

# **PROBLEMS AND PROSPECTS IN DEVELOPING AQUACULTURE FOR LIVELIHOOD ENHANCEMENT IN GUCHA, MERU AND TAITA-TAVETA IN KENYA: A BASELINE STUDY**

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## **Abstract**

There is considerable variability in aquaculture production within the study areas of Gucha, Meru and Taita/Taveta regions. Aquaculture activities involve the production of Nile tilapia and African catfish using earthen ponds. Most ponds are individually owned (93.8%). Most of the ponds were constructed and stocked between January 2007 and July 2011, which reflects the change in strategy by the government towards promoting aquaculture. Farmer's pond sizes are averaging at 300m<sup>2</sup> an aspect highly promoted by ESP. Most farmers indicated that they culture Nile tilapia (99%) at a stocking density of 3 fish /m<sup>2</sup>. The same applies to African catfish while Gold fish is stocked at 10 fish /m<sup>2</sup>. The latter is mainly cultured in Meru region where there is high demand for ornamental fish.

Fisheries Department was the main source of seed to farmers (40.5%), National Aquaculture Research and Development Training Centre, supplied 30.3%, Dominion farm contributed 13.2% while small-scale hatcheries run by individual farmers supplied 16%. Uga and Sigma feed manufacturers were the main fish feed providers (93.4%), while on farm feeds comprised of 6.6%. The profits ranged from 25 -75% depending on management and seed and feed quality. While the farmers acknowledged the impotence of aquaculture they face several challenges, which included quality feed, seed, technical advice and predation.

**Key words: Aquaculture development, Livelihood enhancement, Quality seed and feed.**

## **Introduction**

Aquaculture despite being a new science in the developing countries is viewed as an alternative for reducing the widening gap between fish demand and its supply. Global aquaculture production has grown rapidly during the past four decades, contributing significant quantities of fish for human consumption FAO, (2004a). Yet in the continent only Nigeria and Egypt have been dominant countries in aquaculture production surpassing over 50% of total African production of farmed fish. The situation is critical in Sub-Saharan Africa (SSA) where poverty is higher and chronic malnutrition continues to affect large proportions of the population (FAO, 2001). As yet, many countries in SSA have the potential to develop aquaculture but they continue to produce negligible quantities of fish. For example, in 2006, Sub-Saharan Africa contributed a paltry 0.03 % of the world's aquaculture production.

Kenya's development blueprint covering the period between 2008 and 2030 commonly known as *Vision 2030* aims at making Kenya a newly industrializing, "middle income country providing high quality life for all its citizens by the year 2030". The vision is based on three pillars that is; the economic pillar, the social pillar and the political pillar. It comes after the successful implementation of the Economic Recovery Strategy for Wealth and Employment Creation (ERS) that has seen the country's economy back on the path to rapid growth since 2002, when Gross Domestic Product (GDP) grew at 0.6% rising to 6.1% in 2006 in 2007. The economic pillar aims at providing prosperity to all Kenyans through an economic development program aimed at achieving an average GDP growth rate of 10 % per annum by deliberately prioritizing growth in areas that had hitherto not been fully exploited such as the fisheries sector particularly aquaculture.

Government intervention in aquaculture started in 1921 when the colonial government introduced trout, common carp and black bass into the country. In 1954, the department of fisheries was started and a program of stocking dams and ponds was initiated in Western Province (Dadzie, 1992). In 1960, the "eat more fish campaign" was launched and fish farming quickly spread in many parts of Kenya including areas of non-fish eating communities. Despite these government initiatives, aquaculture had not integrated with other farming systems thus its minimal contribution to the national economy. Most aquaculture projects previously started by the government lacked sustainability and became non-functional within a few years of their launching. In the year 2008, the government launched a national Economic Stimulus Program

aimed at jump starting the economy which had suffered due to post election violence between 2007/2008. In this regard, Kenya shilling 1.12 billion was set aside in 2009/2010 budgets for construction of fish ponds in 140 constituencies. The success of the current government initiative will depend on the extent to which factors that contributed to past failures and non-sustainability are identified and appropriate interventions instituted for the purpose of making the sector viable. Quality and affordable seed and feeds, capacity building, right ponds management, market linkages, value addition technologies and quality control are important aspects in commercialization and sustainability of aquaculture programs.

In this regard, Kenya Marine and Fisheries Research Institute (KMFRI) was funded to the tune of Ksh 24 million by KAPAP with an overall objective of addressing the main factors that are affecting sustainability and commercialization of aquaculture. The approach that is been adopted is to analyze the fish and aquaculture value chains, identifying constraints and opportunities, and developing interventions at weak links at all levels across the aquaculture value chain. To understand the aquaculture value chain, a base line survey was to be carried out on the selected study areas.

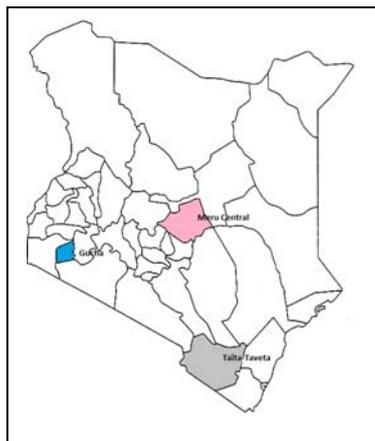
### **Objectives of the study**

The study had the following objectives;

- i. Conduct baseline survey in order to evaluate the current status of aquaculture development in three study areas i.e. Gucha, Mueru and Taita-Taveta districts.
- ii. Evaluate the impact of the ESP aquaculture programs in the study areas
- iii. Identify the major obstacles to the establishment of aquaculture in the KAPAP study areas face
- iv. Assess market dynamics for the two most culture fish species Nile Tilapia and African Catfish
- v. Identify limitations to expansion and sustainability of aquaculture as an economic enterprise.

### **Study area**

Study sites were guided by the Kenya Agricultural Productivity and Agribusiness Project (KAPAP) study areas thus the selection of Gucha, Meru and the Taita-Taveta counties. Gucha is located in Nyanza close to L. Victoria with high human population challenged by land area and limited protein source. Meru is in Eastern part of Kenya at the slopes of Mt. Kenya to the East. It equally has high human population which is traditionally not a fish eating community. Taita-Taveta comprising of a traditionally non fish eating community is in the South Eastern part of the country with erratic climatic condition resulting to low crop yields For the Marketing survey, were conducted in the three counties with the following centers targeted for their involvement in the industry ; Kariene, Kionyo, Meru, Nkubu, Nyachenga, Magena, Nyamaiya, Riverland, Kakoromoni and Taveta markets were surveyed for the marketing dynamics for aquaculture fish marketing potentials and related the markets to the expected increase in supply of cultured fish. This was followed by a prediction and pre-determining of what need to be done in relation to value addition and expanded trade.



## Methodology

Data was collected using semi-structured questionnaires; key informant interviews were also administered to opinion leaders and key stakeholders in the fish industry in the study areas. The survey team was divided into three, one assigned to each county for the purpose of saving time. The results were keyed into an Excel and SPSS (Statistical Package for Social Sciences) statistical packages and results developed.

The study developed a strategy of involving key stakeholders in the fisheries sector in order to address aquaculture development bottlenecks as indicated above. The stakeholders included the Ministry of Fisheries and Development (Research and Extension Departments), Traders, Aquaculture Association of Kenya (AAK), local Universities, Large scale fish farmers, Feed manufacturers, Aqua shops and other non-governmental institutions performing different but interrelated activities leading to the actualization of the project objectives, following the PPP and AVC principles. Nile tilapia (*Oreochromis niloticus*), African catfish (*Clarias gariepinus*) and Ningu (*Labeo victorinus*) are the main study fish species.

Structured and semi structured questionnaires were used to collect information on the current status of aquaculture development and procedures in the three study areas. There were three sets of questionnaires to farmers, traders, and key informant. Key informant interviews were used on key stakeholders such as chiefs, fisheries officials and opinion leaders so as to understand the opinions of the area residents on problems, prospects and other gender related issues on aquaculture development.

Secondary information through literature reviews and existing information were also used to establish the status and structure of aquaculture systems in the study areas. In all, a total number of 531 farmers were interviewed (Gucha- 205, Meru -192 and Taita-Taveta- 134). This is in addition to 55 traders and 15 Key-informants in each study area.

## **Results**

### **Sizes and ownership of ponds**

The survey intended to know the ownership of ponds for the sole reason that aquaculture may be practiced on parcels that are currently being used for other farm activities or idle land. The use of land involves consultations among the household or community that own it or use the water resource from wetlands. This was also useful for the purpose of identifying farmers who have come together and developed fish ponds for communal purposes where land is limited.

The study shows that most ponds were individually owned (92%) with only groups owning 7% of the ponds. The results also shows that most of the ponds were constructed and stocked in the period between May 2008 and Dec 2010, with most farmers owning one pond (83%) each while 17% of the respondents owned more than one pond. The Ministry of Fisheries recommended ESP pond size (300m<sup>2</sup>) was the most common (94.3%) for small scale farmers.

### **Species reared**

The species reared in the study areas was not a matter of individual choice by the farmers rather, its candidature as a fish species for aquaculture in the country has had a history since 1920 when aquaculture was introduced in Kenya. Culturing of Nile tilapia and African Catfish was favored by two main factors environmental conditions and market preference. The result in the study indicates that almost all the respondents are reported to prefer culturing Tilapia (99%) while only 0.5% preferred culturing Catfish, perhaps as a poly-culture to control tilapia populations. The most reared species is the Nile tilapia as can be shown in the table below;

### **Source of supply of seed and feed to farmers**

The results show that respondents knew the source of seed supply. They mentioned several sources including Dominion farm that supplied 13% of the seeds to farmers. Another that was mentioned was small scale hatcheries run by individual farmers (16%). The Fisheries Department supplied about 41%, while 30% got their seeds from National Aquaculture Research and Development Training Center at Sagana. Uga feed manufacturers was identified by 93.4% of respondents as the source of their feeds while 6.6% of respondents indicated that they made their own feeds. Other sources of feeds are shown in figure one.

### **Type of feeds used**

Feed is a key component for aquaculture development. If farmers have high quality feeds the sector expect to have positive development, while should the opposite be the case then the program will be a futility In the study areas, 49% of the respondents used supplementary feeds in conjunction with the formulated feed, while 49% used formulated feed. The fish were mainly fed in the morning and evening (46%), and 44% fed their fish in the morning only. Farmers used any kind of feed they thought would be good for their fish since manufactured feeds were not available in good time or expensive for them to acquire. Figure 2 displays the variety of feeds that farmers gave to fish in their ponds.

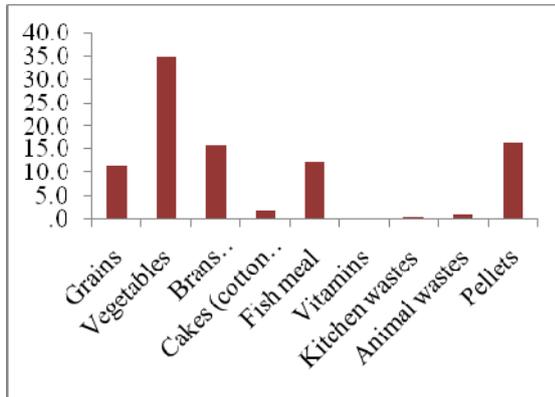


Figure 2: Type of feeds farmers give to their ponds

### Source of water for the fish ponds

Water is a very essential input in aquaculture. The Gucha area used springs from their plots as their main source of water while in the Taita-Taveta canals were used as source of water for their farms. In Meru, farmers mainly used water from streams as their source of water for their farms, which were pumped. There were few cases (5%) of wells being used as a source of water for the ponds adding considerable cost to their operations

### Culture system and stocking density

The ESP program provided all the farmers in the study areas with mono sex fingerlings (male), this is the reason why 98% of the farmers interviewed, indicated that they practiced monoculture system as compare to (2%) of respondents who practiced polyculture. Of the farmers practicing polyculture, the tilapia and catfish in a ratio of 1:10 combination was the preferred stocking density. The stocking density for the two species varied from species to species with a stoking density was 3 fish per m<sup>2</sup> for tilapia and catfish. For gold fish the density varied from farmer to farmer with high of 10/m<sup>2</sup> being recorded in Meru. Farmers do not practice intensive management system as it was observed that 96% percent of the respondents used semi-intensive management while a very low proportion (4%) used intensive culture system.

### Trait of fish

Growth was important trait by the respondents (67%) in reference to market expectations which requires fast growing breed. Costs was an important trait to some farmers (25%) indicated that the survival rate was and important trait to them. Other respondents (8%) preferred a species

that had good feeding habits. On inquiring why they want this, it was explained that since feeds were expensive they would prefer a species that can feed on a variety of food that they could give them. This explains why some farmers were giving anything to their fish.

Pond fertilization is a key aspects pond management, this is important for it enhances primary productivity particularly when the fingerlings have just been introduced into ponds, and also helps in making them get more food by feeding naturally. This is important as fingerlings have a delicate digestive system that is still developing. It is also important for the survival of the young fish as they learn to feed on formulated feeds.

Respondents were asked to state what kind of problems they were having their ponds. Predators seem to be a major problem to the farmers, which varied from theft of fish to otters (*Enhydra lutris*). Some farmers noted that herons were the biggest threat to their farms including migratory birds never seen in their areas before (figure 3. On inquiry, it was verified that even king fisher, a fish predator common in large water bodies have been noticed in areas with concentration of fish ponds.

### **Expanding aquaculture business**

Farmers were asked whether they would put more investment into their farms. A good proportion of respondents indicated that if given a chance they would reinvest in their farms (84%). Several farmers agreed that they would expand their farms, 47% said that they would do so due to profits that they have gained from fish farming as shown in table 2. Many respondents feel culturing fish is good business. Considerable number of farmers have already gone ahead to expand their activities by constructing more ponds, others are even phasing out other farm activities such as dairy in order to give space for aquaculture development.

### **Improving aquaculture**

Respondents were asked to state what they think should be done in order to improve aquaculture. This was an important element in evaluating what really were the problems that farmers would like to be attended to by key stakeholders. While their opinions were diverse, the study noticed that credit provision was important to the framers. Having realized that fish farming can bring good returns to them, 30% indicated that credit facility was important to them. Other key areas that need attention were quality seed and feed and security.

Table 1 Suggested ways of improving aquaculture development

<b>Suggestions to improve fish farming</b>	<b>Frequency</b>	<b>Percent</b>
Security	53	10
Quality seed/feed	90	17
Credit facilities	157	30
Extension services	58	11
Commercialization of aquaculture	50	10
Processing of farmed fish	3	1
Marketing of fish	94	18
Cold storage facilities	10	1.9
<b>Total</b>	<b>515</b>	<b>100</b>

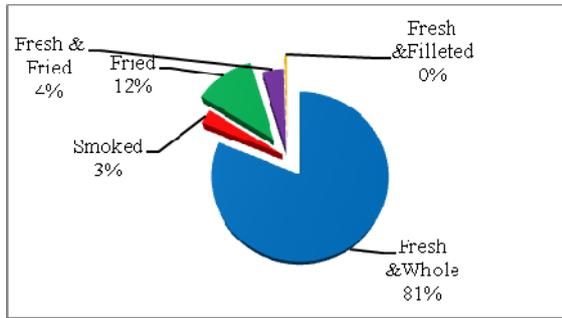
### **Target market weight and product forms demanded**

Most fish farmers harvested their fish at an average weight of 175g (30.6%) with the fish having been reared for a period of 6- 8 months. While this was the case, majority of farmers (61%) said that their target market weight was ranging between 300-500g reared between 8 - 12months. A small proportion of farmers (9%) targeted a market weight of between 600-1000g, which compares well with the fish from capture fisheries and indeed some farmers did achieve this market weight.

Markets for aquaculture fish seem not to a problem given the magnitude of fish demand. Respondents were asked to indicate where they sold their fish. Figure 4 indicates that most of the fish were sold to the community at farm gate (45%). The buyers were either informed in advance or just came by the farm during harvesting. Local markets were also an important outlet to fish produced by the farmers taking 37% of the fish. Other outlets included local restaurants/hotels and urban markets. The sales to urban markets were not as big because not enough was available to reach markets.

Demand for fish is assumed to be high since the farmers could barely meet orders that had been placed to them by consumers.

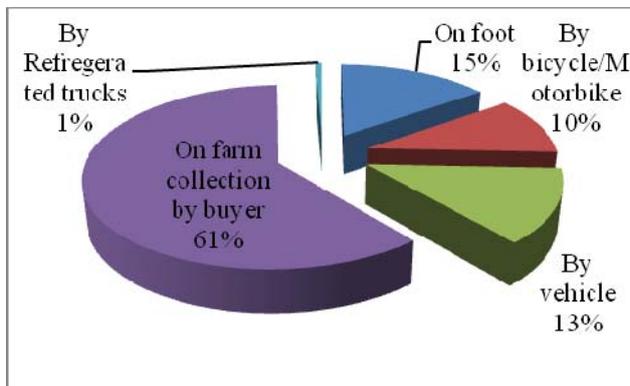
The product preference by consumers was mainly fresh-whole fish (81%), a fact that shows that consumers are used to this kind of product from the capture fishery which is sold fresh and whole form. Other product forms preferred by the market are shown in figure 5.



**Figure 5: Form of products buyers want**

This demand pattern can be used in choosing a value chain that could be developed for the purpose of making benefits to the consumers and farmers when production increase in relation to vision 2030. Several respondents (50%) said that their fish had been targeted by prospective buyers by placing orders that the fish should be sold to them when ready.

Fish that had not been sold at the farm gate took many forms; 43% of the respondents transported their fish on foot to nearby market, while 5% used bicycles. Other used motorcycles, and some were collected by the traders themselves.



**Figure 6: Fish delivery methods**

## Discussions

This study has revealed that KMFRI and Fisheries Department supplied the seed to the farmers among other key partners such as Dominion Fish Farm and Kenya and Lake Basin Development Authority (LBDA) in Western Kenya. Certified private small-scale hatcheries also supplied a significant number of seed to their fellow farmers with the help of Fisheries Department Extension Service (FDDES).

Stocking density ( $3/m^2$ ) in an area of  $300m^2$  by most farmers was based on recommendations by experts from the two sister departments in the Ministry of Fisheries Development. During harvesting though, farmers reported having harvested lower numbers than 1000 fingerlings that had been stocked. The lower numbers could have been as a result of predation, starvation, poor water quality, infections and natural mortalities.

Fish feed is a key input into aquaculture and must be of high quality for fish at various stages of growth and its use must be consistent at different stages of growth. The study reveals that some farmers were using supplementary food instead formulated ones (49%). This aspect of feed supply is critical if the sector has to grow. Using unconventional feeds in farmers' imagination to feed fish can bring setbacks to the sector and farmers as well.

Use of all sets of feeds such as animal waste, maize bran, kitchen waste and the like can only make pond management very difficult and futile to the enterprise. Despite to poor quality feed and seed, a small fraction of the farmers were able to rear fish to 300g and above with a growing period of over 12 months, a size that would easily access the local market. 80% of the farmers thought that the ESP will continue all the years with the government giving all the inputs and other services pertaining to aquaculture development free of charge at every cycle of activity, indicates a high level of dependency syndrome.

Before investing in commercial aquaculture, the potential market for the product must be estimated. Without adequate demand, any enterprise is bound to fail. This was our basis for conducting a marketing study in order to access the demand potentials for cultured fish. We observe that at the moment farmers can barely meet the demand for cultured fish. The market points to demand for fresh-whole fish, though fried products are also in demand by the hotels and restaurants. It has been observed that people who were previously not been traditionally fish eaters cannot differentiate the taste of cultured fish from that of the wild fish.

The confirmation of unlimited demand for cultured fish is reflected in the fact that most farmers did not have to take their fish to markets but had them sold at the farm gate either by announcing to the neighborhood or individuals coming to inquire about the time of harvest at the farm. In order to expand their profits farmers should be able to expanding their farms and products so that they can improve on existing production for larger markets. At the moment, there are several consumers in the name of schools, hospitals (children's homes) who into markets by including fish in their diet. In order to effectively compete in the fish market, the

farmer must isolate the variables that affect sales by monitoring their product. They must consider the time it takes them to produce market weight, pricing against production costs, the intended market and of course they must promote their products by providing timely information to consumers.

## **Acknowledgement**

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