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Impacts of Integrated Fish Culture on Resource-Limited Farms in Guatemala and Panama: An Ex-Post Evaluation

Eighth Work Plan, Adoption/Diffusion Research 2 (8ADR2)
Final Report

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Abstract

The study evaluated the status of fish pond projects initiated in the 1980s on resource-poor farms in Guatemala and Panama. In both places, the host country and the United States Agency for International Development (USAID) provided financial assistance and Auburn University provided technical support to the respective governments. The study examined the impact of aquaculture technology, extension services, and local socioeconomic conditions on the projects. The evaluation team (an aquaculturist, an agricultural economist, and a social anthropologist) had a rare opportunity to evaluate sustainability of two different types of fish farming projects. Other ex-post evaluations of aquaculture projects occur shortly after external support has ended, rather than after 14 and 9 years as was the case in Panama and Guatemala. In both Guatemala and Panama, the projects were designed to improve the nutrition and increase the income of poor farmers, and participants were to become self-sufficient pond managers by the end of the project. The critical difference between the two projects is that in Guatemala fish ponds were managed by individual families on their farms, while in Panama more complex fish pond modules were managed by organized groups of farmers. In central and eastern Guatemala, the team visited 37 family and 2 cooperative fish pond projects between 9 and 19 June 1998. After the team left, a household survey was administered to these 37 families and another 9 families. So far as was possible, households were randomly selected from a list of 651 farm families known to have had functioning fish ponds when external financing was withdrawn in 1989. The team found that 39% of the ponds were abandoned, 48% were under-utilized; and 13% were well-managed. The fish did not have the intended impact on household nutrition and income for a combination of technical, domestic, economic, social, and broad political reasons. These include problematic water supplies to the ponds, lack of sufficient nutrients entering ponds to increase fish yield, theft, inconsistent technical assistance because of civil unrest and changing policy environments, and changing participant priorities linked to changes in household needs over the years. In Panama, the team visited 21 cooperative fish pond projects between 20 June and 3 July 1998. After the team left, a household survey was administered to 115 current or former project members. The team found that 6 projects had been completely abandoned, and 15 were being used to grow rice and/or fish. Only two projects still in use were well-managed. Fish did not have the intended impact on household nutrition and income for a combination of technical, domestic, economic, social, and broad political reasons. These include too little water to maintain pond water level during the dry season, lack of sufficient nutrients entering ponds to increase fish yield, inconsistent technical assistance related to changing government strategies, a lack of managerial and business skills on the part of project group leaders, over-dependence on local elites and/or government for various types of assistance, and macrosocial and political changes. Typically, abandonment or poor performance results from a combination of technical, economic, and social factors, each playing on and amplifying the others. In both countries, many project participants who maintained their ponds did so to irrigate gardens, water animals, or serve as flooded rice paddies. Thus, although the projects did not meet intended goals related to fish culture, participants found ways to profit from the existence of the ponds. In Panama 15 of 21 cooperatively managed pond projects and in Guatemala 28 of 46 individual household pond projects were still used at some level of proficiency.

Introduction

The purpose of this study is to evaluate the current status of tilapia pond projects initiated in the 1980s by the governments of Guatemala (GOG) and Panama (GOP), with financial support from the US Agency for International Development (USAID). This ex-post evaluation is unusual in that most evaluations of aquaculture projects occur within several years after external support has ended, rather than after 14 and 9 years as are the cases for Panama and Guatemala, respectively. This study is an attempt to determine the technological, economic, and social factors that influenced the success or failure of integrated fish culture projects in Panama and Guatemala. The role of women in managing the fish pond projects and the impact of the projects on communities in which they are located was investigated.

In Guatemala the integrated fish pond project was initiated in 1982 and external funding ended in 1989 (Castillo et al., 1992). The project was a collaborative effort, involving the National Directorate for Livestock Services (DIGESEPE), Cooperative for Assistance and Relief Everywhere (CARE), USAID, and the Peace Corps. Auburn University provided technical assistance in fish culture to the government of Guatemala and CARE. The budget for the project was US$953,000, not including Peace Corps contributions and the salaries DIGESEPE paid for 32 local promoters (extension agents) and 7 part-time supervisors. DIGESEPE also provided logistic and administrative support. The Peace Corps assigned 73 volunteers to the project, though not all were in the field at the same time. Volunteers worked directly with project participants and identified local people who could be employed by DIGESEPE as local extension agents (Castillo et al., 1992). The project was designed to improve nutrition and income for poor farm families in eastern, coastal, and northern Guatemala. To do so, the project promoted small-scale fish culture on small, individually owned farms. On many farms, 100- to 200-m^2 hand-dug ponds were integrated with livestock. The manure was used to fertilize the pond waters to increase fish yields. The nutrient-rich pond mud also could be used to fertilize gardens adjacent to the ponds. New ponds were initially stocked at no cost to participating farmers, but later they had to buy their own fingerlings. Most ponds were stocked with mixed-sex Nile tilapia, *Oreochromis niloticus*, and common carp. Participants were taught to produce their own tilapia fingerlings by retaining offspring, spawned in the fattening pond, at harvest for restocking to produce the next crop. Common carp fingerlings were purchased from government hatcheries for restocking ponds (Castillo et al., 1992). By 1989, 1,200 ponds had been built or renovated, about 15% of the ponds were integrated with animals (usually poultry in enclosures suspended over the ponds), and 21% were integrated with vegetable gardens. On average, a pond of 120 m^2 produced about 48 kg (4,000 kg ha^{-1}) of fish annually, of which about 48% was consumed by the household, 42% sold, and 10% given to neighbors or used for restocking ponds (Castillo et al., 1992).

In Panama the integrated fish pond project was initiated in 1980 and external funding ended in 1984. USAID granted the Government of Panama US$1,420,000 to mount a four-year pilot fish culture project in 21 communities. The Panamanian National Directorate of Aquaculture (DINAAC), a bureau in the Ministry of Agriculture and Livestock Development (MIDA), implemented the project. Auburn University provided technical assistance in fish culture to DINAAC. All the extension persons were government employees, most of them from DINAAC. The project was designed to teach organized groups of poor farmers how to manage integrated modules—assemblages of two, three, or four machine-dug ponds and animals and, in some places, gardens and trees—by themselves. Project participants were trained to produce their own Nile tilapia seed in small spawning and nursery ponds for stocking into the grow-out pond. Most projects were stocked with male tilapia, but some ponds were stocked with mixed-sexes and the predacious guapote tigre, *Cichlasoma managuense*, to control offspring in the grow-out ponds. Various types of carp were added to the fish ponds to increase fish production. Because carp are difficult to reproduce, fingerlings were obtained from government hatcheries. Average annual fish yield from grow-out ponds averaging 2,600 m^2 and fertilized with pig, chicken, duck, or cattle manure was 2,177 kg ha^{-1}.

External technical support was to continue for about 24 months, after which the groups were to be largely self-sufficient, with minimal support from extension. Production of fish, garden produce, livestock, and trees benefited the groups by improving their nutrition and by providing them with additional income (Lovshin et al., 1986; Schwartz et al., 1988).

METHODS AND MATERIALS

During June and July 1998 the authors visited 37 family and 2 cooperatively managed fish ponds in Guatemala, and 1 church-managed and 20 cooperatively managed fish pond projects in Panama. Host country personnel who had been involved with the projects in the 1980s coordinated the on-site visits. In Guatemala, families with fish ponds were selected from a list compiled by CARE of 651 families known to have had functioning fish ponds when the project ended in 1989. The Guatemalan extension person in charge of providing technical assistance to fish pond owners in each province assisted with the selection of families visited. The evaluation team made a rapid evaluation of the pond site and attempted to interview either the husband or wife at each site to obtain information on species cultured, source of small fish for stocking, fish care, harvest and utilization, and reasons for pond and animal husbandry abandonment. Ponds were classified as abandoned, under-utilized, or well-utilized for fish culture in Guatemala. Abandoned ponds had no water and bottoms overgrown with grasses and weeds, or were partially filled with water but full of aquatic weeds. Under-utilized ponds contained water and a few fish but were poorly cared for as evidenced by clear or muddy water color, pond banks overgrown with weeds, little noticeable fish activity on the water surface or along the pond margin, and general lack of interest in the pond voiced by owners during the visit. Well-utilized ponds had a green water color, generally well-kept pond banks, observable fish activity in the pond, and the pond owner showed pride and a knowledge of fish culture during the interview. Other observations included the integration of animal husbandry and vegetable gardens with the fish pond and secondary utilization of the pond water for irrigating crops or watering livestock.

In Panama, the team made a rapid evaluation of the pond sites and attempted to interview at least one, and often more, participants or ex-participants to obtain information on fish species cultured, source of small fish for stocking, fish care, harvest and utilization, and reasons for pond abandonment. Projects were classified as abandoned or utilized. Abandoned ponds contained no water and their bottoms were overgrown with grasses and weeds or were partially filled with water but full of aquatic weeds. They were considered utilized if at least one pond was used for growing fish or an agricultural crop, even if remaining ponds were abandoned. Utilized ponds were further classified into three groups: a) culture of rice only in at least one pond, b) culture of fish only in at least one pond, and c) fish culture integrated with animal husbandry.

The number of fish harvests and weight of fish harvested was not recorded by farmers or extension agents in either Panama or Guatemala. Thus, neither a comparison of fish yields at project termination and at the time of this evaluation nor an analysis of economic benefits to project participants was possible.

RESULTS AND DISCUSSION

Guatemala

The team found 14 projects abandoned, 20 under-utilized, and 5 well-utilized. Mixed-sex tilapia were stocked in 24 of the 25 projects with well-utilized and under-utilized ponds. None of the projects reported stocking only male tilapia to reduce or eliminate tilapia reproduction. Of 25 projects still growing fish, 9 reported stocking guapote tigre to permit stocked fish to reach a larger harvest weight. However, a number of fish farmers reported that they did not like guapote tigre in their ponds because they ate all the tilapia offspring and none remained for restocking. Lack of tilapia fingerlings did not seem a major constraint to growing fish.

Fish did not have the impact on family nutrition and financial well-being envisioned when the project was planned. The final report to USAID and the Guatemalan agencies participating in the project (Castillo et al., 1992) did not reflect this circumstance. However, nine years after the project was terminated, most fish ponds evaluated were abandoned or under-utilized. Whatever the reasons for abandonment or under-utilization, in most cases fish ponds were not well-cared-for, and this suggests that fish do not or may not play an important role in family nutrition or financial well-being. Incentives to properly manage the fish ponds are not present. Theft of tilapia from ponds not located close to the household was a problem. Integrating animals with fish ponds to improve fish yields failed. For reasons not fully understood but likely related to unprofitability, broiler and layer chicken production associated with fish ponds was abandoned. Without a consistent source of manures to fertilize fish ponds, producers resort to kitchen and table scraps and on-farm by-products to feed fish. Most families with fish ponds are resource-limited and do not have enough feed to provide the fish with a nutritious diet, and this results in slow fish growth and low yields. Even farmers with the financial means to purchase feed are reluctant to purchase sufficient quantities to adequately feed their fish. Fish simply do not provide the nutritional or financial return to justify the expense of purchased feeds. The most beneficial aspect of the fish ponds appears to be their ability to store water during the dry season to irrigate vegetables and water cattle. Many of the ponds used to store water are not well utilized for growing fish but do play an important role in the nutritional and financial well-being of their owners in other ways. Without the fish pond, farmers would be unable to plant a garden or raise cattle during the dry season.

Since the Guatemalan project did not involve group effort, the survey dealt with division of labor within the household. Women seem to play a much larger role in pond management in Guatemala than in Panama. In Guatemala, women played a significant role in pond management in about 50% of the households. Gender differences between Panama and Guatemala are difficult to account for. However, differences in project scale appear to account for much of the difference in gender role. Women may play larger roles in small, family-sized ponds than in the more complex, multiple-pond system used in Panama.

Abandoning or under-utilizing a small-scale family pond may be an artifact of changes in the domestic cycle. As children become adults and move away from home, particularly if they find relatively well-paying jobs in urban areas and remit funds home, project participants simply have less need for the ponds. In this context, it is useful to recall that most participants entered the project to secure more food. As households become smaller they have less need for additional food, especially in cases where adult children help to support parents and/or in cases where the older person is not as healthy or as strong as she/he was when the project began. The ponds, having done their job, now become part of the past.

Extension agents provide not only technical support but also may be or may become useful economic or political connections for farmers, and lack of extension continuity and constancy may dampen commitment to the ponds. Simply being able to touch base, so to speak, with an extension agent may maintain interest in the ponds. The employment of local farmers to act as extension agents may have been beneficial when the project was active. However, the GOG failure to continue to pay local extension agents after the project terminated and the exit of Peace Corps volunteers left farmers without technical assistance except for government workers located at distant fish hatcheries.

Panama

Six projects were considered abandoned. The remaining fifteen projects still grew tilapia or rice in at least one pond. Four projects had abandoned fish culture and only planted paddy rice in some of their fish ponds. Eleven projects still had tilapia stocked in at least one pond. Of the eleven projects still growing fish, nine also had at least one pond planted with paddy rice and two had not added rice as a component of their integrated project. Of the eleven projects culturing fish, four projects said they stocked mixed-sex tilapia, while seven projects stocked male tilapia. Eight projects stocked carps, and seven projects stocked guapote tigre with their tilapia to control tilapia offspring. Surprisingly, nine projects obtained male tilapia for pond stocking only from government hatcheries even though project members had been instructed in methods to produce mixed-sex fingerlings or male fingerlings by visual selection on-farm. Only one project did not get any fingerlings from the government while one project got fingerlings from both the government and on-farm. Most project participants thought that producing male tilapia fingerlings by visual selection was too difficult. However, participants thought that inadequate availability of fingerlings in a timely manner hindered efficient use of fish ponds. Nine of eleven projects growing fish had an animal husbandry activity associated with the fish pond. Pigs were found on eight projects, chickens on five projects, and ducks and goats on one project. More than one animal was raised on four projects. None of the projects growing fish reported feeding their fish or fertilizing pond waters with chemical fertilizers. Only three projects obtained off-farm manures to fertilize pond waters. Of the fifteen projects still operating, seven had vegetable gardens when the project ended in 1984 (Lovshin et al., 1986). At the time of the survey, only two of these seven projects continued to plant vegetables. However, paddy rice had displaced gardening and was found on 13 of 15 operating projects. Two projects were culturing rice and fish together in the same pond, while the remaining eleven projects mono-cultured rice in refurbished fish ponds. Trees were planted on five of the fifteen projects still in use, and the trees had grown to maturity and provided income, building materials, and fuel.

As in Guatemala, most fish ponds in Panama were abandoned or poorly utilized for growing fish. Fish culture did not have the

anticipated economic and nutritional impact on participant families. Levels of fish, animal, and vegetable production recorded in 1984 (Lovshin et al., 1986) were apparently not sustained. Whatever the reasons for pond abandonment or poor utilization, in most cases fish ponds were not well-cared-for, and this suggests that fish do not or may not play an important role in family nutrition or financial well-being. Incentives to properly manage the fish ponds are not present. Extension assistance by the GOP was not maintained, and contacts between extension agents and project groups were infrequent.

Tilapia continued to be the principal culture fish, although carps were appreciated by some project members. Few project groups were able to learn or were sufficiently motivated to produce their own male tilapia fingerlings. A government hatchery was able to provide fingerlings for most projects still growing fish, though supply was often sporadic. Most project members preferred to purchase fingerlings or to receive them free from the government. Self-sufficiency in tilapia fingerling production was not accomplished, though this was a principle goal of the project. Most projects still growing fish continued to raise animals close to their fish ponds. Although the number of animals raised was below recommended levels for good fish yield, animal manures were the only source of nutrients entering fish ponds. Project members did not provide fish with on-farm or purchased feeds. Although the concept of integrating animals with fish ponds was retained, lack of cash and difficulty obtaining loans from banks, government, and non-governmental organizations hindered the ability of project members to raise animals in a manner that would effectively fertilize the fish pond to increase fish yields. In only three projects had animal husbandry developed into a self-sustaining activity. As in Guatemala, fish ponds were used in a manner unforeseen when the project was designed and implemented. Many ponds had been adapted to plant irrigated rice. The Panamanian government actively promoted the conversion of fish ponds into rice paddies. In many cases, rice has provided a greater benefit to project members than fish and has replaced fish as the primary project activity. Benefits to project members from trees are probably equal to or greater than any other activity. If participants are willing to wait until trees reach maturity, trees make a good addition to community projects as they provide participants with both environmental and economic benefits.

A puzzling question is who does the work of maintaining the fish ponds. To judge from responses to survey questions, in no more than 11.5% of households do women participate. Yet when one spends some time in at least certain communities, it is apparent that women have a more active role than is reflected on the survey. To be sure, there are some places where women play no role in fish-pond maintenance, and there are some tasks with which they may not be involved in any communities. Yet observations made in 1985 indicated that women played a larger role in pond management than the 1998 survey indicates.

As for the number of beneficiaries of the project, there has been a constant drop in numbers. Figures given here refer to 14 communities for which there were complete data in the 1980s. In 1981, when the project began, 353 heads of household enrolled as members (*socios*) in the project in these 14 communities, each head of household representing a family of about six persons at that time. Across the 14 communities, the average number of socios per project was 25.2, with a median of 24.0, and a range of 20 to 38. Average size of the fattening pond in the 14 communities was 2,830 m^2 so that each of the 25 socios had 113 m^2 of fattening pond to grow fish for his family. By 1984, the total number of socios had dropped 31% and was 244, with an average of 17.4 socios per project, a median of 16.5 and a range of 8 to 37. In 1985, a year after external funding for the project ended, there was another decrease, with 172 socios, and an average of 12.3 socios per project group, a median of 11.5 socios, and a range of 1 to 29. In 1998, there were 113 socios in 9 projects because 5 had been abandoned, with an average of 8.1 socios per project group, a median of 6.0, and a range of 1 to 21. Average size of the fattening pond in the 9 projects was 3,009 m^2 and each socio had 376 m^2 of fattening pond from which to harvest fish. Thus, between 1984 and 1998, membership in the project groups in 14 communities had decreased 69%, and between 1985 and 1998 the decrease was 34%. In the 9 ongoing projects mentioned above, 2 had become the property of a single owner, 5 were more or less owned and operated by several related families, and 2 were operated by unrelated community members.

More time identifying communities whose social system was compatible with the demands of rural producers' cooperatives prior to pond construction was needed. Since this is not the place for an extended discussion of donor agency policy, perhaps it will suffice to note that donor agencies operate with fixed, relatively short-term time scales, about three years in the case under study. Moreover, donors require specified objectives to be achieved by carefully budgeted and regularly scheduled activities and expenditures. This is entirely proper given the need for accountability and the organizational culture of donor agencies. This reasonable-enough way of doing things, nonetheless, puts pressure on consultants and recipient agencies like DINAAC to concentrate efforts on the most readily monitored components of a project, such as formally organized groups, numbers of people trained, physical infrastructure, and so on.

However understandable the focus on deliverables may be, it probably makes more sense to invest time up front on social analysis. The cost of making sociocultural studies secondary to technical ones can be high. As an analysis of ex-post evaluations of World Bank and USAID projects indicated, the average economic rate of return for rural development projects which have incorporated sociocultural analysis was more than double that for projects which had been poorly appraised from a sociological viewpoint (Cernea, 1991; Schwartz and Deruyttere, 1996). Sociocultural analyses are not easy, they are always site-specific, and they take time. But they should be carried out prior to building infrastructure rather than concurrently with that activity. The up-front time invested in such analyses turns out not to increase total project length because potential problems (particularly social ones) are identified and resolved early in the project rather than being allowed to fester beneath the surface only to erupt later on. Another reason for conducting sociocultural studies prior to building infrastructure is that no two communities in this or any other project were or are exactly alike. Prior understanding of the particularities of each community, though this takes time, might have made some problems more manageable.

General

Finally, most development projects must not be seen primarily as solely social, cultural, technical, economic, or political, but

rather as a subtle interplay of all these factors. Generally, the team found that project failure was due to a combination of linked causes, rather than to any single cause. Of course, there are exceptions to this statement. For example, even if participants have excellent managerial skills and are genuinely committed to and knowledgeable about fish farming, if a pond simply loses its supply of water, then the project will fail. But more typically, abandonment or poor performance results from a combination of technical, economic, and social factors, each playing on and amplifying the others.

ANTICIPATED BENEFITS

The goal of PD/A CRSP research is to improve animal protein sources to LDCs. Results of PD/A CRSP research must be transferred to farmers to increase fish protein supplies in developing countries. An understanding of the elements that insure that new technology will be accepted and sustained by target farmers and lessons learned from past small-pond fish culture projects will assist the PD/A CRSP and host country governments to design appropriate research and outreach activities.

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