

DEVELOPMENT OF SMALL-SCALE *CLARIAS* FINGERLINGS AS BAIT FOR LAKE VICTORIA COMMERCIAL FISHERIES IN WESTERN KENYA

Quality Seedstock Development/ Activity/ 07QSD02PU

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ABSTRACT

The artisanal fishery of Lake Victoria, Kenya has been degraded by environmental deterioration, and the stock of the African catfish (*Clarias gariepinus*) in the Lake has been drastically reduced because wild-caught catfish juveniles are used as bait. We therefore recognized that income opportunities existed for fish farmers to diversify into small-pond aquaculture to provide farm-raised catfish fingerlings as alternative source of bait. Such a development would transform existing and potential small-scale fish farmers into high-yield profitable production groups, by providing technical assistance in propagation, production, general pond husbandry, and marketing.

All selected fish farmers undertook training on mass production of *C. gariepinus*. Larval stocking densities used by the fingerling producers in simple hatcheries ranged from 100-150 fry per liter of water. They were reared for 14-21 days before being moved to protected nursery ponds or to hapas hung in nursery ponds, stocked at a density of 100 fry/m² and reared for another 21-30 days. Some farmers also co-stocked adult tilapia with 2-weeks old catfish fingerlings.

Preliminary work, building on the previous Kenya Business Development Services intervention, resulted in the formation of farmer clusters—registered groups of farmers with operational accounts. The Vihiga cluster specifically made excellent progress and was able to design and implement a comprehensive program where both experienced and new farmers realized the full potential of fingerling production. Sales among the Vihiga cluster showed a progressive transformation of baitfish farmers towards commercialization.

Results suggest that pricing of baitfish both at source and at end market is dependent on the supply of and demand for the baitfish. Demand is determined by the abundance of wild-caught Nile perch from the lake. Bait traders are mainly women and operate in organized groups or as individuals operating from the beaches along the Lake. A marketing plan was developed that included the current market demographics, trends, and potential for growth. The strengths and weaknesses of the farmer groups, baitfish traders, product offering, financing associated with the marketing channels were analyzed.

Some challenges faced included some farmers getting attached to selling food-size fish and thus being unwilling to sell fingerlings as bait; lack of funding to purchase feeds and seed by farmers; predation on the farm; volatile baitfish price; and lack of quality feed for *Clarias* fry and fingerlings.

INTRODUCTION

Kenya's aquaculture consists mainly of small-scale commercial tilapia (*Oreochromis niloticus*), and also catfish (*Clarias gariepinus*), producing only about 1,000 metric tons annually until the early 2000. In 2007, however, the government reported annual production from aquaculture of about 4,220 metric tons of fish valued at KSh 500 million. The Government of Kenya has recognized aquaculture as a sub-sector with great potential to contribute towards poverty alleviation in rural communities, dietary protein enhancement, and reducing pressure on capture fisheries. As part of the Vision 2030 Economic Stimulus Strategy, the government is supporting the industry with KSh 1.1 billion (\$14.7m) under a program called 'Fish Farming Enterprise and Productivity Program.

The artisanal fishery of Lake Victoria, the largest commercial fishery in Kenya, has been degraded by environmental deterioration (water hyacinth) and a decrease in the number of smaller food species following introduction of the voracious Nile perch (*Lates niloticus*). The stock of catfish in Lake Victoria has also been drastically reduced because wild-caught juveniles are used as bait for Nile perch hooks deployed daily in the commercial fisheries. Although trawling for Nile perch was practiced by some fishers in the past, it is now illegal in the Winam Gulf, a main fishing zone in Kenya. So, some fishers have resorted to longline fishing, using fingerling-sized *C. gariepinus* as bait. The traditional supply of fingerlings is wild-caught from Lake Victoria, but this supply is intermittent and seems to be related to the extent of floating and drifting water hyacinth mats in near-shore areas, with *C. gariepinus* being numerous under the thick growth. Fishers usually use small-mesh beach seines and small seine nets to catch fingerlings for bait, but beach seining is highly destructive of the spawning habitats of native cichlids and is illegal. The Fisheries Department (FD) imposes a fishing moratorium for small seine nets from 1st April to 31st August every year thereby rendering baitfish fisher unemployed for over 4 months. Fishermen also find themselves in a difficult situation because they need the bait on a daily basis at an affordable price to be able to continue fishing. Income opportunities therefore exist for current agricultural farmers to diversification into small-pond aquaculture to provide farm-raised catfish fingerlings as alternative supply source of bait for the commercial fisheries on Lake Victoria.

The African catfish, *Clarias gariepinus*, is endemic to the Lake Victoria region. It is popular with the communities living around the lake. *C. gariepinus* is popularly farmed in polyculture with Nile tilapia (*O. niloticus*) to control unwanted tilapia populations. Catfish

are also grown in monoculture as food fish. Catfish culture is being recognized for its importance as baitfish for the Lake Victoria Nile perch fishery.

Frame Survey results for the year 2000, 2002, 2004 and 2006 showed that there were between 2.5 million and 3.0 million long line hooks operated on the Kenya side of Lake Victoria. This gives the number of boats using an average of 1,000 hooks per day to be 2,500 to 3,000 requiring a similar number of baits on daily basis. At 300 fishing days per year, it is estimated that there is an annual demand of between 750 and 900 million fingerlings at the optimum. At the reported selling price of KShs 5.00 to 8.00 per fingerling and an estimated production cost of about KShs 0.50 per fingerling, farm-based production of catfish fingerlings could be a highly profitable business for fish farmers. Despite the huge demand for catfish baitfish in the region, production has been very limited.

Spawning of *C. gariepinus* is not a major problem, but they generally have a very low survival of the juveniles. However, studies such as Ngugi *et al.* (2004, 2005) have reported successes in survival of catfish juveniles from appropriate stocking densities for fry nursed indoors in 30-L glass aquaria, as well as studies on appropriate stocking densities and varied amounts of cover provided for fry reared in hapas in outdoor ponds. Results from the studies and others suggest that additional work is needed on fingerling survival to increase catfish production for bait as well as food fish. Increased production of catfish fingerlings will raise farm income and contributing to food security in the area.

Our overall objective was to increase catfish fingerling production as bait to feed commercial fishing in Lake Victoria to reduce overexploitation of indigenous species and conserve the diversity of Lake Victoria Fisheries. We achieved the objectives through:

1. Training small- and medium-scale fish farmers as well as fisheries extension officers on hatchery technology, pond operation and management as well as business plans for catfish fingerling production.
2. Organizing fish farmers into production clusters to produce catfish fingerlings as baitfish for Lake Victoria commercial fisheries.
3. Developing the baitfish market in the Lake Victoria region for catfish fingerlings to enhance biodiversity habitats and populations.
4. Providing training for fisheries extension Officers on technology transfer mechanism to fish farmers

METHODOLOGY

Fish farmers were selected from Western Province, a high aquaculture concentration area. The area has good climate and optimum temperatures for catfish and tilapia growth. The region is very close to Lake Victoria, where catfish fingerling market can be developed for Nile perch fishery. Marketing channels would be easy to establish because of the proximity. Transportation of inputs from major town such as Kisumu city would be cheaper and transportation of produce from fish farms to the end markets can be faster.

Six cluster sites were selected from six districts in western Kenya. They were selected based on the availability of static ponds, suitability of catfish fingerling production, and farmers' willingness and ability to participate. A rapid needs assessment was conducted on the capabilities of cluster farmers. Some basic requirements such as minimum number of ponds and ability to source required inputs such as organic fertilizer was set based on a previous study under Kenya Business Development (USAID –KBDS project).

Production ponds for the proposed project were selected based on:

1. Farmers' interest in participating in the cluster and growing cattish fingerling to supply the baitfish market
2. Surface area per pond - should have a minimum of 200 m², and a maximum of 1,000 m² and the farmer must have not less than two ponds. Farmers willing to construct ponds to meet the above criteria were allowed to participate.
3. Farmers should be willing to work in a group and be willing to be trained.

The administrative location of each farmer for the clusters are as follows:

- Funyula Cluster: The cluster members came from four locations within Funyula Division namely Nambaku, Namboboto, Nangoshe and Nambogo.
- Matayos Cluster: Members of this cluster were drawn from two divisions, namely Matayos and Butula. Members from Butula came from the same location (Bujumba) while those from Matayos Division came from Lwanya and Matayos locations.
- Mundika Cluster: All the members of this cluster came from Matayos Division except one from Municipality Division (Township Location). Those from Matayos Division were shared between Busibwako and Buhayo West locations.
- Vihiga Cluster: Three members of this cluster were from Emuhaya Division and are distributed between North-West Bunyore and Wakhomo Locations. The remaining seven were from Luanda Division and all come from West Bunyore Location.
- Lurambi cluster: All members came from Lurambi division of Kakamega district
- The Bungoma/TransNzoia cluster: members were drawn from Kiminini division of transzoia and Kanduyi division of Bungoma

The number of ponds varied between farmers within a cluster and among clusters considerably. In Funyula and Vihiga, the number of ponds per member of the cluster varied from 1 to 8 while in Matayos, Mundika Lurambi and Transzoia, the range was from 1 to 5. The maximum and minimum total pond area for each cluster showed that Matayos and Mundika had the least total pond surface area (62 – 350 and 60 – 650 m² respectively) as compared to the rest (120 – 1055 and 180 – 2060 m²). In Vihiga, maximum total surface area was almost double that of Funyula and Mundika was also almost twice that of Matayos. The minimum average pond size for Vihiga was higher than all other clusters while maximum average pond size was noted in Funyula.

All cluster groups were formed with each cluster having up to ten (10) members; one cluster (Vihiga) had 15 members. The sixty (60) fish farmers selected as cluster members were trained by Aquafish CRSP resource persons and technical staff from the Fisheries Department. Training covered topics such as enterprise budgeting, baitfish marketing, hatchery management, seed production (catfish and tilapia), applications of various hatchery production techniques including broodstock collection, fertilization and spawning techniques, incubation and hatching, egg mortality and their treatment, larval rearing and mass catfish fry production, fish nutrition and feed, fish health management, as well as transportation of live fish. Farmers also learned methods of data recording, leadership styles and communication skills. Extension officers and graduate students also participated in the training programs.

Farmers were also assisted to develop a comprehensive marketing plan that included the current marketing situation, identification of opportunities and threats, and a clearly defined marketing strategy. We developed a marketing strategy that considered market

demographics, market trends, and market potential for growth. We analyzed strengths and weaknesses of the clusters and baitfish traders, product offering, finances associated with the marketing channels and did set up a marketing monitoring and evaluation as a control plan. The plan for the baitfish market also identified buyers and sellers and explored existing market rules as well as proposing new protocols that would regulate bait fish markets.

Collaborations

A leverage fund to the tune of Kshs 4.74 Million (US\$ 67,921) was provided by the local USAID Kenya Business Development Services (KBDS) under contract number A02/010/06 to develop small scale *C. gariepinus* fingerling producers in two districts in Western Kenya. The project is compatible with other donor projects addressing food security and environmental management in Kenya. These include (a) the Lake Victoria Environmental Management Project supported by the World Bank which undertakes fisheries and wetlands management research; (b) the Sustainable Agriculture Community Development Program of the UNDP Country Program Framework 2004-08 which addresses the parallel production, preservation, marketing and small-business development aspects of agriculture; (c) the UN 2004 Flash Appeal for the Drought and Food Security Crisis in Kenya which developed emergency family agriculture projects, and (d) the FAO Special Program for Food Security which identifies the need to develop small-scale aquaculture to counteract declining wild fish stocks.

RESULTS AND ACHIEVEMENTS

Formation of cluster farms and Clarias fingerlings production

Farmers are now able to evaluate and compare alternative fingerling production technologies and apply suitable technologies to produce *C. gariepinus* fingerlings for the Lake Victoria commercial fisheries. They have also learned how to keep good records regarding the operation of fish ponds to enable them assess trends in their fish production. Some farmer clusters have observed increases in fish production and revenues from fish sales. Farmers from Kisumu and Siaya who were not part of the initial training have now organized themselves into clusters from training by Lurambi and Vihiga clusters. There is an increase in cluster to cluster training to construct and manage fish ponds. There is a large spin-off of farmer-to-farmer contacts, increasing dissemination of aquaculture information and reducing reliance on government extension. Farmers are now developing enterprise budgets and business plans for the types of pond systems in use and three farmers have taken loans to increase fish production.

In particular, the Vihiga fish farmers group has become a model that is motivating the formation of other fish farmers groups. The group started off with 10 individual fish farmers as members and has grown to 25 fish farmers, including nine women. This group improved their management skills and started realizing 25 percent survival. Farmers have established a marketing link with baitfish dealers, and are consistently supplying catfish fingerlings.

The success of the fish farmers' cluster program drew the attention and financial support from the Women in Fishing Industry Project (WIFIP) based along the shores of Lake Victoria, Kenya. WIFIP helps women fish traders to identify income generating activities. WIFIP is interested in engaging women in fish farming/aquaculture to provide additional household income, and to support women during the annual fishing ban on Lake Victoria,

when income is at its lowest. WIFIP solicited the help of the some successful cluster farmers to train women in fish pond construction and catfish breeding.

Overall, the number of small-scale farmers producing catfish bait on commercial and sustainable basis has increased. Over 100 cluster farmers were trained during the study period. The level of production is currently supporting more than 20 traders handling about 2,000 fingerlings per day.

Tour of Uganda Fish Farms

Nine (9) fish farmers from Western Kenya accompanied by four (4) resource persons Uganda on a study tour of fish farms as part of the training and learning experience. The purpose of the tour was to learn alternative fingerling production technologies for both tilapia and catfish, and how Ugandan farmers kept records regarding their fish pond (farm) operations. The trip occurred from April 8 – 11, 2009. Places visited included: SUN fish farm - Kajjansi, Wakiso; Aquaculture Research Centre, Kajjansi; Tende Innovation Farm and Training Centre (TIFTC), Garuga, Wakiso; UGA Chick Fish factory and catfish farm; Umoja fish farm; and SON fish farm, Njeru.

Based on what they saw, the fish farmers from Kenya were challenged by the fact that some small scale farms in Uganda could produce up to 500,000 catfish fingerlings a month. Most of the farms visited were also using their farms as training facilities and the farm managers encouraged such integrations to help other farmers learn. The Kenyan farmers learned that they could start small and scale up their operations with little or no bank loans as was the case with some of the farmers they interacted with. They also learnt how strong the Ugandan fish farmers association was. They had the opportunity to attend one of their regular meetings. The Ugandan association has a unified voice to petition the government on matters important to fish farmers, and also work as partners in aquaculture development in Uganda. A private/ public sector partnership has allowed the government of Uganda to take a huge loan from ADB (African Development Bank) to upgrade the Kajjansi Aquaculture Centre. A fish feed extruder imported by the government is now installed at Ugachick factory to make floating pellets. The farmers are now determined to refurbish their hatcheries and turn them into commercial entities. They also commented that field visits and such tours were better methods of technology transfer than classroom teachings.

ANTICIPATED BENEFITS

- There is certainly an increase in supplies of *Clarias* fingerlings that provide Lake Victoria Nile perch fishers with a reliable source of bait.
- Fishing pressure on immature *Clarias* in Lake Victoria has been reduced although this is a long term issue. With time, reduction in beach seining will result in reduced habitat destruction on native fishes in Lake Victoria.
- The number of women taking up this activity as a proportion of males (trained and non-trained through extension) has increased.
- We are working on a steady supply of *Clarias* fingerlings that will help producers in areas where *Clarias* is gaining popularity as a cultured food fish.

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