Baseline study on Socio-economic benefits of artisanal tuna and tuna-like fishery in the United Republic of Tanzania

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Abstract

Tuna and tuna-like species are important fisheries resources for food and have valuable contribution to the country's economic. In most of the developing countries the fishery is mainly artisanal and dominated by men. The overall objective of this study was to access the socio-economic benefit of artisanal tuna and tuna-like fishery along the Tanzania coastline. Finding from this study indicated the main fishing gears for tuna and tuna-like species in the order of preference is gill net, hand-line/long-line, and ring-net, operated by either sail or motorized boat. Fishing is carried out between 5 and 20 kilometers away from the shoreline. The most targeted species are Wahoo (Nguru-maskati), Kawakawa (Sehewa), Tuna (Jodari) and Skipjack tuna (Zunuba). The preference for these species is determined by their availability and high economic returns. The fishery generates a significant amount of income to fishers, middle men and hotels along the market chain. Nationally the fishery generates between 4 and 8 million TZS annually from the royalties charged on exports. The fishery is however challenged by inadequate documentation by different stakeholders; as a result information on the values and contributions of the fishery are difficult to obtain and measure. It is therefore recommended that proper data collection and storage system be instituted at all levels of fishing to ease generation of information. On the other hand landing for tuna and tuna like species has doubled from 2000 tons to 4000 tons in 1994 to 2010 respectively, with the highest peak in year 2009. The fishery has a potential to generate high income for fishers and to the national economy if proper management plan will be put in place along with improvement on catch data and revenue collection.

Introduction

Fish and other marine resource in many places are the vital source of food and make a primary source of income for economic security. For instance in Tanzania, the fishery industry contributes about 1.4 to the Gross Domestic Product (Tanzania Beural of Statistics, 2010) but yet the fishery is artisanal dorminated. Marine fishery in Tanzania is mainly artisanal contributing about 95% of the fish production along the coast of mainland Tanzania (Jiddawi & Öhman 2002). There are about 36,321 artisanal fishers in the 13 coastal districts (Frame survey, 2009), who's lives depend directly on fish as a source of food and income. Thus, any negative impact to the fishery resources would, therefore, threaten the livelihoods of the coastal communities and other consumers along the supply chain.

Artisanal fishers mainly operate in shallow waters within the continental shelf, using traditional fishing vessels – including small boats, dhows, canoes and dinghies. Various fishing techniques are employed, which mainly use simple passive fishing gears such as basket traps, fence traps, nets as well as different hook-and-line techniques. Catch composition and size of the fish varies with gear types and habitats (Jiddawi &Öhman 2002).

It is estimated that, annual catches of tuna fish in the Indian Ocean are over one million tons and brings approximately 3-4 billion Euro per annum (Majkowski 2007). The Western Indian Ocean (WIO) region accounts for 70-80% of the total Indian Ocean tuna catches, and about 20% of the global production. The tuna fishery could play an important role in the national economy and food security of the respective developing coastal and island states in the WIO. However, due to the high demand of tuna and tuna-like species, the fishery is facing a number of challenges with respect to sustainable exploitation across the globe (Majkowski 2007). For example, off-shore tuna stocks are at the verge of extinction, more specific albacore tuna in the Indian Ocean is currently overfished while big-eye and yellow-fin tuna are approaching maximum sustainable yield levels (Polacheck 2006). Likewise, neritic tuna stocks along Tanzania coastal waters are highly susceptible to fishing effort and are at a risk of depletion (TAFIRI, 2012).

While much of the information on tuna fishery has already been collected around the coastal areas, there is limited information on socio-economic status of the fisheries dependent communities, its contribution to the economy and exploitation status of tuna and tuna-like species (TAFIRI 2012). Lack of basic information on artisanal tuna fishery could hinder the

development of appropriately informed management and development options for maximizing the socio-economic benefits for the country. This study therefore provides baseline information on a wide range of socio-economic aspects on artisanal tuna fishery in the coastal regions of Tanzania. In addition, findings of this study can be used to guide policy formulation and decision making processes for promoting sustainable use, management and development of tuna fishery for improved livelihoods andthe national economy at large.

Methodology

Description of the surveyed sites

The study was carried out in five regions in Tanzania mainland namely: Tanga, Dar-es Salaam, Coast, Mtwara and Lindi (Fig 1). We covered 7 districts along the coast. Landing sites within the region were selected based on the large number of potential tuna fishers and accessibility of the landing site (Fisheries Frame Survey, 2009).
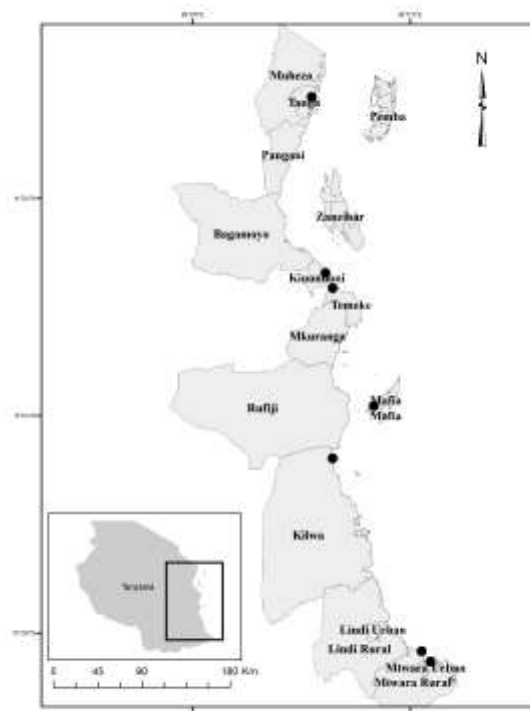

Figure **1**. Location of the coastal districts along the Tanzania coastline. Black circle indicate study sites.

Data collection

Field survey to collect a standardized set of socio-economic and fishery data was conducted between October-December 2012. We employed both primary (qualitative and quantitative methods) data as well as review on the available information from the Fisheries Division database. The qualitative data collection was through Key Informant Interviews (KIIs), Focus Group Discussions (FGD) and Participant Observations while quantitative methods involved administering a semi-structured questionnaire. Fishers were selected so as to best represent tuna and tuna-like fishers rather than having any fishermen who is not involved in the fishery of tuna and tuna-like species. Only species targeted by artisanal fishers were considered here.

Key Informants Interviews: A checklist for key informants was designed to collect qualitative information of respondent perceptions and experiences. 1-5 key informants comprising the District Fisheries Officers (DFOs), hotels, supermarkets and fish processing industries were interviewed to get crucial landing site information and key study variables.

Some of the information gathered includes:

i. Fishing related facilities available
ii. Fishing technology and methods
iii. Gender disparity in fisheries activities
iv. Proximity to nearest market for tuna and tuna-likes species
v. Reliability of road connections
vi. Information on role and fishery contribution to economy
vii. Closest social facilities available (schools, health clinic etc.)
viii. Marketing aspects for different tuna species [Fish supply, fish market destinations (at different levels), fish prices, market volumes, products processed, success, failures]

Focus Group Discussion: Focus group discussions using a topic guide schedule were conducted to groups of different fisheries stakeholders i.e. fishers, BMU members, fish processors and fish traders. Each group had 10-12 members. The discussions aimed to assess livelihood constraints and coping strategies. Key issues discussions included how the fisheries stakeholders benefit from the fisheries resources, constraints faced in the fisheries and how fishers cope with the constraints.

Questionnaire survey: Semi-structured questionnaires were administered to individual fishers dealing with tuna and tuna-like species.

Fishers: The information focused on:

i. Demographic characteristics (sex, education, family size, marital status, and age)
ii. Socio economic status (income levels, investments levels, alternative activities)
iii. Residency status

iv. Information on assets (land, fishing gears, housing and its characteristics) and their location
v. Financial services
vi. Fishing activities undertaken through the year
vii. Level of involvement in fishery, trading/processing
vii. Health status
viii. Well-being indicators

Hotels, supermarkets and fish processing industries: Hotels, supermarkets and fish processing industries in the sampling regions (whenever available) that deal with tuna and tuna-like species were interviewed to generate data for value chain analysis. The following information was generated:

i. The value and share of benefits from this value along the whole commodity chain of tuna and tuna-like species, i.e. from capture to consumption.
ii. The points in the chain where bio-economic efficiencies and equity of distribution can be improved.
iii. The major participants involved in the tuna and tuna-like Value Chain
iv. The structure of the distribution chain for tuna and tuna-like species from catch to national markets.

Literature reviews: To establish knowledge gap on the fish production including export and local use data for tuna and tuna-like species, two approaches were used:

(i) Desk review of relevant reports from the Fisheries Department

(ii) Examine Fisheries Department database on catch rates, landings and fish biology with regards to tuna and tuna-like species.

Data analysis

Data collected within fish landing sites were combined per region. Using SPSS (version 19), summaries of the data were generated as frequencies, means and percentages and presented in tabular forms and charts. More elaborate statistical analyses of variable relationships were done for selected data, using mainly cross tabulations. For the KIIs, the discussions were recorded. The content analysis method was used to analyze qualitative information, particularly recorded dialogues which were broken into meaningful themes or tendencies.

Results

Number of fishers and engagement

A total of 194 respondents participated in the study. These included 119 fishers interviewed through semi-structured questionnaire, 5 District Fisheries Officers drawn from each surveyed district, 2 supermarkets outlets in Dar es Salaam, 4 hotels (distributed equally between Dar es Salaamand Mtwara regions), 2 fish processing industries in Dar es Salaam, and 62 fishers from FGD represented by (11 in Mtwara, 10 in Lindi, 12 Tanga, 17 Dar es Salaam, and 12 Coast regions). Interestingly, the fisheries is dominated by males as only 2.5% (n=3) of the fishers interviewed through semi-structured questionnaire and 2 from the FGD were women. Out of the 119 fishers interviewed, 55% were boat crew and 23% were boat owners (Table 1) who were fishing together with other crews.

Table 1**.** Distribution of fishers by district and level of engagement in the fishery

Category	District of residence				
	Mtwara municipal	Kilwa	Mafia	Ilala	Tanga
Fishing unit owner	4	7	8	3	5
Fishing unit renter	3	2	3	6	2
Crew	11	10	7	7	18
Processors and Traders	4	3	2	4	10

Age and education level

The minimum and maximum age of the respondents involved in the tuna and tuna-like fishery were found to be between 18 and 67 years with dominant age group ranges from 31-35, 41-50 and ≥51 (Figure 2a). However, there is a variation in age groups among the surveyed regions (Figure 2b), where fishers with age ranging from 18-25 years dominated in Lindi, 26-30 in Coast, 36-40 in Mtwara, while 41-50 and ≥ 51 years were dominant in Tanga.
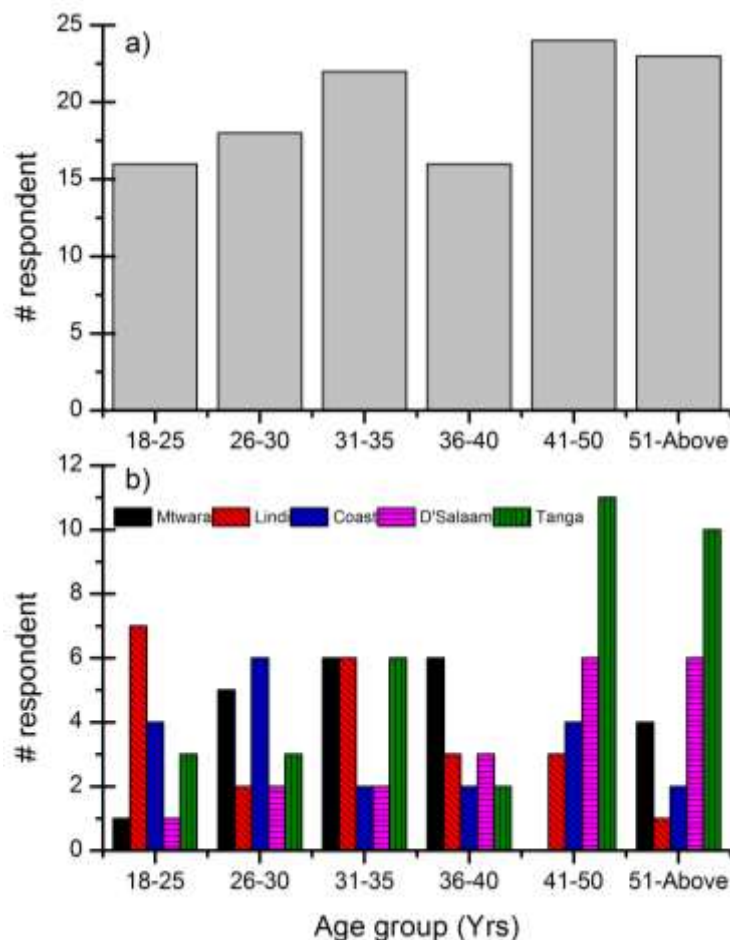
Figure 2: (a) Number and age group of respondents (b) Age group variation among the surveyed regions

Education status

The level of literacy is important for fisheries management as well as adoption of new technology. However, this seems to be a challenge in fishing communities as about 32% of the fishers interviewed had no formal education (Figure 3a). In addition, comparison among the study regions indicated that fishers without formal education dominated in Lindi but least in Dar-es Salaam (Figure 3b). The highest percentage of fishers who have completed primary education was found in Tanga followed by Mtwara and Dar-es Salaam. For the secondary school, high percentage was found in Tanga and Dar-es Salaam but least in Lindi, Mtwara and Coast (Figure 3b).
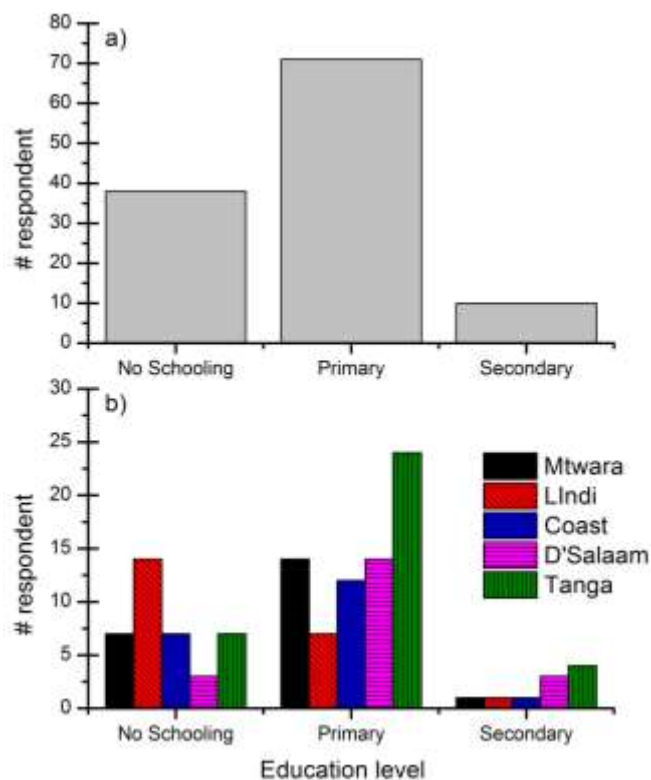
Figure 3: (a) Number andeducation status (n = 119) (b) Education status per surveyed region.

Fishing gears and main fishing areas

The main fishing gears used in the tuna and tuna-like fishery are gillnets, long-lines/hand-lines and ring nets –locally known as '*jarife', 'zulumati/mishipi'* and *'mtando'* respectively. Gillnets are the most preferred fishing gear while the hand lines and ring nets are least preferred. The mostly preferred mesh size for gillnets ranges from 5" to 7" (34 -36 ply; DFOs pers. comm.). These gillnets are usually joined together and set to a depth of between 40 and 100 meters where they are left to drift. Hook sizes used for this type of fishery range from number 4 to 7. Long-line/hand-line are usually baited and operated while the vessel is drifting and sometimes stationary. Ring net is simply a surrounding net, used to surround a shoal of pelagic fish. These gears are operated either by sail orout board engine boats. The number of crews in the boat depends on the size of the boat and fishing gear used e.g. a plank canoe can take a maximum of three fishers while out board engine boat with ring-net can take from 15 to 20 fishers per fishing trip.

Exploitation of tuna and tuna-like species

Fishers deals with almost all tuna and tuna-like species but the most commonly caught species are Wahoo (Nguru-maskati), Kawakawa (Sehewa), Yellow fin tuna (Jodari) and Skipjack tuna (Zunuba) - Table 4. Peak fishing season is between September and January.

Table 4.Fishers response on the targeted fish species

Species	Frequency	Percent
Wahoo	98	17
Kawakawa	85	15
Yellow fin tuna	85	15
Skipjack tuna	58	10
Kingfish	57	10
Indian mackerel	37	6
Striped bonito	42	7
Queen fish	34	6
Swordfish	32	6
Sailfish	25	4
Trevally	8	1
Others	4	3

Generally, availability and economic reasons were the main drivers for fishers to target specific fish species. However, the two reasons varied among the studied regions in which a high number of fishers (i.e., more than 50% in each region) from Coast, Mtwara and Lindi regions were targeting tuna and tuna-like species because of their availability, while economic reason was more important in Lindi, Tanga and Dar es Salaam regions (Figure 4).
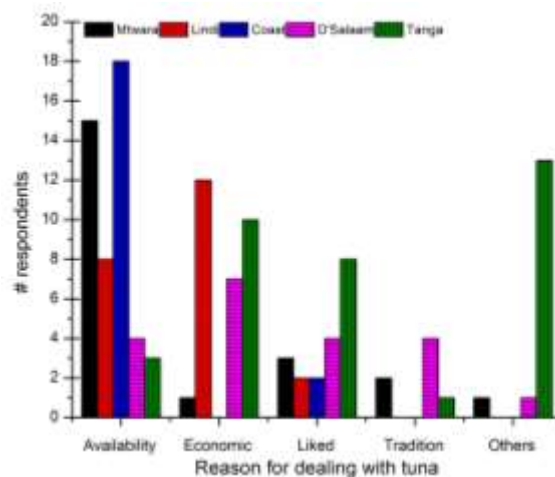

Figure 4: Number of respondents and reason for dealing with tuna and tuna-like species per respective region.

Furthermore, a cross tabulation on fish species and preference indicated that Wahoo was the most preferred species (42%) followed by Kawakawa (25%) and Yellow fin tuna(20%) while the least preferred species was striped bonito (0.84%). The observed preference for these species could be influenced by their availability and economic returns (Table 5).

Table 5. Preference on the tuna and tuna-like species

Species	Easily available	Economic importance	Most liked	Tradition	Others	TTotal
Wahoo	25	11	5	5	4	46
Kawakawa	10	8	6	0	6	30
Yellow fin tuna	5	11	5	2	1	24
Kingfish	6	0	1	0	1	8
Indian mackerel	1	0	2	0	3	6
Striped bonito	1	0	0	0	0	1
Total	48	30	19	7	15	119

Livelihood benefits to fisher's community

Engagement in tuna and tuna-like fisheries has a vital socio-economic importance to the riparian communities. In all regions surveyed, fishers spend about 10 hours per day and 5 days a week for fishing related activities. Most households had 5 members on average, which means that the income accrued from the sector cannot be ignored. Income generated from the daily catches (after deducting fuel costs for motorized boat) is usually divided into three parts, one third goes to the boat owner/renter, another part as maintenance cost of the fishing gear (ring net /gillnet and fishing vessel) and the remaining part is shared among fishers. Generally, boat owners and fishing unit renters generate an average income of about 40,000 and 16,000 TZS respectively with minimum and maximum earnings between 5,000 and 150,000 TZS. On the other side, crew average earning is about 20,000TZS per day with a minimum of 3,000 and maximum of 50,000 TZS daily depending on the catch of the day. Processors and traders get an average income of 21,500 with minimum of 5,000 and maximum of 100,000 TZS per day. However, there were differences in the income earned among the surveyed regions (Figure 5) which mean that we need to be careful while trying to alleviate both nutritional and income poverty in these regions. The number of fishers decreased with increasing earnings except in Dar es Salaam region where few respondents in the lowest income category (category 1) were recorded (Figure 5). Tanga

region had the highest number of fishers in the lowest income category followed by Coast, Mtwara and Lindi (Figure 5).

More than 80% of the respondents acknowledged that tuna and tuna-like species are mainly for income generation and had a significant contribution to their household income. Income from the fishery supported a range of 1 to 6 dependents per household in Mtwara and Lindi, 1 to 5 in Mafia and Tanga and 1 to 4 in Ilala. Fishers have invested a substantial part of their fishery-accrued income into land and construction of houses; both temporal and permanent. For instance, 53% of all fishers interviewed acknowledged possessing a land, of which 38% used their lands for crop farming, 10% for residence while 52% fishers of the respondents do not use their land for any purposes.
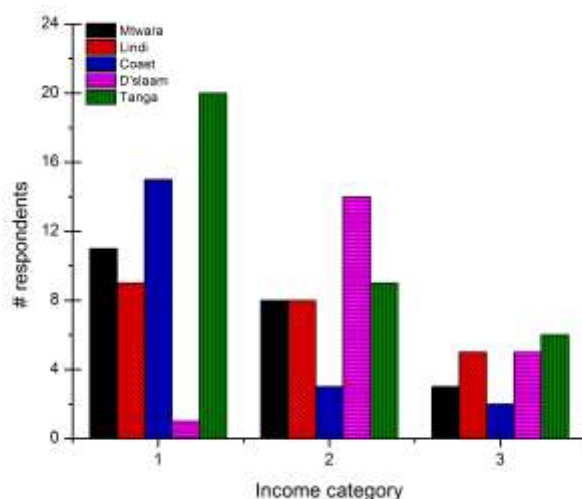

Figure 5. Income generated from tuna and tuna-like species fishery per surveyed region; category 1- represents earnings from 5000-10000TZS; 2-10000-30000TZS; 3->30000 TZS per day.

Tuna and tuna-like income contribution to various fisheries stakeholders

Tuna and tuna-like species are of high commercial importance within the coastal areas. However, lack of documentation at the landing sites from dealers and in most local government authorities, production and income generated by the fishery are inadequately known. Nonetheless, the available data represents a high value fishery not only to fishers but also to all actors in the chain. This study found that during the fishing season,which spans between September and January with a peak in December, fishers earn between 5,000 and 150,000 while

fish traders get an average income ranging from 5,000 to 100,000 TZS per day. The respective local authorities generate income ranging from 5 to 30 million TZS per month from levies which is 15% of all fish sold at the landing sites. This is besides other revenues generated in the markets where the fish are sold.

Hotels and supermarkets get substantially large amount of money from tuna fishery. They buy the fish from agents at a price ranging from 10,000 to 15,000 TZS per kilogram and sell at between 24,000 and 50,000 TZS per kilogram depending on the status of the hotels or supermarkets. At the ferry fish market in Dar-es Salaam, tuna and tuna-like species from 2009 to 2011 generated an income amounting about 2.23 billion TZS (Table 6). However, due to inadequate documentation, the figure could be higher than what is recorded. Furthermore, it should be noted that fish prices vary with season, area and supply and demand.

Table 6. Weight and value of fish handled at the Ferry market in Dar-es salaam (values and price are in TZS), Source: Ferry market Fisheries Office).

Year	Species	Weight (Kg)	Value	Price (TZS/kg)
2009	Tuna	16047	39,759,400	2,478
	Kingfish	17575	45,870,000	2,610
	Kawakawa	186197	235,668,000	1,266
	Queen fish	18090	16,735,400	925
	Indian mackerel	310807	432,005,800	1,390
	Sub total	*548,716*	*770,038,600*	
2010	Tuna	8844	26,210,000	2,964
	Kingfish	12443	37,780,000	3,036
	Kawakawa	57903	81,541,000	1,408
	Queen fish	14325	12,965,000	905
	Indian mackerel	342528	506,120,000	1,478
	Sub total	*436,043*	*664,616,000*	
2011	Tuna	4703	14,010,000	2,979
	Kingfish	16874	39,140,000	2,320
	Kawakawa	93118	147,670,000	2,336
	Queen fish	19392	15,774,000	826
	Indian mackerel	338415	578,240,000	1,151
	Sub total	*472,502*	*794,834,000*	
	Grand total	**1,457,261**	**2,229,488,600**	

Supply chain of tuna and tuna-like species

Tuna and tuna-like- species supply chain consists of fishers (crew and boat owners/renters), agents/auctioneers, fish traders and suppliers, hotels, supermarkets and fish consumers. The supply chain is a simple chain that begins when the fish is caught and ends with consumption. The marketing of fish is a two tier system namely fish for local consumers and hotels, supermarkets and food processing industries. When the fish is caught, the fishers land the fish at the landing site where it is taken by the agents to the fish receiving area for auctioning to various traders. It should be noted that not all fish are auctioned as some of them are sold direct from the fisher to the local consumers or traders. Some of the traders upon buying the fish, they process them (salting) and transport the fish to the country side to sell to the consumers. Other traders sell the fish at the fish markets next to the landing sites, while others have informal agreement with hotels and food industries to supply them with fish. Price at local markets range from 3,000-10,000 TZS per fish while at hotels and supermarkets range from 12,000-50,000 TZS per Kg. Part of tuna and tuna-like species are sometimes sold to Bahari food industry, processed and sold in local touristic hotels (Bahari food. pers.com). The interviews with various players in the value chain attempted to collect information on the business side of the fishery. However, it has proved relatively hard to make sense of this information when compiled to form a value chain analysis or profit share structure. The reasons being the following:

- Units of measurement are variable and lack accuracy.

- People also make mistakes in their statements regarding their business or simply prefer to hide the truth. There is always a certain level of suspicion on what this information is going to be used for;we have experienced a great deal of reluctance to share information.

- Inadequate documentation from the field fisheries officers and BMUs regarding the volumes, prices and actual number of fishers involved in the fisheries.

Contribution of artisanal tuna and tuna-like fishery to the national economy

The annual fisheries statistical report of 2010 included tuna and tuna-like species in the frozen tuna category which generated a total of 4,000,000 TZS as royalty. However, in 2011 tuna and tuna-like species were also included in frozen fish/marine which generated 8,497,900 TZS as royalty. The estimates of 2011 revealed that the highest contributor in the export royalty was tuna and tuna-like species.

The local government generates revenues through boat registration and licensing of both fishers and boats and levies were collected from landing sites and fish markets (Table 7). Funds collected are used for various objectives which include development projects within the local government authority. However, getting this information and particularly the contribution of tuna and tuna-like species proves to be impossible given the current licensing system which does not specify the type of fishery given to a particular fisher.

Total catch of tuna and tuna-like species from 2010-2011 (Annual Fisheries statistics reports) indicated that Tuna, King fish and Indian mackerel landing data from all coastal districts had almost the same quantity of fish caught between the two years but with different trends among the districts. For instance, Tuna recorded the highest catch of about 500 tons in Kinondoni, about 300 tons in Tanga, Mafia and Ilala about 200 tons, while Pangani and Kilwa had the lowest catch of less than 5 tons (Figure 6).
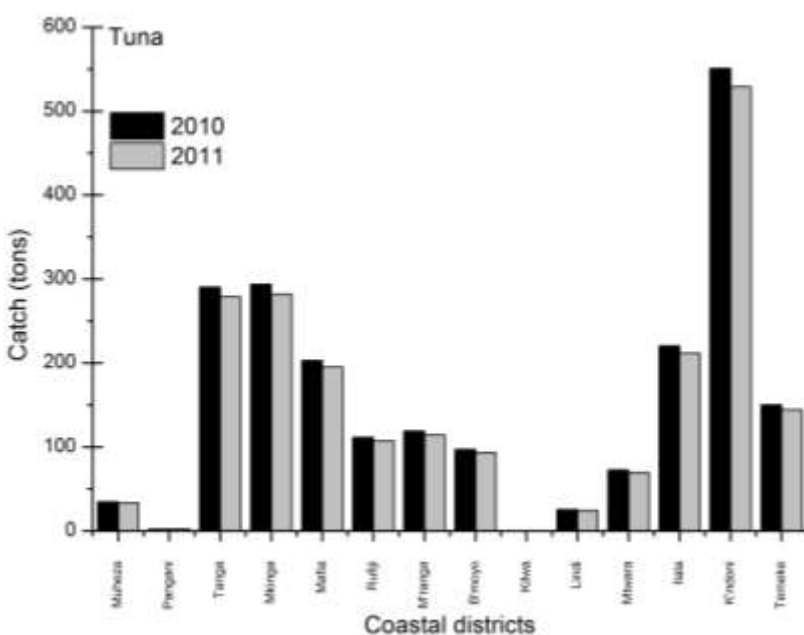

Figure 6: Tuna landings for each respective coastal district (Source: Fisheries Department annual statistics report 2010 and 2011).

For Kingfish, Kinondoni District had the highest total catches of about 250 tons, followed by Ilala (*ca.* 200 t) while catches for Mafia and Temeke were between 150 and 180 tons respectively. The rest of the districts (Pangani, Rufiji, Mkuranga and Kilwa) recorded catches of less than 3 tons (Figure 7).
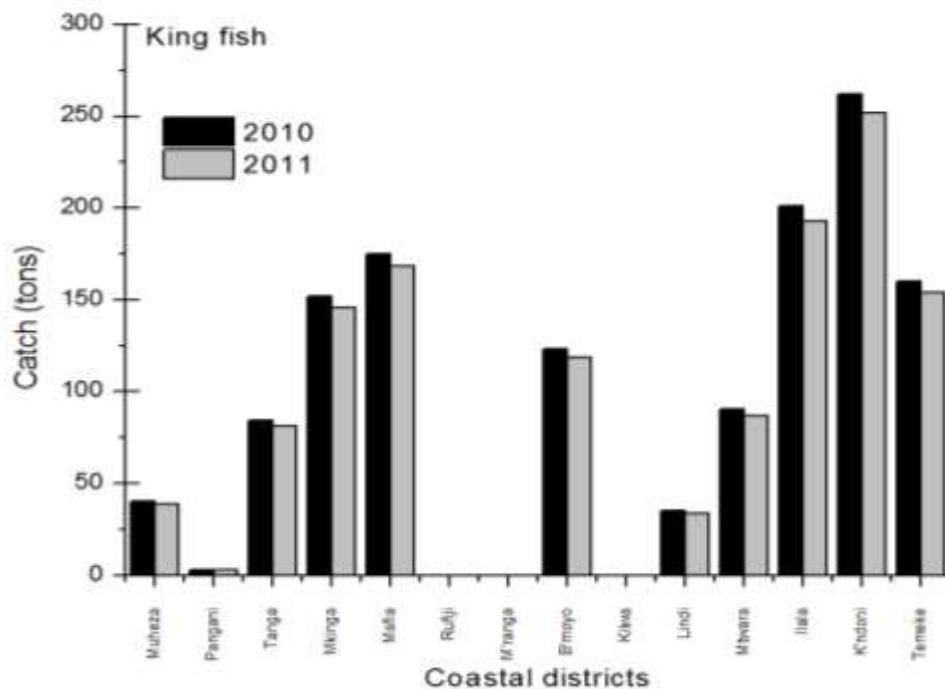
Figure 7: King fish landings for each respective coastal district (Source: Fisheries Department annual statistics report 2010 and 2011).

The highest catches for Indian Mackerel were recorded at highest in Ilala and Mafia (about 800 tons each) followed by Bagamoyo, Kilwa and Mtwara (400 - 600 tons) and less than 5 tons were recorded at Rufiji, Muheza, Pangani and Lindi in the last two years (Figure 8).
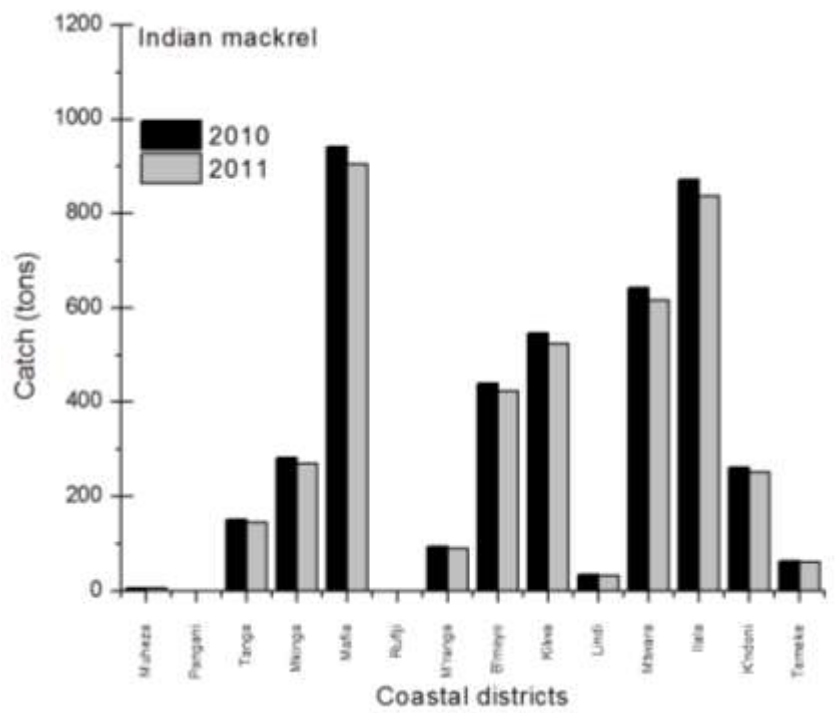
Figure 8: Indian mackerel landings for each respective coastal district (Source: Fisheries Department annual statistics report 2010 and 2011). M'ranga = Mkuranga, B'moyo = Bagamoyo, K'ndoni = Kinondoni

Selected fish landings for Tuna (combined all tuna species), Kingfish and Indian mackerel in the period of 1994 to 2010, indicates a fluctuating trend for tuna, but constant trends for Kingfish and Indian mackerel. For instance, in 2007 the total landings for tuna were about 4,000 tons, which then decreased to less than 1,000 tons in 2008 before increased again to over 7,000 tons in 2009. The catches then decreased sharply to about 2,000 tons in 2010. Similar trend was also observed in Mafia district from 2009 to 2012. The catch trends for Indian Mackerel and Kingfish ranged from 2,500 to 4,500 tons and from 500 to 1,500 tons respectively (Figure 9).
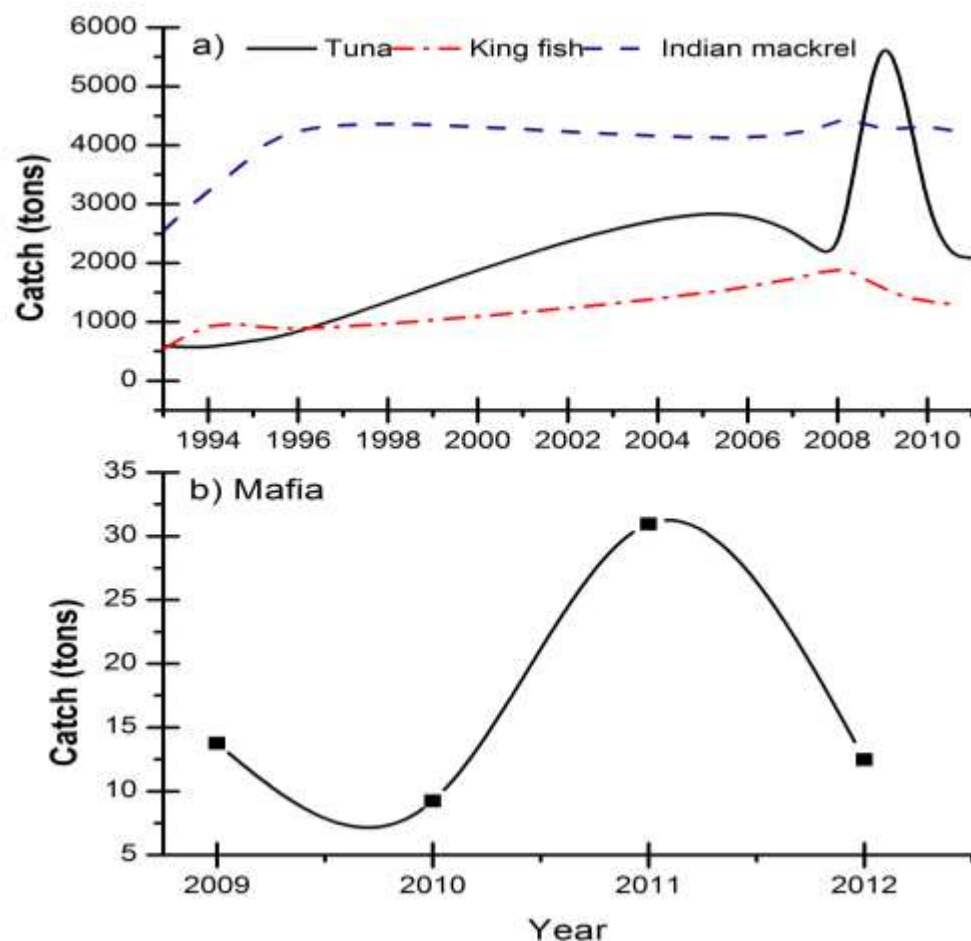
Figure 9: Total fish landings(metric tons) for tuna and tuna-like species (a) all coastal districts (b) tuna species only in Mafia Island.

Sources: (a) Department of Fisheries Annual statistics reports 2008-2011, (b) Mafia District Fisheries Department.

Discussion

The present study indicates that fishing gear used to catch tuna and tuna-like species are traditional/artisanal and cannot be used to exploit the present resources effectively. Fishing is mainly done within 20 km from the coastline using wooden planked boats. Poor fishing gear and techniques used by artisanal fishers were found to restrict fishers to venture into more productive fishing grounds. In addition, there is low investment in fisheries from both fishers and the government.

Currently, the government investment into the fisheries infrastructure is inadequate. Therefore, if the goal is to have fisheries which can contribute significantly to economic development of the country, there is a need of dedicated fisheries investment such as establishment of fishing harbour, fish processing facilities and transportation networks. In addition, the government should provide more incentives to attract private sector investment into the fisheries (especially offshore fishery) and hence improve livelihoods of fishers' communities. For instance, a removal of levy from fuel used for fishing activities could trigger more investment as over 90% of the total cost of fishing operation goes to fuel (pers. comm.). However, sustainable fisheries management practices such as introduction of fishing quotas and controlling the fishing effort through licensing of fishers and vessels should be put in place and enforced to avoid overfishing.

Majority of fishers interviewed acknowledged that tuna and tuna-like species form an important and sometimes a sole source of their income. Therefore, a change of stock size and availability of these fish could have major impacts on the fishers and riparian communities'livelihoods. Without investment in human, social and financial capital, the fisheries has little or no chance to contribute to fishers' sustainable livelihoods (Allison & Ellis 2001).

In Tanzania, official records as far as the contribution of fisheries to the national economy is concerned are export oriented focusing on major commercial fish species. While artisanal fisheries, especially near-shore subsistence fisheries, are recognized as fundamental for social, cultural and food security, their catches are seldom accounted in official statistics. Thus, their contributions to the Gross Domestic Product (GDP) are often not taken into consideration, which greatly under-estimate the contribution of the fishery sector to the national economy. In addition, levy and other income collected at the landing sites and fish markets by local government authorities are not included in the computation of GDP, the results of which is gross under-estimation of the same. Therefore, mechanisms should be put in place to ensure that all data related to income generated from fisheries (species specific) are collected at all levels i.e. from the landing sites to the central government. There is a need to conduct a comprehensive study to develop a mechanism that will correctly capture fisheries data by addressing serious under-reporting of the actual catches see Jacquet et al. (2010) which could mask the real contribution of fisheries sector to the national economy.

It is evident that knowledge of the status of the tuna and tuna-like species is inadequate with lots of uncertainties, let alone the contribution of this fishery to the livelihood of the artisanal fishers

and its contribution to the national economy. Therefore, there is a need of deliberate effort for improvements. Improvement would necessitate better data collection on the catch, their characteristics, biological knowledge and fishing effort of the species. Without these improvements, fisheries management measures which aim at conserving these fish species for improved livelihood of both current and future generations will not be possible. One of such improvements could be monitoring of catch at the landing sites by strengthening BMUs in areas where BMUs are not effective. Otherwise, for those landing sites where BMUs are effective, members of the BMUs can be trained and engaged in data collection. This improvement implies sustainability of the fishery.

In conclusion we recommend that there is a need to mark and geo-reference fishing grounds for tuna and tuna-like species and this activity should incorporate both spatial and temporal variations. Information gathered will not only be important for management and conservation purposes but also for ongoing FAD deployment activity in the region and characterization of potential fishing grounds. Throughout this study, lack of quality data from all levels has been clearly echoed. It is therefore important to create a data collection system which will consistently ensure the availability of the data even to species level if need be. This is important in order to capture the contribution of not only the fisheries sector, but also species specific information to the national economy and understanding catch trends with certainty. We further recommend that small scale fishers should be trained on fishery products value addition, and should be empowered to venture into deep sea fishing grounds. Fishers and private sector should also be involved in development and implementation of the tuna management plan for sustainability of the fishery sector. Better access to microfinances and saving schemes is crucial for fishers livelihood, thus this aspect should be improved. The best way of achieving this would be through co-management channels such as BMUs, CBOs and CSOs. There is a need to put management plan for costal tuna (tuna and tuna like species). Currently it is said to be under the IOTC, however information of the national status of this fishery is poorly captured.

Acknowledgments

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