



# AQUACULTURE CRSP 21<sup>ST</sup> ANNUAL TECHNICAL REPORT

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## INCOME, FOOD SECURITY, AND POVERTY REDUCTION: CASE STUDIES OF FUNCTIONING CLUSTERS OF SUCCESSFUL SMALL-SCALE AQUACULTURE PRODUCERS

*Tenth Work Plan, Food Security Research 1 (10FSR1)  
Final Report*

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### ABSTRACT

Aquaculture plays an identifiable role in helping rural Hondurans achieve food and income security, but there is a need for a better understanding of how tilapia culture works at the village level. This report summarizes two case studies of locations where practicing tilapia farmers have managed to grow repeated crops of tilapia over an extended period. Lessons learned from actual circumstances where tilapia culture is a regularized component of local farming systems could provide realistic guidance to efforts to foster aquacultural development. A central constituency for this information lays in an aggregate of agencies and organizations that features aquaculture as one component in its array of development interventions. Understanding gained from case studies of successful clusters of practicing fish farmers can better direct aquaculture's inclusion in current and future development initiatives. Case studies of sustained practice of tilapia culture were based on reviews of available documents, interviews with officials, extended conversations with fish farmers, visits to rural communities, and other sources of information. We interviewed 54 subsistence producers in Santa Barbara, Honduras, and ten commercial producers in Olancho, Honduras, obtaining financial information from the latter firms as well. The results suggest that certain patterns of technical assistance and conditions of solidarity and collaboration among producers fostered the sustained practice of tilapia culture in both locales. Certain cautions and vulnerabilities are identified in each place, as well as implications for technical assistance and research.

### INTRODUCTION

Aquaculture plays an identifiable role in helping rural Hondurans achieve food and income security, but there is a need for better understanding of how tilapia culture works at the village level (Molnar and Lovshin, 1995). Lessons learned from actual circumstances where tilapia is a regularized component of local farming systems could provide realistic guidance for the network of national and regional institutions dedicated to advancing aquacultural development. Another constituency for this information lays in the broader aggregate of agencies and organizations that feature aquaculture as one component in its array of development interventions.

Understandings gained from case studies of successful clusters of practicing fish farmers can contribute to the goal of better directing aquaculture's inclusion in current and future integrated community development initiatives. This report summarizes two case studies of locations where practicing tilapia farmers have managed to grow repeated crops of tilapia during extended periods (Trejos-Castillo, 2003; Martínez-Mejía 2003). We describe the experiences, circumstances, and resources that enable their successful realization of the enterprise. Study 1 describes small-scale producers in Santa Barbara, Honduras. Study 2 examines a cluster of commercial producers in Olancho, Honduras, profiling the economic niche they occupy.

## METHODS AND MATERIALS

The objectives of this study are to:

- 1) Identify clusters of small- and medium-scale producers that have engaged in repeated cycles of tilapia production in Santa Barbara and Olancho, Honduras;
- 2) Elucidate the circumstances and conditions that contribute to successful implementation and continued practice of tilapia culture;
- 3) Formulate principles and guidelines for providing technical assistance and research support for small- and medium-scale tilapia farmers in Honduras.

### Case Studies

A case study is a method for learning about a complex instance based on a comprehensive understanding of that instance obtained by extensive description and analysis of that instance taken as a whole and in its context (USGAO, 1990). Case studies are the preferred strategy when "how" or "why" questions are being posed, when the researcher has little control over events, and when the focus is on explaining a phenomenon in a real-life context (Yin, 1994).

Because aquacultural development may operate in different ways in different regions, we chose locations that are geographically dispersed and represent diversity in rainfall and elevation. Both Santa Barbara and Olancho have known clusters of successful tilapia producers, yet they represent contrasting physical and social settings for aquacultural development.

#### Study 1

The department of Santa Barbara is located about 125 miles northwest of the Honduran capital, Tegucigalpa, and about 65 miles southwest of the commercial center, San Pedro Sula. Mountainous, with an average altitude of 1,200 m, Santa Barbara's regular rainfall and productive soils support a diverse agriculture that centers on coffee production. One of the more densely populated locales in Honduras, Santa Barbara has an area of 5,115 km<sup>2</sup> and a population of 384,900 (753 persons km<sup>-2</sup>). High levels of poverty characterize most villages where the small adobe houses usually lack electric and telephone services. Most households grow a small kitchen garden in addition to farming dispersed plots in the surrounding countryside. Thus, growing tilapia was part of a broader approach to solve a food security problem in the area.

Two communities were the focus of Study 1. Although 11 communities were visited at the Santa Barbara department, the study focused on 21 de Octubre and Nuevo Lempira because of the centrality of the tilapia enterprises for many families and the extended period that producers in these locales had been growing tilapia. The first community, 21 de Octubre, is located near an American-owned mining operation that provides rotating spells of wage labor to many area workers. The community's name derives from the Soldier's national holiday celebrated on 21 October. Approximately 150 households comprise the settlement with most households deriving livelihood from the practice of subsistence farming. The second community, Nuevo Lempira, is named after a historically significant Indian leader, as well as the unit of Honduran currency. Similarly, the 100 more-dispersed households in Nuevo Lempira primarily depend on subsistence farming. Fieldwork consisted of 54 unstructured interviews conducted

in June 2003. Discussions addressed the characteristics, dynamics, and socioeconomic impact of tilapia culture at the household and community levels. Group interviews were also conducted with community residents. A short interview guide was used to lead conversations with the farmers. Local markets also were visited to observe the items for sale, the extent to which tilapia was available, how it was presented, and at what price. The data for the subsistence producers are summarized in terms of the central themes or issues that emerged from the interviews and observations made during field visits to the communities.

#### Study 2

Located in east central Honduras, Olancho is the largest department in the country (24,351 km<sup>2</sup>). It has a population of 415,100 people, resulting in a relatively low population density of 17 people km<sup>-2</sup>. A cattle and forestry area, Olancho represents somewhat warmer temperatures and lower elevations than Santa Barbara, with broad valleys and low mountains.

Data were obtained in repeated visits to ten commercial tilapia producers during the months of July and August of 2002. The contacts consisted of introductory visits to schedule a subsequent interview lasting on average 2.5 h. After the interviews were complete, a group meeting was held to discuss technical problems in fish culture with Dan Meyer, Zamorano.

The data for the commercial producers are summarized in terms of the management strategies the farmers used. One thematic means for summarizing the operation of a firm is to identify the strengths, weaknesses, opportunities, and threats (SWOT) perceived by its management. Learned et al. (1960) described this analytical tool as particularly useful in identifying the strategic approaches used by management. It is employed here to clarify the reasons for sustained practice of tilapia culture in this locale. The interview also obtained financial information that was used to develop an enterprise budget for tilapia.

## RESULTS

### Study 1

The main findings of the Santa Barbara field study center on fingerling supply, marketing, motivations for adopting tilapia culture, and problems the farmers experienced with growing fish. All of the Santa Barbara producers were small-scale and had mainly backyard ponds less than 100 m<sup>2</sup>. In both communities the seven field representatives of a nongovernmental organization (NGO), Proyecto de Reconstrucción Rural (PRR), were the primary source of technical assistance and fingerlings, although a Taiwanese technical mission staff member also operated in Santa Barbara and was known to the residents of both communities.

Few individuals work permanently on other activities such as commerce in nearby towns or wage labor such as grass cutting or crop harvesting. There was a high degree of solidarity in both communities but particularly so in 21 de Octubre. There, residents participate in committees that focus on various aspects of community development. Members endeavored to construct concrete roads, to provide piped water services, and to press the ongoing struggle for legal land titles. Social relationships among individuals are very strong, centering on

strong religious and “good neighboring” beliefs. Relationships among villagers are shaped by the physical proximity of their households that foster more direct interaction among neighbors to address common problems and interests as well as looking after each other’s well-being.

#### Fingerling Supply

A focal concern in the adoption and continuing practice of aquaculture has to do with the availability of seed supplies. PRR has provided fingerlings to farmers without charge to maintain the enterprise. In turn PRR obtained fingerlings primarily from El Carao National Fish Culture Research Center at Comayagua. Although some private sources exist, El Carao functions as the main source of seed stock and supplying fingerlings for most of the small- and medium-scale producers in Santa Barbara.

The privatized fish station at Rio Hondo has not been as helpful to local producers as had been hoped due to the cost, quality, and quantity of fingerlings produced at that station. Sometimes farmers experience reproduction in batches of fish stocked with ostensibly all-male fingerlings. Among commercial producers, any reproduction in grow-out is viewed at least as a nuisance, as it leads to the production of many small fish (Lovshin, 1999). Poor quality fingerlings are those with a large number of females among the fingerlings stocked for grow-out, but poor quality fingerlings also may refer to low rates of survival due to bad genetics or poor handling in transport.

Small-scale farmers have a divided opinion about having mixed-sex fish in their ponds. Continuous reproduction in the pond impedes the growth of larger-sized fish. Some farmers are dissatisfied with the situation of eating many small fish instead of fewer big fish. For others, having fish of all sizes in the pond represents an advantage. Through partial harvesting they are able to eat fish more often during the culture period. Women are more inclined to prefer mixed-sex tilapia crops, which provide small fish for their children. Small tilapias are easy to eat because fish bones are soft. Furthermore, when deep-fried or grilled fish bones become crispy and easier to chew and swallow, this poses less of a major risk for children.

#### Marketing

Subsistence activities in developing rural settings often are not viewed as business undertakings but rather as activities that affect the welfare of all members of the community (Ruddle, 1996). The Nuevo Lempira and 21 de Octubre communities started growing tilapia with the purpose of improving diets and, in particular, meeting the nutritional needs of children. Since the beginning their repeated cycles of production have primarily been intended to meet family food requirements and not those of the market. These subsistence farmers view income as a secondary benefit of tilapia production. Cash income from selling fish is rarely realized. Only one farmer commented that he sold fish on two occasions because of a neighbor’s petition. Two other farmers shared fish with other families that they thought were in more need of the fish at that time than their own family. Selling fish (or producing tilapia to be sold) has not been adopted as a common practice in the study communities.

#### Motivations for Adoption

For a variety of reasons, the rural poor are not early adopters of new technologies (Rogers, 1995). Subsistence farmers more

often base their farming decisions on social considerations rather than on economic considerations (Ruddle, 1996). Villagers seem to derive personal satisfaction from the simple accomplishment of producing fish. The social recognition received from neighbors was frequently mentioned as a source of reinforcement for continuing with the project.

Community leaders also play an influential role in the continuance of tilapia culture. Some individuals in the community set pond management and production standards, an example others seemed to follow in order to get the same social recognition. They become “experts” in the eyes of the other villagers who visit them to ask for guidance in fish culture and other personal and farming activities. Consequently, religion and education seem to be two factors related to the enduring practice of tilapia culture in the communities.

At the 21 de Octubre cluster, the individual who has achieved the best results with the project is also a preacher at a local church. After interviewing the villagers from this cluster, it was discovered that most of the farmers enrolled in the project were very religious individuals who regularly attended his church and others.

#### Problems Experienced

When reviewing the causes of abandoned ponds, farmers described accidents with children, neighbors complaints, and new tenants who do not know the dynamics of the enterprise. Accidents were reported mainly with small children falling into the ponds. Those accidents spread fear among some residents, raising a negative attitude toward the backyard fishponds. Extension agents have addressed the situation by encouraging farmers to construct a small fence around ponds to avoid such undesirable situations in the future. Some neighbors voiced complaints about water coming from the ponds that flooded gardens and houses. Pond draining is practiced at the end of every culture period, and water easily runs down the hills in many directions.

#### Study 2

The main findings of the Olancho case study are summarized in terms of the strengths, weakness, opportunities, and threats that ten sustained practitioners saw for their operations. All the producers had substantial land holdings. The producers ranged in age from 27 to 68 yr. One was a woman. Their education levels ranged from first grade to bachelor’s degree. Seven of the producers had attended some type of formal training in tilapia culture.

#### Strengths

Strengths are the most advantageous aspects of the firms’ situation as perceived by their owners and managers. According to these producers, their main strength is the location in an area with good soils, sufficient rainfall, and groundwater resources that enable tilapia production. Their proximity to a population center (city of Catacamas) contributes to the profitability of their tilapia enterprises.

Most Olancho tilapia producers market their fish through direct marketing from stands and the pond bank, as well as sales through local restaurants and resort areas. Because the producers directly execute most marketing, there is less need to deal with third-party middlemen. The resulting condition is termed “oligopsony”—oligopoly market with a short marketing chain

and a higher producer's share of total returns.

It is important to underscore the "family activity" aspects of the Olancho operations. Most members of the cluster and their families are related—cousins, uncles, aunts, and godfather. Those who are not family related have lived near each other for many years and have created strong bonds that result in trust and understanding. For this reason they share technical knowledge, inputs, and advice regarding each other's decisions related to the management of the farm.

#### Weaknesses

Weaknesses represent the limiting internal factors that constrain a firm's ability to realize its current potential or to seize new opportunities or that make it vulnerable to threats. Most producers agree that their main weakness is lack of capital. These producers own high value farms but have limited operating capital. Some have turned to private banks for loans but have encountered several difficulties in the process. One of the producers stated, "When I went to the bank and talked to the loan officers about my plans, he offered me a line of credit for six months. I tried to explain that the line of credit that I needed was for eight months—the average length of the production cycle—but he did not understand, and at the end I did not get the loan. The problem is that loan officers have little knowledge of tilapia growing." In general the members of the cluster have the assets to support the amount of capital needed for tilapia culture, but loan officers do not finance what they do not know despite the profitability of the enterprise. Perhaps aquaculture does not yet represent a market big enough to interest the banks.

Now the question is how important must the aquaculture sector be in the region so that banks would be willing to train or hire employees with enough knowledge of aquaculture to properly evaluate rural producers' proposals. Until this happens, some producers will be unable to get a bank loan. According to one member of the cluster, aquaculture in the region currently is not important enough to make banks interested in aquaculture loans. To overcome this limiting factor, producers turn to commercial credit mainly to buy fish feed at a higher price than cash would buy.

#### Opportunity

Changes in external factors such as government policy, interest rates, production technology, and consumer preferences can present new prospects for expansion or diversification. Some members of the cluster felt that the scope of their future opportunities would depend on the total production coming out of their farms. The main opportunity is related to their current customers. All agreed that the natural landscape of the region provides an attractive and relaxing environment appropriate for tourism, which is why most of them consider visitors seeking recreation as their main opportunity for expansion. The main opportunities mentioned by producers were:

- Expanding the local market for tilapia fillets,
- Use of bones and filleting waste to manufacture fish meal as a feed ingredient,
- Expanding demand for prepared fish (fried tilapia) due to customer acceptance,
- Opportunity to combine recreational park-centered activities with fish farming,
- Better exploit the market for red tilapia,

- Explore possibility of international markets, and
- Explore markets for fingerlings and small fish for stocking ponds.

Tilapia culture presents a series of different potential opportunities. From different marketing strategies of final products to serving the needs of culture systems, the members of the cluster are evaluating these opportunities, and if profitable, they will expand their operation to supply these new markets.

#### Threats

Conditions external to the firm may affect Olancho producers in adverse ways. In general, producers cannot manage or modify threats, but they must take threats into account when making decisions. The main threat to tilapia culture in the area is water supply disruptions due to drought or pollution from upstream sources. Farmers are aware of the devastating effects of shortfalls in the supply of quality water for fish culture.

Other perceived threats were:

- Lack of locally available good-quality fingerlings,
- Inappropriate infrastructure, and
- Neighbors' concerns about disease that might be connected to fishponds.

Again, the diversity of the assets owned and the management skills possessed by each fish farmer result in different producers perceiving different threats. The list is short when compared to the other components of the SWOT analysis, and the identified threats can, for the most part, be overcome with good management.

## **DISCUSSION**

Fingerlings—their purchase price, transport, and availability—are central issues for aquacultural development in Santa Barbara. Although the subsistence farmers were technically proficient with growing tilapia and had a clear liking for their household fishponds, there is a threat to sustained practice of fish culture among these producers. Their dependence on the NGO technicians for fingerlings makes this example of sustained practice somewhat tenuous and perhaps slightly artificial. Technical assistance must move to a phase that encourages better producers to also become fingerling suppliers for their neighbors. The autonomous practice of fish culture must be a goal for those who provide technical assistance so that subsistence producers can have ready access to fingerlings of known quality and sex composition at prices they view as reasonable. Local production of fish seed will also contribute to savings through lower transport costs. Income from fingerling sales will benefit the local economy.

The Olancho study revealed two patterns of intention in the conduct of tilapia culture. Producers who already own their land do not seek to use tilapia to obtain a high rate of return on their investment. They are primarily interested in generating a modest income from fish culture and utilizing their holdings productively. On the other hand, producers with recent initial investments or who are paying back a loan are obliged to obtain a higher rate of return from production and, therefore, take additional risks. These additional risks include higher stocking densities for ponds and more aggressive feeding regimes for growing the fish. The interest rates on bank loans in Honduras can be as high as 26%, due in part to rampant inflation.

## CONCLUSIONS

We identified clusters of small- and medium-scale producers that have engaged in repeated cycles of tilapia production in Santa Barbara and Olancho, Honduras. The research documents the circumstances and conditions underlying the sustained practice of tilapia production.

The two case studies elucidate the considerations and conditions that contribute to successful implementation and continued practice of tilapia culture. Technical support was a central ingredient for the successful introduction of tilapia culture to the Santa Barbara communities that had water and soils amenable to fish culture. An innovative producer in Olancho learned the principles of fish culture, built a highly visible set of ponds, and provided technical assistance to his neighbors who decided to grow tilapia.

Creating tourism-based local demand for their production and seeking proximate urban markets, these producers were able to establish and expand a niche that has proven lucrative for most participants. The costs of capital and inherent limits to the market for tilapia in the region may limit the number of new entrants, particularly if existing producers with internal financing continue to expand their operations.

Several observations emerge that are particularly relevant to those providing technical assistance and research support for small- and medium-scale tilapia farmers in Honduras. First, subsistence producers with resources amenable to fish culture are many, but sources of technical assistance are few. NGOs and public agencies must consciously develop programs of technical instruction that provide intensive initial training and support, followed by diminishing patterns of extension assistance, while maintaining subsistence farmers' access to technical support when it is required.

Secondly, fingerling production should be fostered as an enterprise among experienced producers who have a commitment to advancing fish culture in their communities. Training programs and mailing lists should occasionally refresh fingerling producers with new techniques, possibilities, and cautions about seed production. The sustained practice of small-scale fish culture in Honduras, and more broadly in Central America, will be leveraged on the presence of a dispersed network of fingerling producers that keep the enterprise moving forward as public and private institutional support wanes or changes focus to other locales.

Finally, commercial producers will respond to market incentives and opportunities, given that tilapia have now become a recognized commodity in the Honduras food system. There is a need to educate financial institutions about the economic viability of medium-scale tilapia culture and the specific capital needs of producers. National and local educational institutions as well as NGOs have a significant role to play in providing training experiences and technical problem solving and providing reliable financial expectations to reduce uncertainty for lenders and producers.

Public sector fingerling production will remain a significant supplier of fingerlings for small-scale farmers but will likely be unable to keep pace with producer demand. Universities and government stations will have important roles to play in facilitating the development of private sector seed stock production, helping renew and maintain the quality of broodstock available to producers, and enabling the commercial sector to realize opportunities in new products, species, and export markets.

## ANTICIPATED BENEFITS

The primary benefits of this study accrue to new insights about the conditions and circumstances underlying the sustained practice of tilapia production in Honduras and more broadly in Central America. The study suggests that NGOs can more confidently feature tilapia production as one of an array of enterprises that they might support for communities. The results also may guide government agencies as they consider how to allocate resources to support both the development of the aquaculture industry and promote food security in the countryside. The findings point to the need for more intensive attention to the development of a dispersed network of local fingerling suppliers for both subsistence and commercial producers.

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