fluctuations.

Height (length) determinations could also be made and might in the long run be a more sensitive indicator of growth performance than weight in and of itself. Height measures have the advantage that most malnourished children fall in low percentiles of healthy children. Frequency of children below selected percentiles (e.g. 90th and 80th percentiles) could be used to test the hypothesis about the effect of the fishpond program on growth. Since height gain is fairly slow, seasonal effects would probably not be detectable in short term height gain. Thus frequency of low height measures can be compared before and after introduction of the fishpond (measures being taken during the same season of the year).

Weight-for-height (comparison of observed weight with recommended weight for the child's height) combined with height percentiles can also give a good estimate of current nutritional status. The "Waterlow table" - numbers of children deemed normal, stunted, wasted, or stunted and wasted - can be compared by Chi-squared analysis before and after interventions by season to monitor changes in the nutritional well-being of the children.

As stated above, growth performance is influenced by multiple factors and an increase in protein quality and quantity is probably not adequate to effect a change in the growth parameters if all other factors remain unchanged.

Trip report of Judity McGuire
26 November, 1979 to 14 December, 1979
Panama

Meetings with People

26 November	Dwight Walker, AID/ARD
27 November	Bob Jordan, AID/ARD Anthony Cauterucci, AID/HRD Herb Caudill, AID/HRD Elias Padilla, AID/ARD
28 November	Dr. Richard Pretto, DINAAC, Santiago, Veraguas Extension agents, DINAAC, Veraguas Visits to fishpond sites, Veraguas
29 November	Dr. Richard Pretto, DINAAC, Santiago, Veraguas Extension agents, DINAAC, Veraguas Visits to fishpond sites, Veraguas
30 November	Extension agents, DINAAC, Veraguas Visits to fishpond sites, Veraguas
3 December	Joe Kwiatkowski, AID/ARD Pedro Martiz, AID/HRD
4 December	Dr. Cutberto Parillon, Director of Nutrition Directorate, Ministry of Health, Panama Lcda. Cristina Martinez, Complementary Foods Program, Ministry of Health, Santiago
5 December	Lcda. Viodeldia Gomez, Complementary Foods Program, Ministry of Health, Regional Nutritionist, Santiago Extension Agents, DINAAC, Veraguas Villager interviews -- Rincon de las Palmas
6 December	Extension Agents, DINAAC, Veraguas Villager Interviews -- Buenos Aires
7 December	Extension agents, DINAAC, Veraguas Villager interviews -- Peru Dr. Richard Pretto, DINAAC, Santiago
14 December	Informal presentation of findings to Bob Jordan, Dwight Walker, Pedro Martiz, Elias Padilla and Herb Candill

APPENDIX V

Fish ponds visted 28-30 November, 1979

28 November	Gavilan (de la Mesa)	Small pond (we went into the old woman's house here)
	Cerro Redondo (de la Mesa)	Large machine dug pond with pigs and ducks
29 November		
a.m.	(Rincon de) las Palmas	Med.-sized (where the man brought out his list of figures and we went to the Iglesia)
	Cerro Pajal	Med.-sized pond with silver carp (near las Palmas)
	La Trinidad	1 small and 1 large pond (where we saw the Guaymi on road)
	Los Mendez (de la Mesa)	Small pond (we had to scramble up a little hill here and didn't meet any of the people)
p.m.	Los hijos (higos?) de San Jose	Med.-sized pond (where the machine had been left, unused, near the RENARE project)
	San Jose	Very large pond; ciclo basico and asentamiento
30 November		
a.m.	Trinidad -- Rio de Jesus	Large pond with pigs; ciclo basico
	Rincon Sucio	Med.-sized pond with a few ducks (man with radio and gold teeth spoke with us)
p.m.	Atalaya	Inst. Jesus Nazareno.

ALTERNATIVE DESIGNS AND

COMMENTS ON EVALUATING THE NUTRITIONAL CONTRIBUTION OF FISHPONDS

with Reference to the USAID/Panama
Managed Fishpond Project

A REPORT TO THE USDA NUTRITION ECONOMICS GROUP

By: Jon Hitchings

Under RSSA 3-77 (Economic Analysis of Agricultural Policies) with the Office of Nutrition, Development Support Bureau, AID

January 1980

This note on research orientation and methodology is an outgrowth of, and a response to, Judith McGuire's consultancy report to the Nutrition Economics Group, USDA/OICD, under contract No. 53-319R-0-45. In the following, familiarity with the project is assumed, and a premium is placed on brevity. (But the paper grew inescapably when budget considerations had to be added.)

I. ASSUMPTIONS

The task is to evaluate the nutritional effects of constructing managed fishponds in 30 small Panamanian villages, averaging perhaps 30 households each. These assumptions are made:

1. The ponds are not viable unless they are economically self-sustaining after start-up costs; an independent financial appraisal will be made.

2. The ponds are co-op run, probably not achieving 100% participation; information from co-op managers can be gotten independently of a household-level survey.

3. The nutritional concern is protein intake, indicated by poor protein quality and quantity in the diet. (The extension to energy is straight-forward.)

4. The nutritional outcome variable is the change in household protein consumption per consumer equivalent, to be established by surveys. The individual is not the focus, but households are asked whether fish is given to children.

II. RESEARCH OBJECTIVES

1. Do fishponds boost total household protein consumption?

2. What household characteristics affect the outcome?

3. What community characteristics affect the outcome?

Objective 2 aimes at discovering:

2A. Which households benefit and why?
2B. Are households having the poorest diets reached?
2C. Are fish substituting for other foods?

The substantial expansion of the questionnaire required for determining indirect effects may or may not be warranted:

2D. Are fish altering diets through price effects on other foods?
2E. Are fish altering diets through income effects from changes in labor allocations or private commercial disposal inside or outside the village?

Objective 3 aimes at discovering (partial list):

3A. Should the project be extended to other communities? What type?
3B. Is total pond output relative to village size adequate to effect a meaningful household-level dietary change?
3C. Is the output distributed to co-op members adequate to effect a change? (Important if some fish are sold by the co-op to meet expenses.)
3D. What are the terms of distribution? Free? Concessional price? According to labor input? According to household size?
3E. Is there co-op distribution to non-members in the village? On what terms and what magnitude?
3F. The extent of co-op participation.
3G. The extent and nature of disposal outside the village by the co-op.

There are differences and overlap between Objectives 2 and 3. The household-level investigation is certainly distinct from a co-op and community inquiry concerned with fishpond operation and output, and community-wide characteristics. But note that objective 3 is really compound. Subquestions 3B-3G hold some interest even if one community is studied and no household survey is conducted. Alternatively, answers to these questions at the co-op level may be demanded to explain a "no consumption effect" result from a household survey.

The important issue of extension of the project, contained in 3A, is another matter. The question necessitates the household survey to arrive at one observation of the community-wide consumption effect. One observation cannot stand alone in this expanded context if community-wide conditions are suspected to vary importantly, so a sample of community effects and characteristics must be analyzed together.

Variations in some of the following conditions might require this approach:

1. Pond size relative to the community size.
2. Type of fishpond feed (commercial, village crops, animal wastes).

3. Access to nets, markets, other disposal channels.
4. Co-op participation, management structure, fish-distribution procedures, or harvest frequency. (Do more fish go to larger households?)
5. Productive potential of the ponds due to sunlight, altitude, climate, harvest schedule, size, etc.
6. Proximity to extension services.
7. Preferences and baseline diet: Will more fish be eaten if rice is dominant?*

If these factors are deemed important and variant across villages, then pertinent community data must be collected.

The overlap of Objectives 2 and 3 allows some valuable cross-checking of co-op and household figures for:

1. The extent of membership.
2. Labor inputs.
3. Quantities and frequency of fish distribution to the household.
4. Conditions of distribution to members and nonmembers.

Two important transactions which probably cannot be checked by comparing co-op answers with household answers are gift transfers and resale.

III. THE CRUX

Whether the evaluation is successful may turn on the study's ability to penetrate the temporal and household distribution of fish.

1. Temporal Distribution Timing enters three ways: through seasonality, the production cycle, and storability. The expected best and worst seasons can be treated separately. These are seasons with high or low protein intake from non-fish sources. However, there may be seasonality in the pond production levels. Do experts say output is constant? What about seasonality in level of fish feed if it is derived from crop or animal sources? It cannot be assumed that the yearly average protein intake equals the best season/worst season average, yet stratifying by season is probably sufficient to be highly informative.

Within seasons, the timing of the survey with respect to the last fish harvest is critical. McGuire reports that fish "lasts no more than 10 days after it is

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* In other words, are there variations in the complementarity of the existing diet with fish?

harvested (and dried) and most people used up their allotments in 2-4 days." It is argued that weekly harvests are necessary to significantly alter the diet. Even if they are achieved, there is reason to suspect within-week fish consumption cycles. It is not unlikely that some villages will harvest two or three times a month at best. Fish may displace certain foods to other days and thereby raise protein consumption even when fish is not eaten, but the strong expectation remains of several protein consumption peaks and trailing-off periods per month.

The utter uniqueness of studying a phenomenon potentially having such marked periodicity, (high amplitude, short cycle) must be recognized and built into the research design, in my opinion. Two examples follow; others are plausible:

Example 1: One village is under study, before and after the fishpond. The harvest cycles are 10 days, but most households are interviewed in the "after" survey 5 days since the last harvest. The effect is underestimated.

Example 2: Several villages are compared. Villages further away tend to be visited systematically later in the week, as a result of convenience. This corresponds to being surveyed later after harvest. A particular community variable (distance, altitude, certain crops?) shared by the remote villages is statistically related to a fictitiously low protein effect. The recommendation is handed down not to expand the project to villages with that characteristic in the future.

To really handle this problem, it may be necessary to randomize days of observation somewhere along the line, and (not or) include questions pinning down when the last harvest was. Surveying three days in a row does not suffice since a crucial issue at stake is whether there are biases influencing the beginning of the observation period. Validly sampling the cycles presents its own unique administrative burden.

2. Household Distribution It should be relatively easy to obtain total production. The household distribution is more difficult. Where does it all actually go besides into the kettle? Invisible transfers, gifts, sale or re-sale

by households, sale by the co-op, spoilage, unequal distribution, may all bear investigation. If distribution, by design or default, is at a concessional price to co-op members, some households may purchase more than they intend to consume, lowering the village consumption effect if it is resold elsewhere.

IV. A PARAMETER

About 40 pounds whole fish per week in a community of 100 consumers supplies 4.4 gm protein per person per day. This is about 10% of the pilot study's observed protein intake, including two villages (out of three) already having ponds. This compares with an average weekly yield of 50-70 pounds at a model site in the village of Buenos Aires, Panama. A 10% gain may not be an unreasonably high target.

V. EVALUATION DESIGN

The stated research objectives require household and community data. Even without the issue of extending the project (3A), community information on the functioning and output of the pond is needed to fully interpret the household effect should no consumption gain be observed. Judging the project's nutritional success in terms of community characteristics entails a further expanded set of village data, as sketched above.

Testing the statistical significance of a protein consumption gain should involve a careful examination of what is the unobserved dimension requiring generatization. Another approach to the same issue is to ask "What is being randomized and sampled?" McGuire advocates surveying all households in the community. If they are all included, there is no need to infer or generalize the result to other community members. There are no unobserved households, and there is no need to randomize a 100% sample. The "significance level", in this context, gauges the

likelihood of the outcome if all observations were included. In this sense it is superfulous.

Likewise, if the universe of interest is all communities in the project, and they are all surveyed, as recommended in McGuire's report, then the question of sampling and significance again does not arise viv-à-vis unobserved project villages. The "universe of interest", however, might be all villages which might become project sites or fishpond sites in the future. Then the question is whether the villages chosen in this project are representative of others that may be of interest.

The other unobserved dimension is consumption by households on days not surveyed. Have they been adequately sampled? The above comments on the periodicity of fish consumption expose the need to avoid biases in the days of observation. Three possibilities are::

1. Some randomization of the days of observation;

2. Weighting the consumption effect of different days according to the time since the last harvest and the number of days at that level represented; This may require prior knowledge of the timing of harvest, and some drop-off-in-consumption estimate. If we knew harvest was on Monday, and consumption (of fish) would tend to be high and constant on Monday and Tuesday, low and constant on Thursday through Sunday, weights of 2 and 4 for observations on Tuesday and Friday might yield a good weekly figure. (Wednesday is assumed to be in between.)

3. Spreading the households surveyed through the harvest cycle. This may give a good community figure (under certain assumptions), but it could present problems for analyzing household characteristics. Since no household by itself has a representative level of fish consumption (if indeed it tapers off after harvest and has marked periodicity), spurious household characteristics might be held accountable for variations. A partial correction might be possible if a question on lapse time since harvest is included.

Perhaps periodicity of intake and the biases of days of observation are not as severe as these reflections imply, but a strong prima facie case can be made that it demands some careful consideration.

Probably all communities should be observed if 1.) one goal of the evaluation

is to decide whether the project should be extended to other villages; 2.) important community-level variables are believed to vary significantly; and 3.) the communities in this project are representative of others, within or outside of Panama, that might become fishpond sites. Even with all villages in the study, N equals 30 communities. This means that at best, maybe one to three characteristics will emerge as important predictors of what type of village a pond is likely to affect nutritionally, assuming some successes and some failures. Discriminant analysis would be possible. If this technique is used, villages would be grouped into "large protein gain" and "small protein gain" categories, and a dummy variable indicating this classification would be the dependent variable. The difference in protein consumption, before and after the pond, at the community level, is used to place villages in categories. The technique is more appropriate if the outcomes are bunched (clear successes and clear failures), but the level of gain that qualifies a village for inclusion into the "large effect" or "success" category can be set arbitrarily or in conjunction with nutritional considerations. An 80-100% household sample within villages is recommended.*

If no extrapolation is required (objective 3A is dropped) and only the present project is being evaluated, then a 100% community sample (all villages) is probably not necessary. Fifteen or twenty villages, chosen at random, should give a good idea of the impact of the project on protein consumption. Sampling no more than half of the households in each, a t-statistic based on a household N of 225 would suffice for the total picture. Each variable in this test would be the household difference (paired), and the SD would have to be computed on the set of household differences.

Any investigation of household characteristics affecting the outcome will probably require merging villages. If regression is used, for example, (there are assumed to be no more than 30 households per village on average) even a 100% sample would allow only one or two explanatory variables to be included if a single village were studied. Regressions might be performed on households merged into two or three

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* This approach does not depend on household pairing.

different classes, varying on some important community-wide characteristics, or some community variables (pond area in square meters per co-op member?) might enter a regression of all households combined. In either case, the dependent variable would be the household difference in protein consumption per consumer equivalent.

In conclusion, studying either household characteristics influencing the protein effect, or the total success of the project, may not demand a 100% sample of the villages, nor a 100% sample of households within. Projecting the impact of future fishponds may require a 100% village sample, a nearly complete sample of households within each, and the assumption that the villages the project enters are representative. The ability of the evaluation study to validly represent the short-term cycles in fish consumption that are expected, and to penetrate the distribution of output, will largely determine its utility.

It may be advisable to have a long-term follow-up survey of a few villages providing more than the 18-month perspective afforded by McGuire's suggested design. Since the construction of ponds is phased in over three years, the survey teams will still be operating in some villages long after the first ponds are in operation. This facilitates a later follow-up of the communities where ponds were first introduced.

VI. ALTERNATIVE PROPOSALS

HOUSEHOLD ANALYSIS

Although randomizing the days of observation is the most appealing solution to the periodicity of intake problem from the conceptualization and analysis standpoint, the logistical and administrative difficulties may seem insurmountable. A key parameter is the harvest cycle length from which days would be sampled--the longer, the more burdensom. Barring this approach, combining possibilities two and three may be a "second best" solution. Three successive days of observation would be made to overcome day-to-day variations in intake, as under McGuire's Option A. The three-day periods would be spread across the harvest cycle by design, so that some households would be observed during, just after, and long after harvest, and at the midpoint between harvests. Hopefully this will yield a fairly accurate village average intake over the cycle. The problem of spurious household characteristics being held accountable for differences in household level intake, which are actually due to the time factor, remains. However, the questionnaire can obtain information on the time since harvest, the storability of fish, and changes in intake through time. The two most apparent methods of using this information to correct for biases would be either to include the number of days between harvest and the survey as an explanatory variable in a regression analysis, or to estimate a "drop-off in consumption" function and use this to impute average levels of intake over the cycle. The cycle lengths would be expected to vary between villages, and again, this question of periodicity gains importance when the cycle is long. It may not be such a problem if a weekly harvest schedule is actually followed. Without due care, there will be a troublesome tendency to gather information from the households which

only reflects the periodicity issue without being appropriate to use directly in the consumption-effect analysis. The questionnaire must be designed with the specific type of analysis in mind to minimize the amount of less-usable secondary-type data.

It is possible that high protein foods will be displaced by fish in the sense of being consumed later after harvest once the fish has been used up. This will of course mitigate the periodicity of protein intake. However, a working hypothesis is that fish intake at least, and maybe protein intake, may have a quadratic drop-off functional form. So it may be worth pointing out that the time since harvest (number of days) and probably its square, would both be appropriate in a regression.

It has been suggested that for evaluating the nutritional impact of the project, somethingless than a 100% sample of households in villages may suffice. In some cases, it may be cheaper to survey all households than to trace household I.D.s to find a particular sample. For what village size is the trade-off equal? McGuire's report assumes a census of households has been made prior to the survey. I would suggest, as an approximate approach, including all households in villages under 40 in size, and half of the households in larger villages. This should not introduce any new wrinkles in the question of whether to weight observations when households from several villages are combined for analysis. The villages would not be equally represented in McGuires"100% of all villages" recommendation anyway. If some villages are large and households are unweighted, the proposed modification would reduce over-representation as well as cost (presumably).

I am dubious of the merit of collecting income and expenditure data for the purposes at hand. Curtailing the scope of the questionnaire in this respect would also lower cost. Neither this suggestion, nor the recommendation to survey half of the households in large villages are costed out in the budget estimate that follows (after village analysis). A guess as to the cost of

spreading observations throughout the harvest cycle is made. The main cost increases would accrue from more time and more travel.

In the pages that follow, Options C and D are added to McGuire's A and B for survey design. C and D both include the suggestions made above, and it should be kept in mind that some of these modifications will lower costs, although this has not been included in the budget estimates. The main difference between C and D is in reference to the number of villages visited. D is geared to including objective 3A (inferences about future projects) in the design, and therefore requires a larger village sample than needed to just evaluate the one project. The village differences between C and D are elaborated on below. The main reason for not recommending changes in the household sample size, comparing C to D, is the inefficiency of hunting down and sampling large portions of small villages when a 100% sample may be easier.*

Both C and D envisage a long-term follow-up of villages that first had ponds constructed, probably in 1984. This is considered extremely important to realistically evaluate the project's impact. The impact in the first year after construction may not look like the years to follow. Taking only one of many examples, have the ponds silted up without being re-dredged?

* If village sizes ranged from 100 to 200 households (many times larger than in Panama), for example, then it might make sense to sample 30 households from each for the purposes of C, and a larger number for D, or if household analysis within a village (instead of villages combined) were of interest.

VILLAGE ANALYSIS

The following is one possible approach to studying village characteristics as they influence the success of fishponds.

Two questionnaires would be drawn up, called the "Village" and the "Co-op" survey forms. The first would record the more stable features of the village such as location with respect to roads and markets, access to advice from fishpond extension agents, the number of households, the proximity to non-agricultural employment possibilities, e.g. in semi-urban or urban areas, fixed factors that may affect fish pond productivity such as altitude or temperature, the fish pond size, and the like. A physical measurement of the fishpond may be necessary. (Circumference and depth?)

The Co-op form would be administered to the fishpond managers asking about co-op participation from the village (How many households?), the fish feed inputs to the pond, harvest frequency, yield, distribution schemes, labor inputs, nets, etc.

Under Option C, Confined to a project evaluation, the Village form would be used 30 times: all 10 of the first series of villages would be surveyed at the time of the Winter Post Test (Household) Survey; 5 of the second-series villages and 5 of the third-series villages would be surveyed at the time of their Winter Post Test Surveys; and the first 10 villages would have a repeat visit in January and February of 1984 for a long term follow-up.

The reasoning for this suggestion is:

a.) Without extending the total length of the evaluation, only the first villages in which ponds are constructed are candidates for a long-term follow-up. Since there are so few of these, all 10 should be included. This means using the form in 5 first-series villages from which no household information is sought under Option C, at the beginning, and late into the project.

b.) The village characteristics of interest are not likely to change seasonally, so this form does not need to be completed in both seasons; however, they may change by the time of the long-term follow-up, so it is repeated then. Access to markets is one such characteristic that may change.

c.) The Village Form cannot be given during the pre-test survey since the pond size, and perhaps depth, if this is not standard, are being treated as village characteristics.

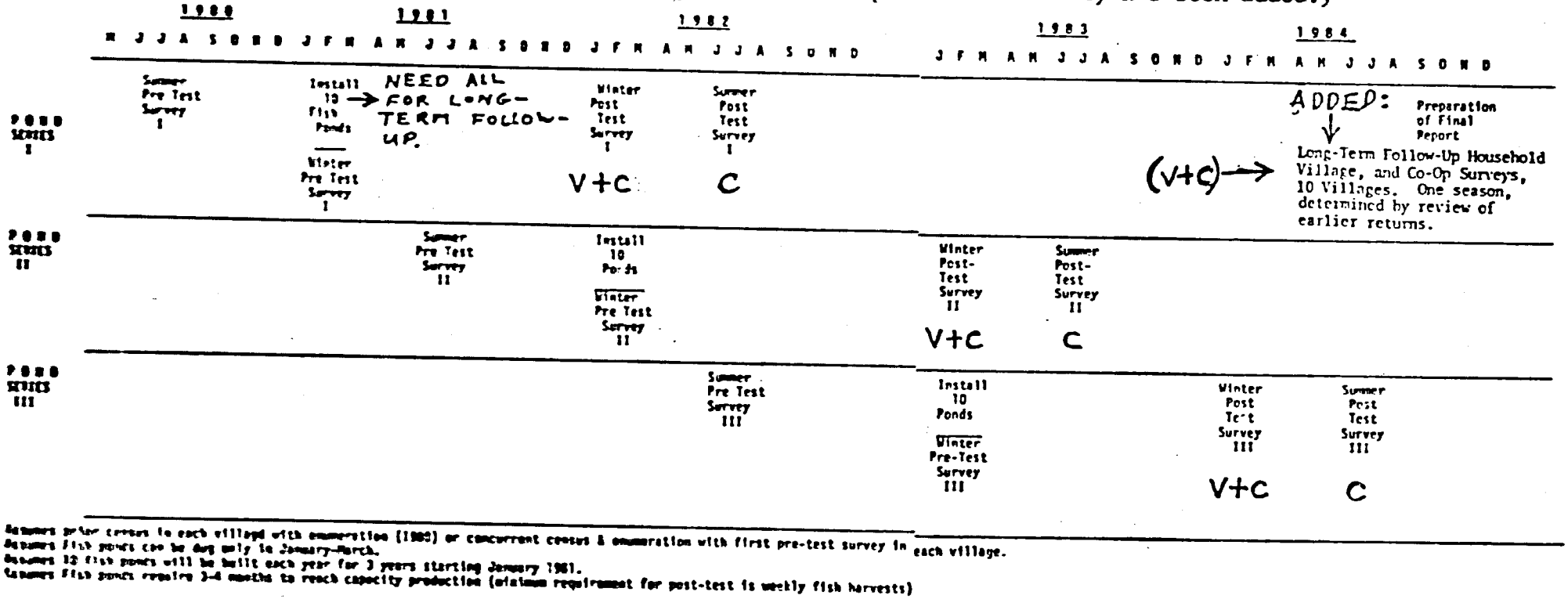
The Co-op Form would be given whenever the Village form is given. In addition, it would be given in the second season during the Summer Post Test Household Survey. However, it would only be given once during the long-term follow-up, since the household long-term follow-up surveys are only given once. It is assumed that in general, output, participation, and distribution information from the co-op will be of interest in both seasons.

Under Option D Option D requires all villages to be included so that the sample is large enough at the village level to extrapolate from to other possible fish projects. The protocols for the Village and Co-op Forms would be the same, but would be applied to all second and third series communities.

A reproduction of McGuire's Timetable, found on the next page, conveys the overview in simpler terms than the narrative approach above. "V" has been written in for the Village Forms, and "C" for the Co-op survey. The long-term surveys have been added under 1984. However, the timetable does not distinguish between Options C and D with respect to whether half or all of the second and third series villages enter the analysis.

Timetable for Expanded Survey Design

V = Village Characteristics Survey
C = Co-op and Pond Operation Survey
(A long-term follow-up household survey has been added.)



Assumes prior census in each village with enumeration (1980) or concurrent census & enumeration with first pre-test survey in each village.
Assumes fish ponds can be dug only in January-March.
Assumes 10 fish ponds will be built each year for 3 years starting January 1981.
Assumes fish ponds require 3-4 months to reach capacity production (minimum requirement for post-test is weekly fish harvests)

VII. BUDGET

A. Notes on McGuire's Budget

A partial budget is given on p. 34 of McGuire's report. The interview and coding cost for her Option A is given as $43,500 and for Option B, $20,800. The author states these figures are exclusive of expenses for cars, gasoline, and fixed costs, which she does not attempt to estimate. Fixed costs include training for interviewers, analysis, report preparation, the project director's salary (full time for four years), etc. It is unstated in the report, but she has figured all labor at $7.50/day, including drivers, per diem's at $7.50/day, and equipment at $50.00/set. Coders do not receive per diems. Her calculations assume 25 households per village, and the census costs are external. It should be noted that no costs are included for questionnaire preparation or testing. There will be a significant amount of manual or computer matching of household questionnaires which will add to the cost of analysis.

B. Alternative Budgets

Using the same set of assumptions, wage rates, and limitations, a very rough idea of the interview costs of other alternatives, Options C and D, can be worked out. In both C and D, it is planned to interview households for three consecutive days per season, as in McGuire's Option A. This is probably necessary to overcome day-to-day variation in intake. Both C and D envision Village and Co-op surveys, and a long-term follow-up in ten villages including a one season repeat household survey. Option C considers only five out of ten of the second and third series villages. This reduces the total number of surveyed villages by a third. Option D, recommended for analysis extrapolating beyond simple project evaluation to find village characteristics conducive to

success at other fishpond sites, would survey all the villages. The suggestion to drop detailed income and expenditure portions of the household survey is partially off-set by requiring more information about the use and disposal of fish and the timing of the last harvest. Some budget savings may result, but the recommendation follows from the belief that given the intake data and the purposes of the evaluation, it is unnecessary. There will be a savings in terms of coding and analysis from its omission, again partially off-set by the additional village and co-op data that I am recommending be collected. Is it really the intent of the evaluation to perform thorough economic analysis of expenditure patterns and income?

The follow-up of the first series of villages in 1984 may cost about $3,500 for the interviews. This is similar to the 1980 expense of the first visit to this group of ten communities. Spreading the interviews through a harvest cycle is going to mean more time and transportation. As a guess, this may escalate costs 30-50%. Let's pick 40%. Two partial budgets for interviews would be:

Partial Costs of Interviewing and Coding

Option C

$43,500	McGuire's Option A figure
- 14,500	Dropping 10 Villages (One third)
29,000	
+ 11,600	(40% added on for spreading interviews throughout fish harvest cycle)
+ 3,500	Long-term-follow up of first 10 villages, Household Form
+ 1,300	Village and Co-op Surveys (See Below)
TOTAL $ 45,400	

Option D

$ 43,500	McGuire's Option A Figure
+ 17,400	Spreading the Interviews adds 40% (assume)
+ 3,500	Long-Term Follow-Up
+ 1,800	Co-Op and Village Surveys (see Below)
TOTAL $ 66,200	

Assumptions underlying Co-op and Village Survey Costs (Interviews Only):

Option C: 20 villages + 10 repeats = 30 Village Forms filled out
50 Co-op Forms (More since seasons)

40 Interviewer days
40 Driver days
10 Coder days
80 Per Diems

Assume one village and one co-op questionnaire per day.
When doing seasonal co-op forms, assume two per day.

Option D: 30 villages + 10 repeats = 40 Village Forms
70 Co-op Forms

55 Interviewer days
55 Driver days
15 Coder days
110 Per Diems

It is expected that compared with the household level survey, a substantial amount of village characteristic and co-op data can be collected at low cost. Whether co-op records of pond output are kept may be critically important. Distance wheels or some other equipment may be needed to figure out pond area (the area can be found from the circumference if round). There are no additional equipment costs in the budget.

These interview budget guidelines have made some heavy assumptions and are totally dependent on McGuires figures and additional assumptions. Are they

informative or believable?

The consultant believes $7.50/day (50-80% above agricultural work) is reasonable for interviewers. Whatever does apply, it should probably be above the rate for drivers (McGuire has assumed the same wage). Only a pre-test will tell if six household interviews per person per day is reasonable. One village and one co-op form per day is a less strenuous pace. The 40% added on for spreading the timing of the household survey is pure speculation. There is no contingency allowance in the budget, nor additional time for repeat visits to locate missing respondents.

NOTE: Before launching into an evaluation of the protein impact of the project, in my opinion, there should be a clear demonstration that protein is a distinct, widespread (in target villages) and important nutritional constraint. The apparent heavy reliance on tubers is suggestive.

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