

Winners and Losers in the Finfish Trade on Mafia Island: A Value Chain Analysis

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Keywords: Value chain, market arrangements, finfish trade, economic winners and losers, bargaining power

Abstract — Fish trade on Mafia Island involves several players in the value chain from fishing to the plate, either on Mafia Island or mainland Tanzania. This paper investigates the different actors in the value chain to establish how much each of them invests in the process of adding value to fish as a traded commodity, and how much they gain from it, with the intention of establishing who are the winners and losers in the fish trade. The results showed that small-scale fishers in Mafia are mostly on the losing side, spending long hours preparing for and undertaking the risky activity of fishing in rudimentary canoes, plus the cost of maintenance and the acquisition of their fishing gear. Due to their disadvantaged position and lacking the necessary facilities for the preservation and storage of their catch, they are forced to sell it at low prices in prearranged market arrangements to avoid spoilage and, therefore, incur loss. The findings of this study indicated where a major policy change would improve fishers' welfare. Arrangements need to be made for small-scale fishers and female fish vendors to access markets to improve their gain at most fish landing and trading sites. This would help to reward the hard work and risk taken by fishers and women fish vendors, and reduce their poverty.

INTRODUCTION

Fishing is an important activity for communities living adjacent to rivers, lakes and seas, constituting an economic activity that generates income and provides sustenance to those who engage in fishing as an occupation. On Mafia Island in Tanzania, as in most developing countries endowed with marine resources, fishing is mostly undertaken by small-scale artisanal fishers as a subsistence activity which

has, over time, become increasingly become commercialised. Fishing is both a subsistence strategy for small-scale fishers on Mafia Island, providing an important source of protein for their families, as well as an increasingly important income-generating activity which provides for their household needs.

Estimates of the average level of dependence on fisheries among households of six fishing communities on Mafia Island reveal a very high number (85%) depend on fishing

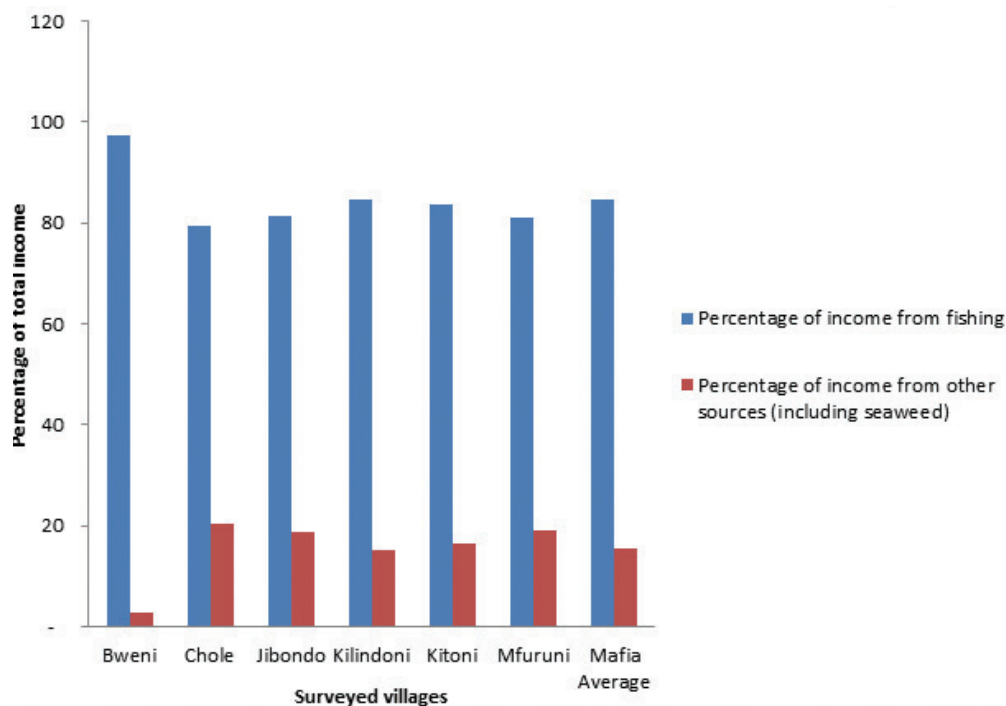


Figure 1: Dependency on Fishing in Mafia Island's Fishing Communities.

(Fig. 1). Furthermore, the sources of livelihood for these communities is narrow, apart from fishing, the second highest contributor to their livelihood being seaweed, representing an average of 12.6% of the total annual household income. Last are agriculture and petty trade which account on average for 2.4% of their activities (see also appendix Table 3). This goes on to show how important fishing activity is to the livelihood of the Mafia inhabitants.

Fishing involves many actors and stakeholders in the linkages in the industry (backward and forward), who play different roles but make up the totality of the industry. The fish trade on Mafia, as in other artisanal fishing communities, involves several players and stages in the fisheries value chain, from fishing itself to the consumers' table, both on Mafia Island and mainland Tanzania, and beyond.

This article investigates the different actors in the value chain to establish how much each of them contributes to the process of adding value to fish as a traded commodity in the markets of Mafia and mainland Tanzania. We focused mainly on the small- and medium-

scale fishers' position in the chain to evaluate their contribution and what they gain from it. The aims were to investigate the categories of business players who benefit most and those who benefit least, or lose, in finfish trade on Mafia Island. To achieve this, we used value chain analysis to try and trace the nature of activities, the costs and the gross margins in terms of market values. Although all of the stakeholders contribute to the total value of the fishing industry, we feel that there are some who benefit more at the cost of others, resulting in a Pareto-inefficient distribution of benefits accruing to the different actors.

We felt that an understanding of the value chain would contribute to the development of livelihood interventions or their improvement to benefit the losing actors, and it would identify constraints and opportunities in the marketing system and elucidate its governance. Value chain analysis would also help identify the potential for adding value (e.g. by improving the product, producing it more efficiently or adding additional higher value services). Improved benefit may be

further achieved for some actors in the chain by reducing its length.

There is growing concern regarding the continued deprivation of the fishing communities and the need to improve their livelihoods and livelihood diversification. The present study therefore focused particularly on the potential to improve their livelihoods, recognising the importance of finfish in this regard. We felt that, apart from financial losses fishers suffer due to a lack of bargaining power in the market chain, they also faced non-market costs and losses in terms of time use and greater occupational risks which exemplify their vulnerability.

In our analysis, we used primary data collected in a 2011 survey in Kilindoni on Mafia Island, incorporating check lists on costs of investment, operational costs and revenue flow through middlemen, processors, local fish market traders and group fishers (with powered boats). Information from restaurants and hotels proved to be difficult to obtain, as well as from the main fish processing plant on Mafia Island (TANPESCA). These were, therefore, not surveyed. In addition to this, we supplemented the analysis with primary data on household income collected from 149 randomly selected households in 2010 from six villages on Mafia Island namely, Kilindoni, Kitoni, Bweni, Mfuruni, Chole and Jibondo (see Appendix Tables 1-6). The 2010 and 2011 field surveys were conducted during a University of Dar es Salaam fisheries research project in collaboration with the Norwegian University of Life Sciences (NMBU) and funded by the Norwegian Programme for Development, Research and Education (NUFU).

The next section presents an analytical discussion of the value chain for finfish in Mafia District, followed by a discussion on the fish trade. Market arrangements for fish and fish pricing on Mafia Island are explained in the succeeding section, followed by the methods used to determine the gross profit from these activities. We finally present empirical results where benefit distribution and value chain governance are discussed followed by conclusions.

The Value Chain Analytical Framework: An Overview

Value chains are defined as, “the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to the final consumers and final disposal after use” (Kaplinsky & Morris, 2000). Value chains can be characterised as being either global or macro, meso or micro in scale (Gereffi & Kaplinsky, 2001). Global analysis considers the whole chain, while micro-level analysis focuses on the producers in the chain (Dijk & Trienekens, 2012). Dijk and Trienekens (2012) further define macro-level analyses as pertaining to the chain at the national level and meso-scale to the regional or city level. In our case, meso-scale is associated with local market activities involving primary production, marketing, processing and consumption in agriculture, fisheries and manufacturing processes in small-, medium- and large-scale enterprises.

The value chain framework in Figure 2 represents a generic linear relationship between one activity and the rest in the chain. While it is possible that such a progression exists, it is seldom the case because of the existence of both vertical and horizontal or intra chain linkages in most value chains (Hempel, 2010; Dijk & Trienekens, 2012). For instance, in a fisheries value chain, a fisher may be the owner, buyer and processor of fish, leaving only the role of retailing to others. Likewise, in small-scale fisheries, an owner of gear and vessels may rent these to fishers and buy their catch (middleman), then sell it to a lucrative market outlet as we shall see is the case on Mafia.

There have been numerous studies on various aspects of value chains over the past two decades. Some studies have aimed at facilitating market development for small and medium enterprises (Streeten, 1991; Sen & Mahajan, 1993; Gamser, 1992), while others have investigated the enhancement of business efficiency and performance through the determination of factors that influence competitiveness and identify

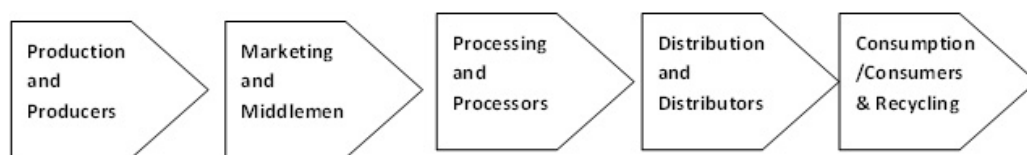


Figure 2. A simplified value chain.

intervention entry points (Kula *et al.*, 2006). Several studies have aimed at making markets work for the poor and vulnerable by highlighting their plight, as well as that of informal producers (Thomas, 1990; Bear & Field, 2008; Bekkers *et al.*, 2008; Daniels & Jeans, 2009). A considerable body of literature has focused on the question of how local producers in developing countries could break into international markets by linking producers to global markets (Dijk & Trienekens, 2012). Studies which have focused on who gets what are of much interest in the current study, particularly the question of benefit distribution in the value chain (Gerefi & Korzewicz, 1994; Islam *et al.*, 2006; Shamsuddoha, 2007; Pietrobelli & Saliola, 2008).

Enterprise development literature considers that the marketing system constitutes the scope of the value chain. It maintains that small and medium enterprises are holistically benefited by the identification of gaps, weak points and bottlenecks at different points in the chain such that services can be rendered to ensure that micro-entrepreneurs are able to access markets. These services include the facilitation of finance, training on market demand and profitability, market access and quality control, among others (Jones, 2011). The main focus is to reduce the length of the chain, eliminating unnecessary points in it and improving its efficiency and competitiveness, reducing unnecessary costs and bringing a product from production to consumption faster.

The Mafia Island Fish Trade

The Mafia Islands fisheries sector consists mainly of small-scale fishers utilizing rudimentary fishing vessels, including dugout canoes, outrigger canoes and plank boats (Bryceson *et al.*, 2006; Tani, 2010; January & Ngowi, 2010). Fishers fall into the following groups: fisher/owners who own gear and vessels

(normally small unpowered vessels that carry up to six people); fishers employed by vessel and gear owners; fishing cooperative groups (6 to ≥ 20 members) comprising fishers that work together and own gear and powered fishing vessels or rent them from owners under agreed conditions. Fishing cooperatives are few, and those which become established either disband after a short time, after gear purchased with the initial investment wears out or because of mismanagement and a breakdown in trust between the members.

While the working arrangements of these different fisher categories are many and are often customised, most involve the distribution of benefits based on the proceeds of the catch being divided into four equal parts: one goes to the owner, one to equipment maintenance and replacement, and two to the workers in equal shares. Where the owner also accompanies the fishers, which is common in the small craft, he also gets a worker's share with the other parts of the proceeds. Mafia artisanal fishermen are thus paid equally, irrespective of their role on the boat, unlike more common fishing arrangements where the skipper gets a greater share than the crew (see Kirkley *et al.*, 1998; Lokina, 2008).

Small-scale operations using unpowered boats go out to sea and return to shore every day on average six days a week. Larger operations using powered vessels go further and spend more time at sea. On average, they operate five days per week. Our survey indicated that the average time spent at sea was six hours and 38 minutes per fishing trip. In addition, fishers spend an average of two hours selling their catch and mending nets after every fishing trip. Regardless of the type of operation, both groups of fishers daily spend a considerable amount of time on fishing and on fishing-related activities. They thus work very much the same number of hours as government employees, viz. eight hours per day.

Market Arrangements and Fish Price Determination

Fishers in Mafia District can sell their catch through various market arrangements, some predetermined by agreement, others dictated by prevalent liberalised market conditions. These arrangements include selling at beach landing auctions if there are multiple buyers or, more often, directly to middlemen, buying agents, fish vendors, gear and vessel owners and fish processing plants among others. Middlemen wait on shore for the fishers to return to land, and buy and sell fish at the beach landing sites or take their stock to an established market in Kilindoni town. They have working capital which they use in their trade, taking advantage of the trust that fishers bestow on them to also function as money lenders when catches are bad. This occupies them on average for five hours a day. The mode of fish sales at the landing sites may be through pre-agreed arrangements or by bargaining. If a fishing group rents vessel and fishing gear, they most often find themselves selling to the owner of the vessel and gear. This arrangement has advantages and disadvantages, the former being that fishers are always guaranteed the sale of their fish. However, they may earn less this way as the price may be lower than the market.

This practice is similar to the buyer/lender arrangement where the lender buys all the fish at a lower price as per a loan repayment agreement. In terms of Institutional Economics, we can categorise fish sellers as agents and fish buyers (the lenders or vessel and gear owners) as principals in a repeated principal agent model¹. If the principal can

obtain more than publicly verifiable information, implicit self-enforcing agreements (which supplement the terms of the explicit contract) between the principal and agent may be mutually beneficial. However, fishers on Mafia Island are often faced with 'explicit written contracts' as far as gear renting or credit to fishers are concerned. The pricing of fish is dominated by implicit agreements which are often tacit agreements, where the principal offers a lower price as his reward for guaranteeing a market to the fishers².

All other market arrangements involve a variation in prices, depending on a number of open market factors including the number of buyers at a landing site, the number of sellers and the quantity of fish harvested. At the time of our survey, the Mafia fish processing plant, TANPESCA, offered the highest price in the market of Tshs 1200 per kilogram for emperors (*changu*), rabbit fish (*tasi*), *Carangoides* (*kolekole*), snappers, parrot fish (*pono*) and grouper (*Chewa*). Fishers gained Tshs 900 and Tshs 700 per kilogram respectively from auctions and middlemen.

Due to unreliability in the market situation, a lack of storage facilities, limited market options and other factors, fishers prefer to sell to established buyers even if they do not get their money immediately, thus informally insuring themselves and avoiding risk. Due to their lack of capital, fishers find themselves obligated to sell to their creditors and owners of fishing gear and vessels. In all these cases, a sense of insecurity appears to be an important factor which influences fishers in their decision making.

¹ Agent's actions are observable to the principal but not verifiable in court. The agent's incentives derive both from salary payments (or selling assurance) based on verifiable signals, and from implicit promises by the principal of bonuses for good behaviour (see for example, Klein *et al.*, 1978; Wachter & Williamson, 1978; Peace & Stacchetti, 1998). Typically a principal can make commitments to an agent by offering him a legally enforceable contract which specifies payments contingent on information available to the courts.

² This minimizes the risk on the part of fishers of not selling in periods of unfavourable market conditions. Buyers may sometimes defer payment to a later date in times of shortage of funds..

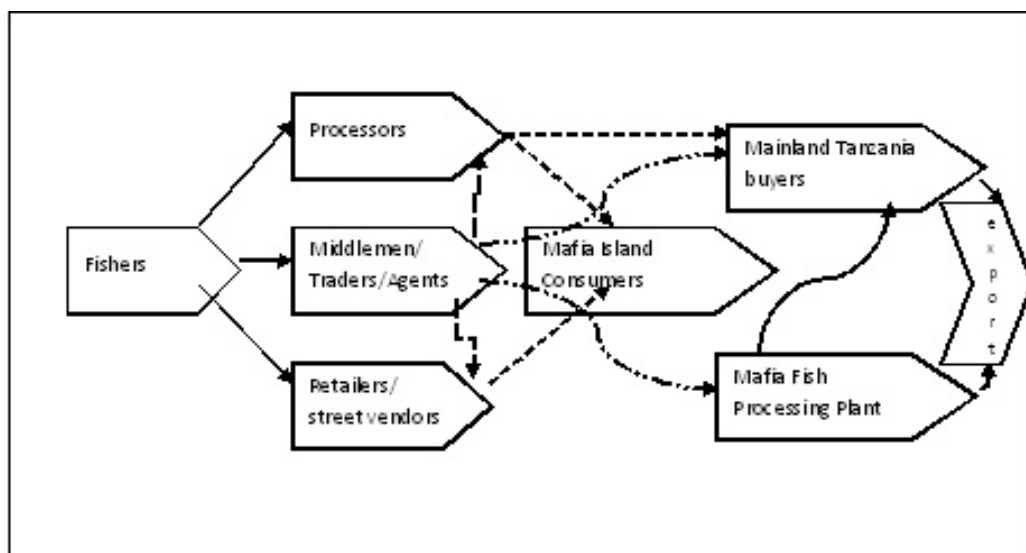


Figure 3. The finfish trade market and value chain on Mafia Island, Tanzania.

We found an interesting reason why many fishers prefer to borrow money/capital from individual money lenders such as shopkeepers, vessel and gear owners, and middlemen, as opposed to borrowing from well-established financial institutions and other credit options. Responses to the question as to why this was the case ranged from fear of losing one's property if one defaulted on payments, to knowing and trusting the individual lenders who accommodated their human shortcomings. This difference between impersonal institutions and personal relationships has a profound impact on the decision-making process of fishers and will affect the architecture of programmes designed to help them. Although the preferred modes of borrowing may be considered more exploitative, the alternative appears more threatening to their security, livelihood and property ownership.

The Mafia Island finfish trade value chain is presented in Figure 3. Fish harvesting is the primary activity of fishers within the aforementioned fishing arrangements. The marketing of their catch is therefore also dependent on the fishing arrangements, which has the implications already described on

fishers' local market access or further afield in more established and lucrative markets on Mafia Island and the mainland (Dar es Salaam). There are also street vendors and women fish fryers who, if lucky, may buy from fishers directly, but they normally have to buy from middlemen at the landing sites. These middlemen buy from fishers cheaply and sell to the vendors dearly, and thus deprive both the fishers and vendors a significant margin of profit. Middlemen and traders also sell their fish to TANPESCA as well as the Temeke and Magogoni fish markets in Dar es Salaam where they enjoy better prospects and prices. The major proportion of the fish find a more reliable market in Dar es Salaam and abroad via TANPESCA, fish traders and buying agents for fish processing plants.

Gross Profit Determination

We calculated the costs incurred and revenues accrued daily for each activity in each chain segment to determine how benefits are distributed in the chain. For this purpose, we used data collected from actors in all sectors depicted in Figure 3. The calculations were undertaken using the following formulations.³

³ See appendix II for revenues and costs determination of processors, middlemen and retailers.

Revenue per day for fishers

$$TAR_d = \sum_{i=1}^k \frac{q_i}{n_i} * p_i \quad \text{-----(1)}$$

Where: TAR_d = Total activity revenue per day

q_i = Quantity of finfish i sold; $i = 1, 2, 3...k$ (Parrot, Rabbit and Emperor...)

p_i = Price of finfish i sold; $i = 1, 2, 3...k$ (Parrot, Rabbit and Emperor...)

n_i = number of fish collection days

Costs per day for fishers

$$TAC_d = w_d + \sum_{i=1}^k \frac{c_i}{y_i} + \sum_{j=1}^m c_j * p_j \quad \text{-----(2)}$$

Where: TAC_d = Total activity cost per day

c_i = cost of fixed item used; $i = 1, 2, 3...k$ (vessel, fishing gear etc)

c_j = variable cost item quantity used; $j = 1, 2, 3...m$ (ice, landing fee, etc)

p_j = price of variable cost item used; $j = 1, 2, 3...m$ (ice, landing fee, etc)

y_i = lifetime of the fixed cost item in use

w_d = cost of labour per day

The finfish targeted for this study included (with Kiswahili names in brackets) emperors (*changu*), rabbit fish (*tasi*), Carangoides (*kolekole*), snappers, parrot fish (*Pono*), grouper (*Chewa*), sardines and mackerels, these being the fish mostly caught and traded by small scale-fishers on Mafia Island. The normal measures of bulk sale included trays which hold an average weight of 10 or 40 kg of fish depending on their size. An estimated lifetime of equipment was used to determine the daily wear and tear on capital investment, this being seven years in the case of artisanal fishing boats and three years in the case of outboard engines. The life span of equipment such as fishing nets, processing tables and utensils was estimated to be one year. An average labour cost was estimated according to the catch and income distribution arrangements described earlier. The cost of fuel was incorporated, where appropriate.

Empirical Results

Data presented in appendix Tables 2 to 6 were used to arrive at the value quotients in Table 1. Some cost categories such as tax and levies were omitted from the fishers' costs because tax data were lacking or incomplete; many fishers do not comply with taxes and fees imposed by the district council and village governments. However, the available costs should provide a reasonable estimate of gross profit by the different groups. All the revenues and costs were converted to daily values and the gross margin ratio⁴ was computed, providing a clear relationship between individual benefits from each dollar of revenue generated.

⁴ Gross profit divided by Total Average Revenue (TAR; where gross profit = TAR minus cost of goods sold, including raw materials and supplies used, Labour and Overhead of the business allocatable to production). This represents the percentage of total sales revenue the business retains after incurring the direct costs of producing the goods and services sold in a 1:1:2 sharing agreement.

Table 1. Value chain benefit distribution.⁵

Activity	Total average cost of goods sold per day (Tshs)	Total Average Revenue (TAR) of activity per day (Tshs)	Gross profit (Tshs)	Gross margin ratio (%)
Fishers with powered boats	320,421	486,667	166,246	34
Fishers with unpowered boats	51,356	57,883	7,527	13
Middlemen	194,060	516,667	322,608	62
Processors (frying)	50,375	105,000	54,615	52
Retailers (town marketplace)	287,400	540,000	252,600	47

Source of data: Field survey 2011, NUFU research

Table 1 reveals that fishers using unpowered fishing boats get 11% of each dollar of revenue generated, the lowest benefit and the least return compared to other activities in the chain. Fishermen with powered boats appear to be moderate winners, getting 34% of the share in revenue. On the other hand, middlemen are shown to be getting the highest returns for investment in terms of their time and other costs incurred relative to the rest in the chain.

Table 2 provides the total average revenue and costs obtained using the popular benefit distribution arrangement of 1:1:2⁶, the labour costs for fish workers being different from those in Table 1. Working fishers in medium-scale operations (boat with engines) get Tshs 9,079 each on average per day, slightly above the national minimum wage of Tshs 8,250 per day⁷. Workers in the small-scale operations, on the other hand, receive Tshs 3,990 on average

per day, far below the national minimum despite the risky working environment. Although the gross margins of the fishers are positive⁸, albeit at low levels (see Tables 1 and 2), the income of individual small-scale fish workers⁹ is below the national minimum wage rate according to both the survey data and the revenue sharing arrangement.

A combination of reasons may explain this outcome. Apart from the costly investments in vessels and equipment, the scale of the fisheries operations and the market arrangements play a major role in the low return to the fishers. A higher price for their fish would increase their revenue and, other things remaining equal, their gross margins would rise. Similar results have been obtained elsewhere (Islam *et al* 2006, Shamsuddoha 2007, Alam *et al* 2012) where small-scale artisanal fishers were found to be on the losing side for the same reasons. These results are thus in consensus with other studies and demonstrate that small-scale fishers are the main losers in the fish trade, receiving the least economic benefit for their products (FAO, 2005, 2013; World Fish Centre, 2011, Russell *et al.*, 2012).

⁵ Labour costs comprised payments to worker fishers outside benefit sharing agreements.

⁶ Total Average Revenue is divided into 4 equal parts after subtraction of direct costs e.g. fuel, transport, food cost, where one quarter is for the owner, the other quarter is for vessel and engine and nets and the remainder two quarters are for fish workers to share.

⁷ For the purpose of this analysis, monthly income is calculated using 20 days for fish workers because those are the number of days they go fishing. Therefore in this case monthly wages will be Tshs 181,584 and Tshs 23,941.5 for fishers in boats with outboard engines and without engine respectively while the national minimum wage is Tshs 165,000 per month for marine and fishing (URT 2010).

⁸ Defined as boat and gear owners for this analysis

⁹ Defined as those employed by fishers.

Table 2. Value chain benefit distribution for fishers using a 1:1:2 sharing agreement.

Activity	Total direct average cost of goods sold per day (Tshs)	Total Average Revenue (TAR) of activity per day (Tshs)	Average revenue net of direct costs (Tshs)	Fishers' share (owner) (Tshs)	Fishing gear costs (vessel, engine and nets) (Tshs)	Fish workers' share (Tshs)	Shares to TAR (%)
Fishers with powered boats	123,500	486,667	363,167	90,791.75	90,791.75	181,583.5	37
Fishers with unpowered boats	10,000	57,883	47,883	11,970.75	11,970.75	23,941.5	4.9

Source of data: Field survey 2011, NUFU research

The winners and losers in the Mafia finfish trade are presented in Table 3 in terms of return, the amount of time spent on an activity and the risk involved in the activity. It should be noted that the different type of fishers face different levels of risks in terms of hazards and market uncertainty. Those fishers who have pre-agreed selling arrangement are sure to sell their fish, although at a lower price relative to prevailing market prices, but face reduced economic risk. The lower prices they command imply that they pay an inbuilt insurance premium to the buyer. However, this does not reduce the work-related hazards at sea for both the small- and medium-scale fishers.

Table 3 shows that fishers are the biggest losers in the chain, based on their low return and the high risks they face at sea. Interviews with fishers revealed that these risks include: strong winds which set them off course and result in more use of fuel; long hours without food; and drowning, injury or even death caused by shark attack or other dangerous creatures at sea. Other risks include

collision with rocks, causing higher costs of maintenance and sometimes drowning, and loss of income due to inclement weather which makes it difficult to put out to sea. Although all these dangers were recognized, non of the fishers carried insurance. The few that were knowledgeable regarding the latter, expressed concerns or unwillingness on the part of insurers to offer their services to small-scale fishers.

Retailers also face high risk in the chain. Their risks include theft and spoilage due to an unreliable supply of ice, among others. Again these traders do not have insurance to guard against such risks. Middlemen, on the other hand, put in less time, incur lower risks and reap higher returns at the cost of others in the chain. However, there are some costs which middlemen with pre- arranged agreements bear and are not accounted for. These include the cost of loans extended to fishers during times of hardship and also 'insurance' against economic risks (market uncertainties); discounting these costs may result in overstated gross profits by middlemen. One is nevertheless tempted to enquire whether

Table 3. Winner and losers in the finfish trade.

Activity	Return	Time spent/ day	Occupational risk	Remarks
Small-scale fishers	Low	≤8 h	Very high	Biggest losers
Medium-scale fishers	Moderate	≥8 h	Very high	Moderate losers
Middlemen	Highest	≤5 h	Minimum	Biggest winner s
Processors	High	≥12 h	Moderate	Moderate winners
Retailers	High	≥12 h	High	Moderate winners

Source of data: Field survey 2011, NUFU research

the loan and insurance services they provide fishers with agreements (documented or undocumented) justify the low prices they offer them. The answer to this question would provide an assessment of the extent of exploitation of fishers in the value chain; however, it must be the subject of another study¹⁰.

Governance of fisheries resource use

The government, fishing communities, private business sector and nongovernmental organisations are among actors that influence the way fishing and fish trade are governed on Mafia. For its part, the Tanzania government clearly spells out priorities for sustainable resource use and the management of the fisheries sector in its fisheries policy and regulations. The Tanzania Fisheries Act of 2003 recognises the need to help artisanal fishers with simple technologies and low capital investment, and encourages the involvement of stakeholders in the planning, development and management of fishery resources (URT, 2003). While recognising that the country's fisheries are mainly artisanal in nature, and the fishers are disadvantaged in the present liberalised market, the Act is not explicit enough to ensure that artisanal fishers are given a fair deal in the market.

Lessons can be learnt from the Organisation for Economic Co-operation and Development/OECD countries, the EU, Korea, USA and Norway where fishers' livelihoods are protected by minimum fish prices aimed at safeguarding producer profitability (OECD, 2003). A minimum price system is set for first-hand sales of fish, which protects against market imperfections such as those in Mafia (Trondsen *et al.*, 2003; OECD, 2003). In the EU and Norway, producer organisations (POs),

which are legally empowered, may take fish and shell fish products off the market when prices fall below withdrawal prices, for resale sell at a later stage. An EU-Norway salmon agreement provides ceilings for the export of Norwegian salmon and floor prices for salmon products (OECD, 2003). The message we can draw from this is that fisher organisations provide a crucial and effective bargaining vehicle in the fish trade. In the Tanzanian case, small-scale fisher organisations could be encouraged at the local and national level.

The Tanzania Minister responsible for fisheries is given the power to impose conditions when necessary for the proper management of fisheries, including the protection of traditional fishing practices that are sustainable and in accordance with community needs and interests. Moreover, section 22 of the Act stipulates that no person shall engage in the harvesting and processing or manufacture of fish products, or the sale or marketing of fish and other aquatic floral or fauna, without a licence for such activity. This provision is aimed at the control and registration of such activities, while generating resource rents from the fisheries sector through the payment of requisite fees.

Several powerful players influence the distribution and allocation of benefits among various groups in the fisheries sector in the country as a whole, and the finfish value chain on Mafia in particular. 'Monopolistic/monopsonistic tendencies'¹¹ create imperfections in the fish trade market; this is especially the case with middlemen, vessel and gear owners, more so when they are both lenders of capital for investment in the fishing business and buyers of fish. Apart from auctioning their fish at the landing sites, most fishers are obliged to honour their pre-agreed arrangements to sell their catch to gear owners and middlemen, and hence are not free to trade freely and competitively on the open market.

¹⁰ We acknowledge that all the parties involved in this business are faced with some level of risk, mostly economic related to market uncertainties at different levels of severity. Because of this, the study treated all economic risks as constant and pointed out the occupational risks qualitatively to bring to the fore the dangers faced by fishers compared to the other categories. A more rigorous analysis of risk could be undertaken by applying a model of decision-making to the uncertainty and risks (See for example, Hadar & Fox, 2006; Hertwig *et al.*, 2004).

¹¹ Fishers are not 'free' to sell to the highest bidder in the market but rather to middlemen and creditors according to pre-agreed arrangements based on trust, 'implicit' insurance of a market for their fish or loans that reduce risk but are not accompanied by the threat of property loss associated with bank loans or collateral.

A paradigm shift in resource management from top-down to community participation has resulted in the Fisheries Division, formerly under the Ministry of Natural Resources and Tourism, to introduce the co-management system in fisheries in which power is devolved and the responsibility of fisheries management is shared with the resource users (January & Ngowi, 2010). Several such initiatives by the government and non state actors have improved the lot of artisanal fishers, including on Mafia. These efforts have included the provision of capital for modern fishing gear and vessels through the Marine Conservation and Environmental Management Project (MACEMP), the Mafia Island Marine Park (MIMP), World Wide Fund for Nature (WWF) under the Rufiji Mafia and Kilwa seascape project (RUMAKI)¹², and encouragement and facilitation to form collaborative fishing groups to increase their bargaining power. These efforts are still ongoing but, unfortunately, with little success. Some of the main factors contributing to the slow progress include a lack of trust among fishers and their fear of losing assets or property used as collateral for loans; alternative 'humane' sources of credit from gear and vessel owners and lenders, as well as traders, are seen as a better option.

CONCLUSIONS

Several factors limit the small-scale fishers' benefits from the fisheries value chain on Mafia Island. These will need redress through multiple approaches to improve the fishers' livelihoods. A start could be made by addressing their capacity to operate efficiently by improving their equipment to harvest a better catch and their facilities to reduce the spoilage of their fish. The lack of storage facilities causes desperation amongst fishers and they sell their catch quickly and at lower prices for fear of it getting spoiled.

¹² See Wild *et al.*, 2008; FORCONSULT, 2010, Niesten & Gjertsen, 2010.

An improvement in their capacity to get better deals would strengthen their bargaining power. Efforts initiated in this regard over two decades ago ought to be continued but improved, recognizing factors which have impeded their success. These include building of trust and the facilitation of trade unions. Similarly, while some progress has been made in providing credit for fishers, more is needed. Current initiatives to form savings and credit cooperative societies (SACCOS) ought to be strengthened through training in project planning and financial management. The formation of small-scale fishers' associations at the local and national level coupled with improved credit would create leverage for fishers to seek and obtain fair deals, better working conditions and more beneficial contractual arrangements. Greater market information is needed. Risks at sea are a reality; insurance for fishers should be a government requirement, just as it is for motor vehicles and drivers.

Acknowledgements – We acknowledge funding for the research by The Norwegian Programme for Development, Research and Education (NUFU). We are grateful for the cooperation extended to us by all the respondents on Mafia Island. We also wish to thank the anonymous reviewers of this article for their constructive comments and useful suggestions which improved the article

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Appendix I

Table 1. Sources of average household income (Tshs) amongst fishers on Mafia Island.

	Bweni	Chole	Jibondo	Kilindoni	Kitoni	Mfuruni	Mafia Average
Average annual income from fishing	5 984 250	4 208 100	3 963 000	17 318 400	10 446 600	1 713 396	7 272 291
Average annual income from seaweed harvesting	125 000	794 538	785 500	3 046 400	1 765 600	345 566	1 143 767
Average annual income from other sources (excluding seaweed)	39 402	286 041	119 589	60 667	293 170	55 973	142 474
Total annual income from other sources (including seaweed)	164 402	1 080 579	905 089	3 107 067	2 058 770	401 539	1 286 241
Total annual household income	6 148 652	5 288 679	4 868 089	20 425 467	12 505 370	2 114 935	8 558 532
Proportion of income from other sources (including seaweed)	3%	20%	19%	15%	16%	19%	15%
Average dependency on fishing (Proportion of income from fishing)	97%	80%	81%	85%	84%	81 %	85%
Proportion of income from other sources (including seaweed)	76%	74%	87%	98%	86%	86%	84%
Average daily household income from fishing	49 869	35 068	33 025	144 320	87 055	14 278	60 602

Source of data: Field survey 2010, NUFU research

Table 2. Costs and income of fishing operations using powered boats at Mafia Island (n=5).

Cost category	Average costs per day in Tshs (\pm sd)	Average revenue in Tshs (\pm sd) of daily catch
Boat (depreciation)	1 935 ¹ (\pm 1339.28)	-
Nets (wear and tear)	22 917 ² (\pm 2083.33)	-
Boat engines (depreciation)	5 903 ³ (\pm 347.22)	-
Fishing licence	450 ⁴ (0.00)	-
Registration fee	92 ⁵ (0.00)	-
Fuel per day	88 500 ⁶ (\pm 16,500.00)	-
Repair/maintenance	3 000 ⁷ (0.00)	-
Insurance	-	-
Transport	10 000 ⁸ (0.00)	-
Food expenditure at sea	25 000 ⁹ (0.00)	-
Time use	164 500 ¹⁰ (\pm 60,500.00)	-
Total average cost	320,421 (\pm 105,762)	-
Total average revenue/day*	-	486,667 (\pm 147,422)
Net average Revenue/day	-	166,246
Gross margin (Gross profit/Total Average Revenue)	34%	-

Source of data: Field survey 2011, NUFU research

¹Average cost of boat/7year life span x 12 months x 20 fishing days per month

²Average net cost/12 months x 20 fishing days per month

³Average engine cost/3 year life span x 12 months x 20 fishing days per month

⁴Average license cost/12 months x 20 fishing days per month

⁵Average registration cost/12 months x 20 fishing days per month

⁶Average fuel cost per day

⁷Average maintenance cost/12 months x 20 fishing days per month

⁸Average daily cost of engine portage

⁹Average daily cost of food at sea

¹⁰Average labour cost per day for 20 crew members

Table 3. Costs and income of fishing operations using unpowered boats at Mafia Island (n=15).

Cost category	Average costs per day in Tshs (\pm sd)	Average revenue in Tshs (\pm sd) of daily catch
Boat (depreciation)	506 (\pm 73)	
Nets (wear and tear)	3242 (\pm 1002)	
Fishing license	450 (0)	
Registration fee	92 (0)	
Fuel per day	-	
Repair/maintenance	3756 (\pm 1264)	
Insurance	-	
Transport	10 000 (0)	
Labour*	36000 (\pm 327)	
Total average fishing cost per day	51356 (\pm 1590)	
Total average revenue/day		57883 (\pm 2050)
Net Average revenue/day		7,361
Gross margin (Gross profit/Total Average Revenue)	13%	

Source of data: Field survey 2011, NUFU research

Notes: Depreciation and costs as in table 2 above

* The average number of fishers/crew is six per fishing boat

Table 4. Operating costs and income of middlemen in fishing operations at Mafia Island (n=5)¹³.

Cost category	Average costs per day in Tshs (±sd)	Average revenue in Tshs (±sd) of daily catch
Buying price	-	158333 (±17559)
Transport	-	30667 (±5859)
Time spent on occupation	-	3167 (±404)
Trade licence		60 (0)
Fish landing levy		600 (±100)
Operational costs		1 233 (±252)
Total average cost	516667	35727 (±5783)
Total average revenue	(±59652)	194060 (±23197)
Net average revenue per day	322607	
Gross margin (Gross profit/Total Average Revenue)		62%

Source of data: Field survey 2011, NUFU research

Table 5. Operating costs and income of fish processors (frying) in fishing operations at Mafia Island (n=5)¹⁴.

Cost category	Average costs per day in Tshs (±sd)	Average revenue in Tshs (±sd) of daily catch
Buying price		22,913 (±2000)
Transport		4,250 (±750.00)
Processing cost		
Cleaning		2,500 (±1,000.00)
Processing table (1 year lifespan)		75 (±35.35)
Salting		600 (±400)
Frying oil		1,500 (±1,500)
Firewood		750 (±354)
Sales costs		-
Stall levy		375 (±176.77)
Depreciation costs		
Frying pan (1 year lifespan)		225 (±106.06)
Spoons (1 year lifespan)		38 (±17.67)
Wood stove (1 year lifespan)		75 (±35.35)
Time use		16,000 (±14,400)
Trade license		-
Tax		-
Total average cost	105,000	50,375 (±8,225)
Total average revenue	(±15,000.00)	
Net average revenue per day	54,625	
Gross margin (Gross profit/Total Average Revenue)		52%

Source of data: Field survey 2011, NUFU research

¹³ These were mainly men engaged in buying and selling at the fish landing sites with operations similar in scale.

¹⁴ Fish frying was undertaken by both men and women with operations similar in scale.

Table 6. Operating costs and income of fish vending stalls in fishing operations at Mafia Island (n=5).¹⁵

Cost category	Average costs per day in Tshs (±sd)	Average revenue in Tshs (±sd) of daily catch
Fish buying price (per tray)		260 000 (±22 913)
Transport		2 000 (±0)
Stall levy		1 500 (±0)
Ice storage		4 000 (±0)
Time spent on occupation		4 800 (±0)
Trade license		100 (±0)
Total average cost		287400 (±22,500)
Total average revenue	540000 (±60,000)	
Net average revenue per day	260,100	
Gross margin (Gross profit/Total Average Revenue)		48%

Source of data: Field survey 2011, NUFU research

Appendix II

Total Activity Revenue functions for processors, middlemen and retailers are described below

$$TAR_d = \sum_{f=1}^f q_f * p_f \text{ -----(3)}$$

Where: TAR_d = Total revenue per day for processors, middlemen and retailers

q_f = Quantity of finfish i sold; f = 1, 2, 3...l (Parrot, Rabbit and Emperor...)

p_f = Price of finfish i sold; f = 1, 2, 3...l (Parrot, Rabbit and Emperor...)

and

Total costs per day for processors, middlemen and retailers

$$TAC_d = w_d + \sum_{i=1}^m \frac{c_i}{n_i} + \sum_{j=1}^n c_j * p_j + \sum_{k=1}^r C_k \text{ -----(4)}$$

Where: TAC_d = Total cost per day

c_i = Cost of fixed item used; i = 1, 2, 3...m (containers, stoves, tables, utensils, etc.)

c_j = Variable cost item according to quantity used; j = 1, 2, 3...n (transport, ice, fuel, oil, levy, etc.)

p_j = Price of above variables; j = 1, 2, 3...n (transport, ice, fuel, oil, levy, etc.)

n_i = Lifetime of the fixed cost item in use (in days)

w_d = Cost of labour per day

C_k = Cost of finfish bought per day; k = 1, 2, 3...r (parrot, rabbit, emperor ...)

¹⁵ The type and scale of activity of fish vendors at the market stalls were quite similar.