Constraints and potentials of the fish market in the Okavango Delta, Botswana

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The Okavango Delta is the largest multi-species and multi-gear fishery in Botswana. However, there is lack of an understanding of the nature of fish market in the Delta. The objectives of the survey were (1) to identify and describe the socio economic profile of the fishers in the fishing market, (2) to describe the operations of the market and (3) to identify market constraints of fishing. A structured questionnaire was used to collect data from fishers in four study sites in the Delta. The study revealed that fishing market in the Okavango Delta is very 'informal' in nature, with almost no intermediaries, and catering only for the local population. Lack of preservation facilities, transport, low levels of skills and lack of access to credit are the various constraints facing fishers.

INTRODUCTION

The Okavango Delta in Botswana, the world largest Ramsar site, is the largest national fishery in the country, as well as the largest source of fresh water in northern Botswana (Merron and Bruton, 1988). The annual fish yield of the Okavango Delta has been estimated at 5 to 8000 tones (FAO, 2003). Fishing sustains the livelihoods of most rural communities in the Okavango Delta as it contributes to household food security (example, rich source of protein), source of income and employment and a natural safety net (Abbot et al., 2007; Shakelton and Shakelton, 2004; Jim- Saiki and Ogunbadero, 2004; Omwenga, 2006; Navy and Bhattarai, 2009; Rahman et al., 2002; FAO, 2005; Mmopelwa et al., 2008). Fishing also has cultural significance as seen in the skills and occupational identity of the fishing communities (McGoodwin, 2001). Some of the cultural aspects of fishing in the Okavango Delta relate to the fisher's long time accumulated indigenous knowledge on migratory routes and feeding habits of specific fish species (Mosepele et al., 2007). According to Siar (2003), traditional knowledge about the time-space distribution of fishery resources and the fishing gear used, determine the fisher's capacity to exploit fish more effectively.

Fishing in the Delta is carried out at subsistence level where the primary goal is home consumption, and small-scale commercial where the yield is marketed (PLANTEC AFRICA, 2003). However, as it has been observed in the Okavango Delta and other places, it is common knowledge that subsistence fishers do not, strictly speaking, fish purely for home consumption, as they also sell part of their fish catch (Abbot et al., 2007; Arnason and Kashorte, 2006; Ngwenya and Mosepele, 2007; Mmopelwa et al., 2008). Subsistence fishing is characterized by the use of simple fishing technology such as wooden boats and traditional fishing traps. The fishers range from self-employed single operators through informal microenterprises to formal sector businesses (Teweldemedhin, 2008). Commercial fishing, on the other hand, is characterized by the use of modern fishing gears such as engine powered boats, and the catch per fisher is generally higher than that of a subsistence fisher (Mosepele, 2001).

Literature shows that previous fish related research in the Okavango Delta focused on various aspects, including the socio economics of fishing (Skjønsberg and Merafe, 1987; Ngwenya and Mosepele, 2007), description of the structure of fishery (Mosepele, 2001),

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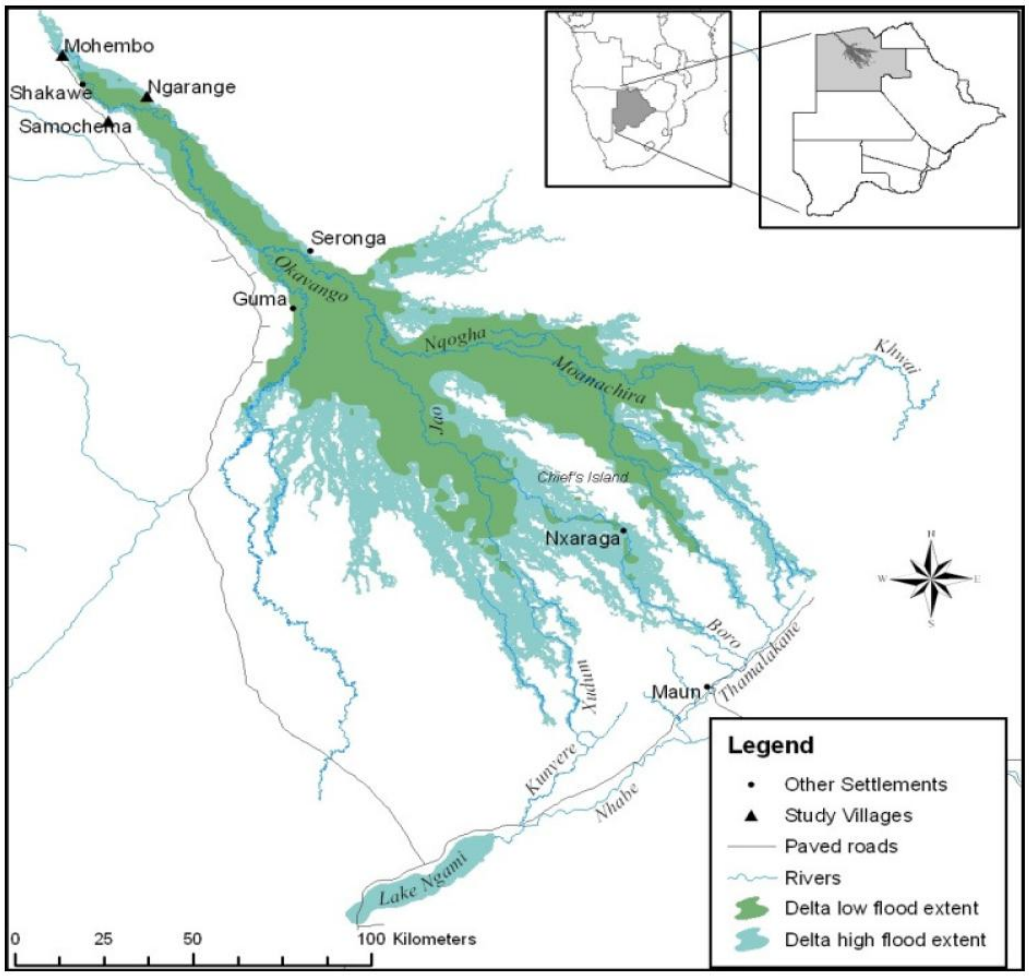

Figure 1. Map showing study areas.

financial analysis of commercial fishing (Mmopelwa et al., 2005) and the role of fish as a safety net (Mmopelwa et al., 2008). While these studies have contributed to an understanding of the socio dynamics of fishing in the Okavango Delta in general, they have not adequately described the nature of the fish market in the Okavango Delta. Specifically, the socio-economic profile of the fishers, the operations of the market and the nature of the market constraints faced by the fishers, have not been fully documented. This information is critical in informing policy aimed at improving the contribution of fishing to sustainable rural livelihoods in the Delta.

The aim of the study was to study the fish market with the view of identifying constraints and potentials of the market in the Okavango Delta. The objectives of the study were: (1) to identify and socio-economic profile of the fishers in the market; (2) to describe the operations of the market; (3) to identify market constraints of fishing and (4) to suggest policy development implications of the findings.

MATERIALS AND METHODS

Description of the study sites

The marketing survey was conducted in four fishing villages located along the Panhandle of the Okavango Delta (Figure 1). The four villages were Ngarange, Mohembo (east and west), Shakawe and Somochima. The 2001 Population census estimated the population of Ngararange at 948, Mohembo east and west at 1299, Shakawe

Table 1. Commercial and subsistence fishers and gear used.

Type of fisher	Gear				Total
	Fishing net	Hook and line	Fishing basket	Fishing net and hook and line	
Commercial	24 (73)	0 (0)	0 (0)	2 (33)	26 (46)
Subsistence	9 (27)	14 (100)	3 (100)	4 (67)	30 (54)
Total	33 (100)	14 (100)	3 (100)	6 (100)	56 (100)

Figures in parenthesis are percentages.

at 4389 and Samochima at 847. Fishing is an important livelihood in these areas, but there are also non-fish related livelihood activities such as arable and livestock farming, collection and utilization of veld products and formal employment. In and around the Panhandle, households are involved in a number of livelihoods (Applied Development Research Consultants, 2001; Kgathi et al., 2004; Kgathi et al., 2007). Ethnically, the Hambukushu, Batawana, Bakgalagadi, Bayei and Basarwa have inhabited the Panhandle environment for many years. The main livelihood activity of the Hambukushu is subsistence arable agriculture, the Batawana are predominantly cattle keepers, but also practice dryland farming (Bendsen and Meyer, 2003). The Bayeyi's main livelihood activity is fishing, while the Basarwa collect veld products.

Sampling

Prior to sampling, all households and their livelihood activities in each village were recorded in order to identify households involved in marketing fish. A total of 132 fishing households in Ngarange, Shakawe and Mohembo east and west were recorded during the survey. The total number of fishers involved in marketing of fish was 64(48%) (34 small-scale commercial fishers and 32 subsistence fishers). However, only 56 of the 64 fishers were interviewed as the remaining fishers had migrated to unknown areas or were in areas that were inaccessible due to flooding.

Data collection and analysis

This survey was undertaken in the months of September and October 2007 using a detailed structured questionnaire. Prior to data collection, the questionnaire was pretested among fishers in Maun and then used to collected primary data. Data were collected on many aspects including household demographic characteristics, sources of income and employment, fishing assets, mechanism of setting the price of fish, fish processing and distribution and marketing constraints. The questionnaire was supplemented by focused groups organized with some fishers. Secondary data including catch data for the small-scale commercial fishers of 2007 were used. Data were entered and analyzed using statistical package for social sciences (SPSS) and presented in the form of frequency tables, charts and cross tabulations.

RESULTS

Profile of fishers

Small-scale commercial fishers comprised 46% of the total fishers who marketed fish, the rest were subsistence fishers. Female fishers comprised 5% of all the fishers. In terms of the age of fishers, a small number (about 2%) was young people below the age of 18 years. A majority (52%) was in the age group of 30 to 49 years indicating that people below the age of 30 years and above 49 years were not as much involved in fishing. The highest percentage (41%) of fishers in this study had no formal education, while fishers with secondary education were the least (1.8%).

Fishing as livelihood strategy

The Hambukushu are generally known as dryland cultivators but they constituted the highest percentage (66%) of fishers selling fish in this study. Fishing was not regarded as the main livelihood activity by 18% of the fishers. Fifty-four percent and eighteen percent of the fishers were also involved in arable and livestock farming, respectively. The results indicate that households are usually involved in more than one livelihood activity.

Fishing gear and other equipment

Different types of gears are used in fishing. Small-scale commercial fishers use mostly fishing nets, while subsistence fishers use fishing nets in combination with hook and line or fishing basket (Table 1).

Other assets owned by fishers include cold storage rooms, cooler boxes, fridges, and engine powered and wooden boats (Table 2). Most fishers reported that they did not have cold storage facilities. The high temperatures in Okavango Delta (maximum 41°C) during the peak of the fishing season (August to December) pose damage risk to fish as it is a highly perishable product.

Fish catches

During the first two months of the year (January to February) fishers are involved in agricultural activities (ploughing), and are only actively engaged in fishing during March to December. The main fish species are three spot tilapia (*Orechromis andersoni*), thin face large mouth or humpback large mouth (*Serranochromis anusticeps or, Serranochromis altus),* red breasted tilapia (*Tilapia rendalli*), African pike (*Hepsetus odoe*), bull dog

Table 2. Number of fishers that own boats and preservation assets.

Fisher type	Assets				
	Cold storage	Engine powered boat	Wooden boat	Fridge	Cooler box
Commercial	1	13	18	10	10
Subsistence	0	1	14	0	1
Total	1	14	32	10	11

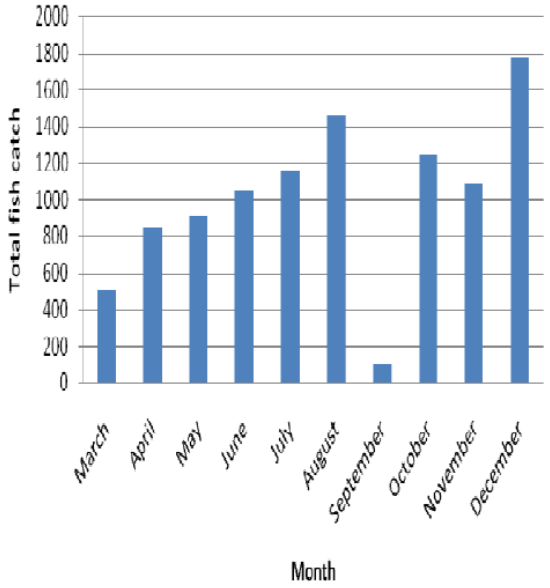

Figure 2. Fish catches by semi-commercial fishers at Mohembo during 2007.

(*Marcusenius macrolepico*) and tiger fish (*Hydrocynus vittatus*). Fish catches vary from one operator to the other, depending on factors such as the type of gear and time used in fishing. Based on self-reported catches per day, the average number of fish caught per subsistence fishers was estimated at 22. Mosepele (2001) estimated the daily catch rate of a basket fisher to be 1452 g and the annual production from hook and line to be 176 tons per fisher.

Figure 2 shows the total fish catch (number of fish) for small-scale commercial fishers in Mohembo west in 2007. The total catch per year was calculated to be 10154 fishes per fisher. The trend shows that fish catches are smaller during the early part of the year (high floods: January to March) than in later part of the year (low floods: August to December). The lower fish catches during the early part of the year can be attributed to less involvement of fishers in fishing and more involvement in arable farming activities.

The total fish catch (kg) for small-scale commercial fishers at Mohembo west in 2007 is shown in Figure 3. The estimated total fish catch for these fishers was 8726 kg (8.726 tones). Using the price of [1]P16.5/kg, this translates to total annual revenue of BWP143 979 or BWP14397.9 per small-scale commercial fisher.

Price setting mechanism

Fish is sold either fresh or smoked, and a majority (98%) of fishers reported that they sell fresh fish because consumers prefer it that way. Most (78%) subsistence fishers use eye estimation to price fish. The set price is subjected to bargaining and ranges between BWP7 and BWP16 per fish.

Small-scale commercial fishers price fish on the basis of weight (BWP/kg). The current price is set at BWP16.50/kg. The price is increased at the beginning of every calendar year and remains almost uniform for the rest of the year though it is expected that the price should vary according to the seasonal availability of fish. There is no strict grading or sorting system of fish and a single price is used for all different species of fish.

Subsistence fishers reported that they maintain a constant price throughout the day because in the event that there is unsold fish they consume, smoke or preserve it using salt. In this study, 52% of the subsistence fishers reported that they consume the unsold fish, 41% reported that they preserve unsold fish through salting, while 7% reported that they smoke unsold fish.

Fish processing and distribution

When the fish reaches the landing site it is degutted and de-scaled. Our observation at the cold storage facility for small-scale commercial fishers showed that the fishers had limited competencies in food handling, food processing and safety. Only 20% of the fishers indicated that they transport fish in ice-filled cooler boxes to the sale point, while the rest did not have any means of cooling during transportation. However, most small-scale commercial fishers indicated that they transport fish during the cool hours of the morning to reduce the risk of

[1] I US$ = BWP6.50

Table 3. Means of distribution for fish.

Fishermen type	Mechanisms of distribution		
	Pedaling in the village (%)	Sell from own fish stall (%)	Sell from syndicate building (%)
Commercial	5 (17)	16 (70)	23 (100)
Subsistence	25 (83)	7 (30)	0
Total	30 (100)	23 (100)	23 (100)

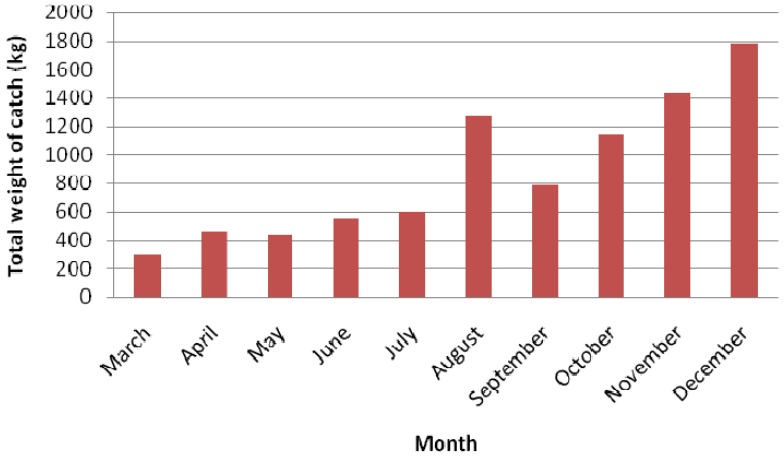

Figure 3. Weight (kg) of fish catch by semi-commercial fishers at Mohembo during 2007.

spoilage. The distribution chain in the fish market in the Okavango Delta is short, consisting of fishers and consumers, and occasionally, retailers. Table 3 shows the means of distributing fish to consumers.

Most subsistence fishers (83%) sell fish by pedaling in the village on a door-to-door basis, aiming to sell most of the fresh as fast as possible before the close of the day. Some fishers also distribute fish to their regular and trusted consumers.

Small-scale commercial fishers who have organized themselves into fishing syndicates store their fish in freezers as soon as it is processed. There are no middlemen/women who buy fish to sell it in larger markets. Only two retailers who buy fresh fish directly from small-scale commercial and then sell it fried to the public. The buyers in the local market comprises tourists and tour operators in the area, government employees, residents, retailers, school teachers and members of the Botswana defense force based in Shakawe. Residents constitute the largest portion of the consumer market followed by government officers. Using the selling price of fish of BWP16.50/ per kg, and the retail price of BWP22.00 per kg, the average marketing margin was calculated to be 0.75.

Marketing constraints

Fish marketing in the Okavango Delta is mainly constrained by a small market, lack of transport, high transaction costs, lack of access to credit, insufficient storage facilities, lack of business and management skills and lack of adequate fishing equipment. Lack of access to credit facilities and lack of preservation facilities were reported by most respondents (Figure 4).

DISCUSSION

Characteristics of fishers

This study has revealed that fish marketing is done mostly by men as they are also involved in catching. However, most studies indicate the contrary. For instance, in Ghana most fishing trade is undertaken by women because fishing is their source of part-time employment (Lawson, 2007). Similarly, in the southern districts of Orissa in India, women were more involved in fish trading than men as they are the main income earners in the family (Salagrama, 2004). A study on fish

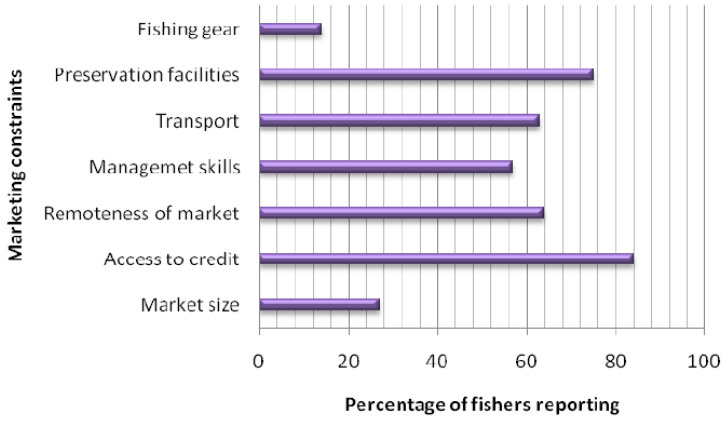

Figure 4. Marketing constraints as reported by fishers.

production in Ibeju-Iekki local government area of Lagos State in Nigeria by Jim-Saiki and Ogunbadero (2004) also revealed that fishing was undertaken by males who then handed over their catches at the landing sites to their wives, landladies, landlord's wives, mothers or concubines to market it as fresh or smoked. In Maiduguri Gamboru in north eastern Nigeria males and females participated in fish marketing, but the participation of males was dominant (Ali et al., 2008). According to Lawson (2007), where women are involved in fish trading, it is very likely that the opportunity cost of their labour is lower than that of men.

Most fishers in this study had no education at all. Research conducted among other fishing communities has showed similar findings (Harris et al., 2002; Rahman et al., 2002; Omwenga, 2006). The lack of education translates into lack of the skills in developing marketing strategies that would help fishers to align themselves with the market which they serve (Fafield, 1992).

While this study has shown that fishing plays a significant role in the livelihoods of fishers, fishers diversify their livelihoods. Studies in other similar fresh water systems and lakes in Africa suggest that communities in these environments diversify their livelihood activities to cope with variability in the natural and socio–economic environments (Bene et al., 2003; Geheb and Binns, 1997; Omwenga, 2006; Sarch and Allison, 2000; Abbot et al., 2007). Similar observations have been made in other parts of the world such as Brazil (Cordell and McKean, 1992), Canada (Berkes, 1977) and Spain (Freire and Garcia-Allut, 2000).

One of the adaptive practices among the fishers in the Okavango Delta is the use of range of fishing gears. According to McGoodwin (2001), the use of a range of gears enables subsistence fishers to use a particular gear in a specific fishing location. Furthermore, multi-gear technology allows full exploitation as some gears are more appropriate for catching certain species of fish (Mosepele and Kolding, 2003). For example, basket fishing in the Okavango Delta is undertaken in the floodplain areas, while gill net fishing is undertaken mainly in lagoons and floodplains (Mosepele, 2001).

Price fixing

This study has revealed that subsistence and small-scale commercial fishers set the price of fish differently. The use of eye estimation in pricing by subsistence fishers was found among the fish vendors in Katima Mulilo area in Namibia (Abbot et al., 2007). However, in the well developed Fulton fish market in New York City, fish suppliers charge different prices for different customers, who then would accept the price, walk away or start bargaining (Graddy, 2006).

The price of a resource sends a signal to the consumer about the availability of the resource. Generally, a higher price than usual indicates that the resource has become scarce. During the hot summer months (low floods) fishers intensify fishing especially in the flood plains, while during winter months (high flood), there is less fishing in the Okavango Delta (Mmopelwa et al., 2008). However, as revealed by information from catch and sales records and discussions held with fishers during the survey, the price of fish remains constant throughout the year. This practice does not conform to the general practice in formal markets where the price of fish is not only determined by its seasonal availability, but also by species of fish as particular fish species are highly priced because they are more preferred than others

(Graddy, 2006; Bestari and Morales, 2005; FAO, 2001).

It is also expected that the price of fish sold by subsistence fishers would be varies during the course of the day due to changes in temperature that affect quality of fish (Abbot et al., 2007). Later in the day the quality of fish decreases due to higher temperatures, and logically it would be expected that fishers would reduce the price of fish as they do not have ice or cold facilities to preserve. However the price is not lowered because unsold or excess fish is consumed, smoked or preserved using traditional technologies.

The mechanism of pricing fish in the Okavango Delta, even among the commercial fishing, reveal the characteristically informal nature of the fishing market in which the fishers could be described as ' non-market' oriented' fishers (Gilbert, 1989) primarily because they lack an understanding of how the market (should) operate(s).

This study has also revealed that the fish marketing chains in the Okavango Delta are shorter than in most market structures. A limited number of participants in the marketing are suggestive of a small marketing space, reflecting under-development of the market. In larger or more organized fishing markets, the sale of fish goes through a series of interplayers before ultimately reaching the consumer. According to Wang (1999), such markets consists of a chain of middlemen/women each of whom qualifies as a firm, buying fish from fishers and selling it to consumers. In Sri Lanka and Bangladesh, the chains consist of primary markets, secondary markets, higher secondary markets (consisting of one or more of the wholesale markets or centre) and terminal markets (which are mainly retailers buying to sell to the consumer (FAO, 2001).

Marketing constraints

The marketing of fish in the Okavango Delta is constrained by several factors including small market, lack of transport, high transaction costs, lack of access to credit, insufficient storage facilities, lack of business and management skills and lack of adequate fishing equipment. Small scale fishers in most areas generally face the same kind of constraints (Jagger and Pender, 2001; McGoodwin, 2001; Khannan et al., 2003; Adeokun et al., 2006).

Small market

The size of the market determines the scale and production of fish. Generally, the larger the population, and hence the consumer group, the bigger the market place (Murray and Little, 2000). A high population leads to increased demand for fish, which in turn will induce fishers to supply more fish to meet demand. A smaller market in the Okavango Delta also suggests that since fishers are selling below their potential, the average cost of production is higher than if they sold larger quantities of fish.

Lack of access to credit

Ownership of assets, determines the extent to which fishers can get assistance from financial lending institutions. Small-scale fishers are by nature vulnerable to poverty and lack collateral to access credit from lending institutions (Mills et al., 2009; Rahman et al., 2002). Since the ceasation of the financial assistance policy (FAP) a programme that was designed to overcome finance related constraints on productive enterprises development by providing equity finances where commercial financial institutions fail to do so (Valentine, 1993), most fishers have not been able to replace their equipment.

Among the Mymensingh fishing community in Bangladesh, where fishing forms a major, and sometimes the only source of income, the principal source of money for procuring fishing inputs was the usury market and money lenders charged interest rates as high as 100%, making it difficult for the borrowers to pay back (Rahman et al., 2002).

Remoteness location of markets

Remote location of markets in the Okavango Delta present a challenge to fishers because fishers incur costs related to procurement of production inputs from distant locations. Furthermore, due to the bad state of roads in some areas fishers cannot sell their fish in other areas.

Lack of management skills

Effective operation of an enterprise requires basic skills such as record management. Low levels of education, lack of exposure to an effective business management environment and lack of financial capital contribute to lack of skills. Without responding to these challenges the market is more likely to remain informal or traditional in nature.

Lack of transport and preservation facilities

Consumer preference for fresh or frozen fish by consumers also presents a challenge to fishers as good refrigerated storage facilities are fundamental to having good quality fish all the time (Jagger and Pender, 2001). Lack of transport by fishers in the Okavango Delta means that fishers cannot sell their fish in larger markets even

during the low flood season when there is abundant fish. Teweldemedhin (2008) also found in Eritrea that lack of supply of ice and lack of transport limited the capacity to distribute fish to market outside the country In the Ibeju-lekki local government area of Lagos State in Nigeria, fishers were sometimes forced to sell their fish on credit because they lacked ice or refrigeration and smoking equipment (Jim-Saiki and Ogunbadero, 2004), while in the upper Zambezi River floodplain high transportation and opportunity cost constrained fishers to sell their fish directly to the larger markets.

CONCLUSIONS AND POLICY AND DEVELOPMENT IMPLICATIONS

This study has revealed that fish marketing in the Okavango Delta is undertaken by men. In other countries fish trading is the role of women. Small-scale fishers are also characterized by low levels of education that affect fisher's ability to run their enterprises effectively.

Subsistence fishers used eye estimation to price fish. Price setting among both subsistence and small-scale commercial fishers is neither based on any grading system nor on types of fish species, and does not vary according to seasonal availability of fish. The marketing channels are short with fishers selling their fish to the consumers who are mostly the local population.

The study has also identified the main marketing constraints as small sized market, remoteness of the fish market to urban areas, high transaction costs, lack of access to credit facilities, poor management skills, lack of transport and lack of preservation materials. Majority of fishers cited lack of preservation facilities as a constraint.

In order to address the problem of poor management skills there should be a deliberate effort by government to support the development of fishing by training fishers to acquire the relevant skills. The fisheries department should collaborate with local enterprise authority (LEA) to organise training courses geared towards developing enterprise skills of men and women fishers. Fishers also need basic training in food handling and proper hygiene during storage and transportation.

Given also that fishers do not have access to credit, lack refrigeration equipment and transport, the government should consider assisting fishers by establishing 'fishing enterprise fund' with the aim of improving the contribution of fishing to rural livelihoods. The fund can be used to support fishers in undertaking preservation technologies such as sun-drying and smoking, as well as acquiring refrigeration facilities, transport and other equipment. The availability of transport will enable fishers to sell their products in larger market, leading to growth of the fish market. Fishers should also form strong organizations so that they can speak on their behalf on matters regarding improvements on their welfare as well as to be able to acquire financial support.

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