

DEVELOPING SUPPLY CHAIN AND GROUP MARKETING SYSTEMS FOR FISH FARMERS IN GHANA AND KENYA

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ABSTRACT

The activity proposed a supply chain framework for small-scale and medium-scale commercial fish farmers in Ghana and Kenya to enhance their access to and integration into urban fish markets for better returns. The arrangement for marketing farmed fish in the two countries followed two distribution chains - a short chain from farm gate to neighboring markets and a long chain to distant markets. The nature of the marketing arrangement depended on the scale of production, proximity of production points to urban markets, and size of fish. Some changes in the marketing pattern were proposed especially changes in the volume and supply consistency of tilapia sold by the small-scale and medium-scale fish farmers. These fish farmers traditionally operated independently but given their scale of production, they needed to be taught and encouraged to engage in collective efforts to plan production, and manage supply and sales. By improving on the current cluster farming system in Kenya and fish farming associations in Ghana, fish farmers could utilize their collective organization to develop strategic assembly location points for collective sales, and also minimize their marketing risks by benefiting from government programs and engaging in contracting with both input suppliers and fish buyers.

INTRODUCTION

Fish production technology has tremendously improved in Ghana and Kenya resulting from the developmental efforts of NGOs including Aquaculture CRSP. The aquaculture industry has benefited from foreign technical assistance that has led to increased food fish production (FAO, 2009). For example, the Aquaculture CRSP activities in Kenya were designed to stimulate development of viable small-scale aquaculture businesses (Neira et al., 2009). However, very few large scale commercial farms exist in the industry and most aquaculture production is by small-scale commercial farms. The number of small-scale commercial farms is growing but fish farmers lack the knowledge and skills in supply chain issues and marketing. The aquaculture industry in Ghana and Kenya could benefit from increased support from developing market chains that link small-scale commercial fish farmers into the market chain of the established large scale commercial aquaculture, capture fisheries and seafood markets, through organized and collective marketing

efforts. This could be achieved by a thorough understanding of the fish marketing channels in order to ascertain how best small-scale commercial farms could be integrated into the existing supply chain.

The growth in aquaculture in Ghana and Kenya can be sustained if fish farmers engaged in a marketing system that involved a chain of links between producers and consumers, including all mechanisms, flows, interchanges, services and operators (Johnson and Hofman, 2004). This would provide great earnings opportunities for fish farmers. The flow of fish products through a well-functioning fish marketing system includes information on prices, market situation, trends, consumer preferences as well as flows of money, and credit. By developing this chain, there will be potential benefits for aquaculture development, employment, higher income for fish producers, potential micro-financing by fish vendors and middlemen (FAO, 2002). The extent of the potential benefits depends to a large degree upon the efficiency and design of the system. Leyva (2004) demonstrated that a thorough understanding of urban markets and coordinated production and marketing efforts are key factors to profitability of fish farmers in Nicaragua and Honduras. Leyva (2004) further found that profitability resulted from primary sales to restaurants, with supplemental sales to supermarkets in relative proximity to the target restaurants. Fish farmers in Ghana and Kenya sell fish at pond banks and in the immediate local market and lack the knowledge and skills required to access lucrative and distant urban markets. The training in supply management provided fish farmers a better understanding of opportunities and constraints in the fish/seafood value chain, and the effects on competitiveness, demand, and linkage to specific markets.

The overall objective of the activity was to develop a supply chain framework for small- and medium-scale commercial fish farmers in Ghana and Kenya to enhance their management skills to access and become integrated into urban fish markets to realize significant profitability. The framework involved training and building synergies that allowed both buyers of farm-raised fish products and small- and medium-scale fish farmers to act to minimize their joint transactions costs.

The specific objectives were to:

1. Develop an aquaculture supply chain framework to create value for farm-raised fish in Kenya.
2. Train small- and medium-scale fish farmers in supply chain management, risk analyses, costs analyses, pricing strategies, quality and cost effectiveness in post harvest value chain.
3. Build synergies between fish producers and fish vendors for improvements in product and service delivery through cost effective supply-chain coordination.
4. Equip farmers with skills for group marketing, developing new markets, developing distribution and market structures and networks, and identify value-added opportunities for tilapia and catfish.

METHODS AND MATERIALS

Background information and data on fish marketing were collected from primary and secondary sources. The primary data were obtained through a survey using structured questionnaires, personal communications and observations in Ghana and Kenya. Information was gathered from fish retailers, fish producers and agents connected to the marketing of fish products. The questionnaires elicited information on quantities supplied and demanded, prices, mode of distribution, challenges encountered, etc. Retailers were selected randomly for the survey from Accra and Kasoa markets in Ghana and from Nairobi and Kisumu markets in Kenya. Fish producers were also chosen randomly for the interview. Both owners of very large commercial fish farms and small scale fish farms were

interviewed in both Ghana and Kenya. Information gathered from personal communications came from officials at the ministry of fisheries in the two countries, host country project directors, and other personnel with more insights and in-depth understanding of the supply chain for fish. Observations were also made from the locations visited to provide first-hand knowledge of the flow of fish products from producers to consumers.

Secondary data were obtained from sources such as annual reports on the fisheries sector, fisheries policy and development strategies, national production statistics, imports, exports of fish, and other fisheries project reports. These documents provided some background information and understanding of the environment and macro-economic fish policies prevailing in the host countries.

Two workshops were conducted on June 15 and 22, 2009 in Kenya and Ghana respectively. Participants at the workshops included fish farmers, fisheries officers, fish processors, and fish traders. The training curriculum covered the importance of value chain, principles of supply chain management, principles of marketing, group marketing, developing new markets, and developing distribution and marketing networks.

RESULTS

Fish Supply in Kenya

Fish supply is mainly from wild capture fisheries and imported marine fish. A large percentage (92%) of the total domestic fish supply comes from Lake Victoria, 4% from the Indian Ocean, and 3% from inland lakes and rivers (IFPRI, 2003). However, the ministry of fisheries reports that farmed fish accounted for 3% of the total national fish production in 2007 (Ministry of Fisheries Development, 2008). The main sources of local fish supply and the country's fish exports come from Lake Victoria which is located on Kenya's western boundary. Lake Victoria shared by Kenya (6% of the shoreline), Uganda 43% and Tanzania 51%, supports a valuable artisanal and commercial fishery (Njiru et al., 2008). However, overexploitation and environmental pollution from water hyacinth and agro-chemicals appear to have affected the supply of wild capture fish from the lake. That industry is on the decline with very limited fishery resources. For example, at the Dunga Bimu landing beach in the Nyanza province, data on fish landings revealed a quantity decline of 80% for Nile perch and 60% for tilapia over the past couple of decades. Despite the reduction in the catches, the number of fishermen at the Dunga Bimu beach remained the same.

Supply of aquaculture products mainly comes from small-scale farms scattered in the Western, Central, Eastern, Rift Valley, Coast, and Nyanza provinces. Production ranges between 500 and 1500 kg/ha/year. Very few intensive and semi-intensive commercial farms exist and production levels ranges from 2,000 to 20,000 kg/ha/year for intensive systems; and 5 to 50 kg/m²/year for semi-intensive systems, depending on managerial skills. Total fish production from aquaculture in 2007 was 4,245 MT valued at 424 million Ksh (Ministry of Fisheries Development 2007). Tilapia accounted for 70% with the remaining 30% representing Clarias (890 MT), Common Carp (338 MT) and Trout species (47 MT). Approximately 4,742 fish farmers operate 717 hectares of fish farms in Kenya (Ministry of Fisheries Development 2008). This is a significant improvement in farmed fish production from under 1,000 MT in the early 1990s. This increase in production resulted partly from the intervention and technology transfers by Aquaculture CRSP.

Demand for Fish in Kenya

The average annual fish consumption of fish in 2003 was estimated to be 4kg/per capita/year

(FAOSTAT, 2009). A small percentage of the Kenya population considers fish as part of their traditional diet. The level of consumer demand for fish depends on their location. The regions close to the large lakes such as the Western and Central provinces of Kenya have the highest levels of fish consumption. Demand for fish is also high in urban areas mainly driven by population growth and higher income. The urban population in Kenya is growing at a rate of 4% and accounted for about 22% of the total population in 2008 (McGinley, 2009).

Marketing of Wild-Caught Fish in Kenya

The marketing of fish in Kenya is illustrated with figure 1. The fish market in Kenya is mainly from natural catches of Nile perch and tilapia from Lake Victoria and the smaller rivers and lakes, and to a lesser extent, marine fish. The marketing chain for the lake fisheries is long and complex, and involves several marketing agents who carry fish from the landing points to the processing facilities as well as to the village market and/or the city markets (Figure 1).

The long and complex fish distribution and marketing arrangement typically involves transactions in Nile perch from fishermen on the landing beaches to industrial processors. Some industrial processors have their own fishing trawlers that supply them with Nile perch. However, the bulk of Nile perch harvested from Lake Victoria are purchased by buying agents or middlemen tied informally or formally on a contract basis with the processing industries. The purchase price of Nile perch appears to be negotiated but interactions with fishermen suggest that they are usually on the weaker side of the negotiations. The buying agents / middlemen mostly dictate the price at which they are willing to purchase a given quantity of Nile perch suggesting that these buying agents exercise some market power. However, they play a very strategic and major role in fish marketing between the fishermen and industrial processors.

When fresh whole Nile perch are supplied to the processing facilities, they are cleaned, scaled, trimmed, and processed as whole dressed product or as fillets. The fish is largely exported to European countries and to a lesser extent, the United States. Only small quantities of processed products that do not meet the export quality standards are sold in the domestic market for local consumption. Domestic demand for the Nile perch fillets is low because few consumers can afford the price for the high value fillets.

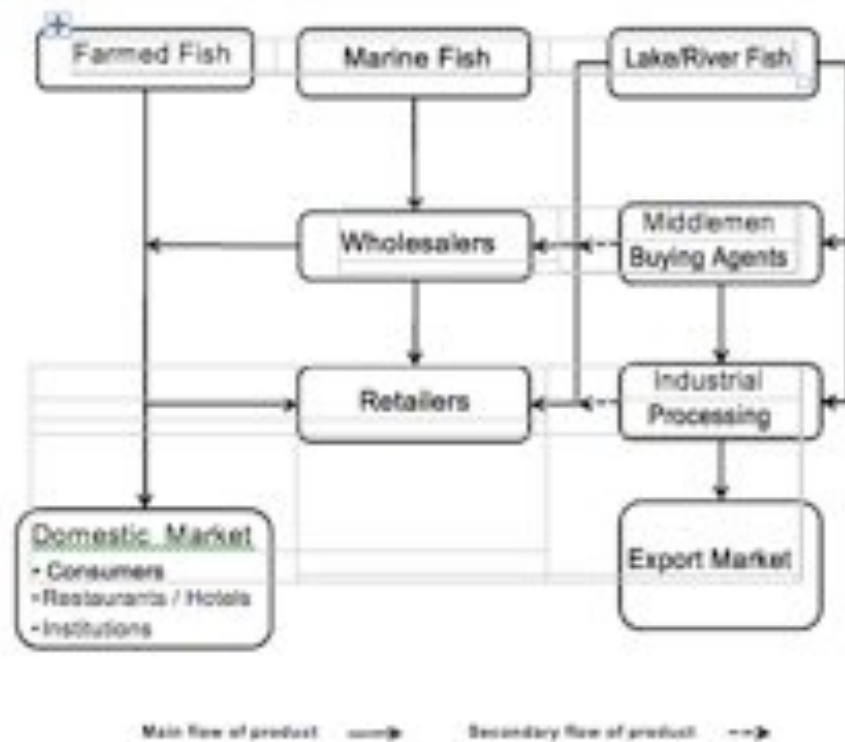


Figure 1: Fish Marketing Chain in Kenya

Marketing of Farmed Fish in Kenya

The marketing channel for aquaculture products is very short and link producers directly to consumers or retailers (Figure 1). Middlemen have a minimal or no role in the marketing channel. Farmed fish is usually produced at the village or farm level and is sold directly to consumers or retailers in nearby places. Farmed fish is usually harvested at a market size of between 300 g to 500 g from the ponds after a growing period of at least six months. Individual farmers sell directly to individual consumers, fish retailers or nearby small establishments such as restaurants, schools, and hotels. Quantities sold are generally small and supply is inconsistent. Fish is mainly sold fresh. Some low cost preservation technologies such as smoking and deep-frying are used by some farmers to add value and increase the shelf life of their products.

When food fish is ready for sale, fish producers informally contact the buyers about the availability of fish and pricing using mobile telephone. Tilapia fish sold at a price of 40 Ksh per piece of 300 g, which corresponds to a little more than 120 Ksh per kilo. This price of tilapia is almost constant throughout the year and does not vary with the seasonality of the wild capture. The price of farmed tilapia is competitive with the price of the wild capture tilapia. Unsold fish are kept in the ponds because of lack of cold storage facilities.

The means of transportation used by farmers to deliver fish to customers are commonly bicycles, motorcycles or public transportations. Transportation prices are negotiated according to the distance travelled. The major roads between urban centers cities are generally in a good condition but roads linking small rural towns and villages where fish production takes place are generally in poor condition. Thus, transportation is a constraining issue for most fish farmers in rural Kenya. Farmers located in remote areas with poor transportation roads face high transaction costs and risk of product spoilage.

Fish Distribution and Retailing in Kenya

Large fish retailers either own or rent a shop in the municipal market and have at least four hired employees working full time in the business. Such retailers have a cold storage facility (freezer) to increase the shelf life of the fresh products sold. This helps them to deliver high quality products to customers. These retailers obtain their fish supplies from different Lakes such as Lake Victoria, Lake Naivasha, Lake Turkana, Tana River and Masinga reservoir on a daily basis. The quantities of fish supplied and prices vary with seasons. On average, about 200 kg of tilapia and 500 – 1,000 kg of Nile perch are purchased daily from fishermen. The purchasing price of fresh whole Nile perch fluctuates between 130 Ksh/kg and 150 Ksh/kg; that of fresh tilapia vary between 100 and 180 Ksh/kg. Retail prices are generally set by negotiation with customers and the marketing margin ranges between 10 to 30 Ksh per piece of fish sold. Prices are generally unstable and depend on the season, demand and supply. Consumers generally demand fresh tilapia and Nile perch. These retail businesses also supply institutions such as hotels, restaurants, and other smaller retailers.

Medium-size fish traders also rent stalls and have 1 - 2 employees in the market. Fishermen from various lakes supply them with fish either on a daily basis, or by specific orders through phone calls. The quantity of fish supplied daily is about 80 kg for Nile perch and 20 kg for tilapia. The average prices are 135 Ksh/kg and 180 Ksh/kg respectively for Nile perch and tilapia. Tilapia and Nile perch are sold in whole and fillet forms. The medium-size traders also store fish in freezers to preserve the quality of the products, but there can be problems of irregular electricity supply, which can affect the quality of fish. The main customers are individual consumers and small roadside restaurants. The small size of the business makes it difficult for them to deal with big institutions.

The very small fish retailers sell fresh, smoked, sun-dried or deep-fried tilapia and Nile perch. Middlemen supply them with fish, and their customers are from low to medium income groups. These retailers rent cold storage space from facilities in the market. Others also preserve fish with ice blocks or crushed ice purchased from a local ice plant.

Most fish retailers process their fish. They either contract some individuals to process the fish or have employees who do the processing. Processed products are mainly whole dressed fish and fillets. The frames (bones and head of fish after removing the fillet) are collected by some petty traders who fry them and sell them to the very poor consumers.

Fish Supply in Ghana

In 2007, the national fish production was estimated at 375,462 metric tons (MT) with less than 1% coming from aquaculture (Quagraine et al., 2009). Marine fisheries represent more than 80% of the total supply. In 2007, marine fish production was estimated at 290 000 MT. The inland fisheries accounted for 15% of the total annual fish production, 90% of that came from Lake Volta (Mensah et al., 2006). Inland fish catches in Ghana are taken from Lake Volta, reservoirs, aquaculture and

coastal lagoons. However, these statistical records are thought to be largely underestimated compared to the actual production (MOFI, 2008). Data on fish production from the Lake Volta shows signs of overexploitation with a smaller number and size of species being caught (DoF, 2007).

The value of production from ponds and culture-based fisheries is estimated at US\$ 1.5 million a year (FAO, 2006). The aquaculture sub-sector is dominated by small-scale commercial farms using earthen ponds and traditional extensive and semi-intensive practices. There are approximately 1,000 fish farmers with 2,000 earthen ponds and a surface area of about 350 hectares (Mensah et al., 2006). Their production levels are very low. The largest volume of farm raised fish production comes from a few large scale commercial cage fish farms on Lake Volta. Fish farming at the small-scale level integrates other farming systems such as crop productions (horticulture, grains, orchard etc.). Species of fish farmed include monoculture of tilapia, and polyculture of tilapia, catfish (*Clarias gariepinus*), *Heterotis niloticus*, snakehead, and chrysichthys.

A few private large-scale commercial facilities are responsible for producing the bulk of farmed fish. These large-scale operations use the system of cage culture on Lake Volta. Production is very intensive with reliance on commercial feed. The development of cage culture farming is very recent and support many livelihoods in the aquaculture subsector. All the large scale commercial operators grow tilapia (*Oreochromis niloticus*). The emergence of large scale commercial farms has stimulated the domestic farmed fish production industry, opening up avenues for employment. Currently, total production from aquaculture and culture-based fisheries is estimated at about 3,500 MT with production from the small-scale farms representing only 1.5 MT (DoF, 2007). The current large scale enterprises are Crystal Lake Fish Ltd, Tropo Farms Ltd., and West African Fish Ltd. The current combined production for these three operations is estimated to be 3,000 MT but they have a combined capacity to produce up to 10,000MT¹.

¹ The statistic comes from interview with the Ministry of Fisheries officials.

Demand for Fish in Ghana

Fish is considered the most important source of animal protein in Ghana and is perceived as the preferred and cheapest source of animal protein intake (FAO, 2006). It is viewed as the only source of high quality protein whose shelf life can be enhanced through low-cost sustainable technologies such as smoking, drying and salting. In 2003, the average per capita consumption of fish was 28 kg/per capita/year (FAO, 2009). Ghana's demand for fish is estimated at 880 000 MT annually. However, national fish production averages 420,000 MT leaving an annual deficit of 460,000 MT.

Consumption of fish is influenced by urbanization, tribe and proximity to lakes, rivers and the ocean. The main domestic market and consumption centre is the capital city Accra. Other important consumption centers include Tema, Kumasi, Cape Coast and Sekondi-Takoradi. In these markets, the price of fish is more affordable than other quality protein foods such as milk, eggs and meats. Populations in southern Ghana especially the tribes along the coast and those in major cities and along the lakes have high levels of fish consumption. These populations consume fish in multiple forms (fresh, deep-fried, smoked, sun-dried, and salted) with traditional sauces or meals. In the drier northern parts of Ghana where populations are more oriented toward pastoralism, the level of fish consumption is low. Populations along the coastal areas consume more fresh fish while inland populations consume more processed fish (USAID, 2008).

Some trade policies have been adopted by the government to ensure competitiveness of the domestic fish farms, diversification of farming systems into aquaculture and food security. Importation of farmed fish and fish seeds are prohibited. Nonetheless, imported tilapia from China can be found in the market. Government reports suggest that about 75% of national fish production is consumed in the domestic market (Antwi, 2006).

Marketing of Wild-Caught Fish in Ghana

The fish market in Ghana is dominated by marine fish from both local and imported sources (Figure 2). The common marine species of fish are sardinella, mackerel, tuna, anchovies, cassava fish, seabreams and burrito, which are sold in markets throughout the country. At the retail level, some marine species are sold at lower prices than the inland catches, which makes it difficult for the domestic production to compete with marine and imported fish. Majority of the domestic tuna catches is destined to the export market after some industrial processing. Industrial fish processing include tuna canning and tuna fish meal. Canned tuna represents the most important export product for the fisheries sector although other types of fish are also exported in frozen and smoked form to some European Union countries. Marine fish destined for the local market follows the same marketing channel as the inland lake /river catches (Figure 2). When fish is landed on shore, women play a central role as intermediaries.

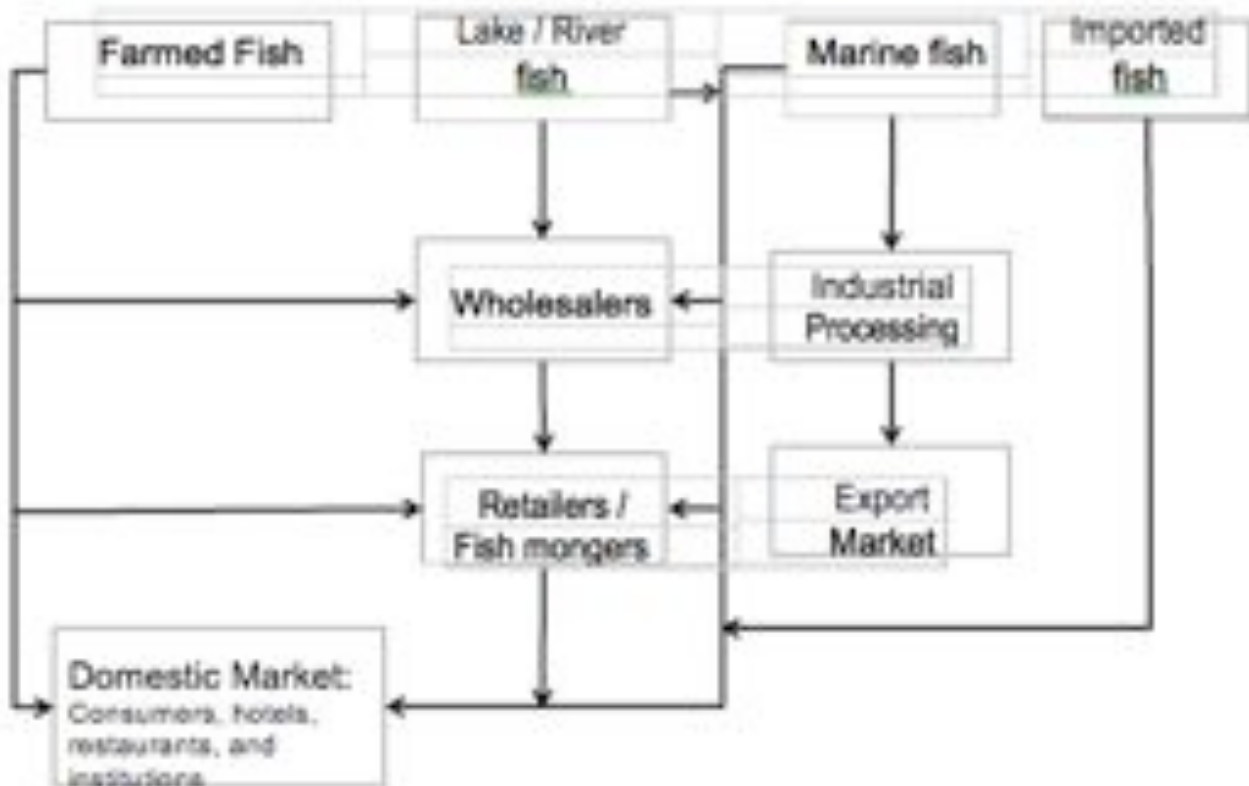


Figure 2: Fish Marketing Chain in Ghana

Marketing of Farmed Fish in Ghana

Farm-raised fish from small-scale commercial farmers have a very short supply chain and supply is

inconsistent. When fish is ready for harvest, small holder farmers inform potential customers by cell phones about the availability of fish and pricing. Some farmers use word-of-mouth or a face to face advertisement because they find it more effective than the telephone calls. Depending on the size, fish can be sold to nearby local communities, fish mongers or to some local restaurants and “chop bars” (wayside eating places). This market is generally small and also has preference for smoked fish that allows them to preserved fish for longer period of time.

Marketing of farmed fish from large commercial farms is either sold directly to retailers, fish mongers and middlemen at the farm gate or through the company owned wholesale storage facility (Figure 2). On- farm sales occur on days when harvesting is done, and usually scheduled on particular days and times. Prices depend on the size and the volume of fish purchased. Three sizes or grades of market-size fish are sold. The regular size is from 150 - 250g; size 1 fish is from 250-400g; size 2 from 400-600g; and size 3 is from 600g - 1kg. Although customers purchase all sizes of fish, fish retailers and fish mongers usually prefer smaller sizes, the regular and size 1 fish. This is because their customers, usually low income consumers, demand smaller sizes as it is cheaper and more affordable to them. Another reason is that most Ghanaian household diets involve eating a whole piece of fish rather than portion cuts of fish and the regular size and size 1 are more affordable to many consumers than the larger sizes. Therefore, demand for smaller sizes fish are generally for home consumption while larger sizes 2 and 3 are demand by restaurants and the hospitality industry. Some large scale farm operations have established wholesale outlets in the urban centers, which are far removed from the farm gate. Fish are kept in cold storage and sold to individual households, retailers / fish mongers, restaurants, hotels and institutions as well as other small distributors.

Fish Distribution and Retailing in Ghana

Fishermen and fish producers normally sell fresh fish. Fish may then be transported fresh on ice or processed and kept on ice. Processing may be in the form of scaling and degutting to produce fresh whole fish or it may be smoked, fried, salted or dried. Transportation of fresh fish could be with ice in coolers, Styrofoam boxes, or in polythene lined jute bag with ice. The use of refrigerated trucks for farmed fish is rare, though it is commonly used to transport imported and marine fish around the country. Transportation of farmed fish is done via bicycle, pickup trucks, public transportation and taxis. Some traders use freezers to store fish.

Besides fresh fish, various traditional methods are employed for fish preservation and processing in order to increase the shelf life of the products. The principal methods are smoking, sun-drying, fermentation, deep-frying and salting. The main processed fishery product is smoked fish which is the most preferred product by consumers because of its flavor, and the fact that it remains intact in whole piece when used to prepare meals. Smoked and salted fish have the advantage of storing well during the lean season and they are also easier to pack and transport to the market.

In Ghana, retailers and fish mongers sell fish in open air markets in towns and cities or along the main transportation roads. Traders are generally clustered in the market, and sell the same forms and types of fish. The products are displayed on bricks or wooden table-tops or on mats spread on the ground. They are grouped in 3 to 5 pieces depending on their size.

DISCUSSION AND CONCLUSIONS

This supply chain discussion will focus on farmed-raised Nile tilapia (*Oreochromis niloticus*) for

the food market because that is the predominant species produced in both Ghana and Kenya. The arrangement for marketing farmed fish in the two countries varied and basically follows two distribution chains; a short chain from farm gate to neighboring markets and a long chain to distant markets. The nature of the marketing arrangement depends very much on the scale of production, proximity of production points to urban markets, and size of fish.

The short chain applies much to fish produced by smallholder fish farmers and the volume traded was very low. The customers are usually small-scale fish retailers or fish mongers who purchase tilapia at the farm gate and transport it by headload, bicycles, or taxis to neighboring retail markets. Sales at the farm gate are also made directly to individual consumers. Since this marketing chain consist of a very short distance, it seems no proper marketing strategies are adopted by these smallholder farmers to improve efficiency, boost sales or improve integration into distant urban fish market. The mode of transaction at this level usually involves price bargaining. The fish buyers are mindful of their customers at the retail end who are mostly low income so they strive to secure smaller sized fish and negotiate for low purchase prices. However, there are opportunities for smallholder fish farmers to improve their revenue and grow the industry through some planning. Some changes in the marketing pattern are required especially changes in the volume and supply consistency of tilapia sold by the small-scale and medium-scale fish farmers to enable them better link to larger markets and obtain higher prices for their products.

Smallholder fish farmers traditionally operate independently but given their scale of production, they needed to be taught and encouraged to engage in collective efforts with planning production, and managing supply and sales. This is what the training workshops accomplished, by building upon group structures already in place in the respective countries. For example, in Kenya, cluster farming groups produce catfish fingerlings that are sold as bait to the Lake Victoria Nile perch fishermen. Similarly, Ghanaian farmers have been organized into associations for the purposes of obtaining technical assistance including a government subsidized bulldozer for pond construction. Though some group dynamics and leadership issues were identified with the prevailing arrangements, such grouping mechanisms could be extended to play an important role in coordinating production and collective marketing for developing some strategic assembly location points. Fish assembly points for smallholder fish farmers offer the advantages of minimizing transaction costs of individual fish farmers, and providing opportunities for quality control and to obtain premiums for their tilapia.

The long marketing chain applies to large-scale commercial operations. The production sites are distant from the markets and accessibility is challenging because of the nature of the roads. In Kenya for example, Dominion Farms is located at Yala, a rural town in Western Kenya, and is about 45 km from the provincial capital, Kisumu, and 325 km from the national capital, Nairobi. In Ghana, Crystal Lake Fish Ltd, Tropo Farms Ltd, and West Africa Fisheries Ltd are located along the Lake Volta in rural districts of the Eastern region of Ghana with poor access roads. The various locations are at least 140 km northeast of the national capital, Accra. Given the volume of production by these large commercial farms, farm-gate sales is very challenging. Consequently, Crystal Lake Fish Ltd and Tropo Farms Ltd have distribution outlets close to Accra. West Africa Fisheries Ltd has a distribution outlet under construction but currently sells at the farm-gate.

The customers of the large commercial farms are typically bulk purchasers such as fish retailers, fish mongers, wholesalers / distributors, and institutional consumers such as hotels, restaurants, schools and, hospitals. Some individual consumers, mainly the middle class, also buy bulk from

the distribution outlets. The mode of transaction at this level usually involves fixed pricing, and discounted pricing on volume purchases. There is no price bargaining.

The market for tilapia remains strong in Ghana and Kenya and is motivating increased interest in fish farming, at all levels (small-, medium- and large-scale) of commercial production. Aquaculture still accounts for a small percentage of total fish supply in both countries and is faced with constraints such as fingerlings supply and feed availability. However it is anticipated that prices will significantly fall as production increases, which will pose a serious challenge to the growth of the aquaculture industries in Ghana and Kenya. That calls for efforts to manage marketing risks if fish farming businesses are to remain successful. Fish farmers face input prices (costs) and output prices (revenues) therefore, any unfavorable prices on either side can be devastating to the fish farming business. Fish farmers need to manage marketing risks both on the input and the output side in order to maintain long-term profitability. For small-scale commercial farmers, strategic buying of fish farming inputs and strategic selling of fish can reduce the effects of price risks on profitability, and that is where the development of supply chain arrangements and group marketing strategies are important to them. By improving on the current cluster farming system in Kenya and fish farming associations in Ghana, fish farmers can utilize their collective organization to develop fish marketing assembly points, engage in contracting with fish buyers, and also benefit from government programs to improve the supply chain of farmed fish.

ANTICIPATED BENEFITS

Supply chain management and marketing are key factors to the development and sustainability of commercial small - and medium-scale aquaculture operations in Ghana and Kenya. The training activity taught an aquaculture supply management framework that would enable rural fish farmers to access urban markets. An understanding of supply-chain coordination would help to place fish vendors and farmers in a better position to collectively engage in direct trade and other economic responsible initiatives. This will result in higher incomes for fish producers, potential micro-financing from fish vendors and middlemen, aquaculture development, and rural employment. Close cooperation through planning, coordination of production, group marketing, and managing supply and sales, would improve the efficiency of aquaculture markets in Ghana and Kenya. It is anticipated that the training activity will result in the formation of group marketing activities by small and medium scale fish farmers. Accomplishment of these could result in tilapia and catfish sales values and farmers' revenues increasing by about 300%. For example, a farmer having pond-bank sales value of \$100 can easily increase sales value to \$400 through a managed supply chain and access to urban seafood markets.

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