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Received: 26 December, 2017

Accepted: 17 January, 2018

Published: 18 January, 2018

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Keywords: Fishing tradition; Fishing rationale; Fishing seasons; Fish cooperatives

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Research Article

Fishing Condition and Fishers Income: The case of Lake Tana, Ethiopia

Abstract

Fishery provides a multitude of benefits ranging from employment to food security. Investigating the factors affecting fishing income and the fishing environment are crucial entry points for efficiency maximization intervention. A survey was conducted in all Woredas' adjacent to Lake Tana. Data was gathered using household survey and focus group discussions and analyzed by a linear regression model. The results indicated that the fishery in Lake Tana is comprised of diverse individuals in relation to occupation, engagement intensity and membership to cooperatives. Fish related income was positively correlated to years of schooling and ownership of motorized boat while negatively correlated to membership to fish cooperatives. Interventions aimed at improving the market infrastructure, delivery of major fishery inputs, training on processing and use of by-products, revising the membership requirements and enforcement of fishery related laws are critical for sustainability of the fishery resource.

Introduction

Fisheries are important supplier of food and income, and provide a diverse set of benefits to many households and communities (Smith et al., 2005). The small-scale fisheries and aquaculture sector provides both direct and indirect food and nutrition security, through providing fish to households and thus generating income (Bjørndal et al, 2015, Natale et al. 2015 [1]). As food security becomes a major global concern, the role of inland fisheries as food supplier is likely to become increasingly important (Suuronen and Bartley, 2014).

In Ethiopia, fisheries are acknowledged as an important strategy in the drive for poverty reduction. They also promote greater economic development. In 2010, Ethiopia realized about USD 14 million from its capture fishery while a total of 40 000 livelihoods were positively impacted upon by the fishery sector in the same year (FAO, 2016). In Ethiopia fishing is practiced in lakes, rivers and recently aquaculture is being practiced. Lake Tana is one of the largest fishing sites in the region and the country which is almost dominated by artisanal fishery men.

Lake Tana, found in Amhara Region, has a surface area of 32,000km² with a maximum and mean depth of 14m and 8m. The Lake provides commercially important three (3) delicious fish species; namely, African Cat fish (*Clarius gariepinus* also locally called "Ambaza"¹), Nile tilapia (*Oreochromis niloticus*, locally called "Kereso") and Labeobarbus spp. (locally called "Nech Asa"). They are consumed by larger part of the

community, rural and urban, and traded widely in the region, the country and even to neighbouring nation, the Sudan. The fishery potential of Lake Tana is 10,000 while the annual catch is 1454 tones and accounts for 25% of the total national catch (Janko, 2014). Fishery covered 0.03% of the regional GDP by contributing an average ETB of 7.94million annually between the years 1998-2003.

¹Currently it is commonly known as "Key Asa", a name that indicates the color of the meat of this fish. The name was coined by Fish Corporation to increase the consumption of the species that was regarded as a food consumed only by "Negade Woito" and despised by the majority Christians and Muslims.

The country imports significant amounts of fish from neighboring countries though some of these imports end up being exported to Sudan. Though there is a strong consumer preference for beef, fish is regarded as an important component of a nutritionally rich diet. However, fish consumption patterns vary according to availability. More fish is consumed in areas where the product is more available, such as in the vicinity of the lakes (FAO, 2016). The per capita fish supply is around 200 g, significantly below the mean 2.6 kg per capita per year for the East African sub region. The contribution of fishery to the regional and national economy is expected to grow as local and international demand for fish and fishery products is growing. For example, the national demands for 2015 and 2025 are estimated at 95, 000 and 118,000 tons respectively (Janko, 2014). Also, fishery plays a vital role in domestic trade as well as in import and export market.

There are some studies (Ameha et al. 2006, Shewit 2014, Tewabe 2015 [2], Tewabe 2015a [3]) conducted on the fishery production and reproduction, however they fail to analyse the determinants of income of fishers using the standard econometric models. Hence, this study was carried out to investigate the factors affecting the income of fishers of Lake Tana and provide policy and development recommendation for stakeholders. Therefore, this study was conducted in June and December 2015, a) to explore the socio-economic profile of fishers, b) assess the fishery production system at Lake Tana, c) to assess the major fishery produced, and d) to investigate the problems related to fishery production and marketing. This study is novel in the study area as it assessed the whole area of fish production (cross section data based) and refuted the traditional assumption of efficiency of cooperatives and proposes/delivers a management option/ the need to strictly control the fishery by allowing only those without much other livelihood option, especially the farmers.

Materials and Methods

Study areas

The study was conducted all over the Woredas² bordering Lake Tana. Bahir Dar Zuria, Dera, Fogera, Libokemkem, Gonder Zuria, Dembia, Takusa, Alefa and North Achefer are the 9 Woredas³ where this study was conducted. The Woredas⁴ are best described fertile areas with the potential to produce much of the locally produced crops and vegetables. They experience a more or less equivalent climatic conditions except some are more nitosols and others vertisols. The numbers of fishers in Lake Tana vary from season to season. According to the reports of the 9 Woredas⁴, there are almost well over 4556 fishermen and women without counting the number of people employed in the fishery value chain (Table 1). Hence, the Lake is an important economic and employment sector for the regions citizens. The results of our survey, conducted in 2015/16³, indicated that there is more production of fish than predicted by others (de-Graff et al. 2006 [4], Janko, 2014) and indicates unsustainable feature. On the other hand, it indicated that FAO estimation of 24,900MT of fish produce using the total lake area estimation procedure was more accurate estimation procedure for the extraction rate at Lake Tana. It is estimated

that the fishery extract was low as North Achefer, Bahir Dar Zuria and Dera Woreda, did not report dried fish.

²Woreda in Ethiopia is synonymous with district.

³2015/2016 in European calendar is meant to represent the Ethiopian calendar of 2007, September to August.

⁴Kebele is the lowest administrative unit in Ethiopia

Sampling and data collection

Data was collected from individual fishers, cooperatives, Fishery Corporation and traders. Since the number of fishers varies from season to season it was hard to get exact sampling frame. Sample fishers were purposively selected during the fishing delivery time in the specific landing sites of the Woredas⁴. A total of 41 fishers were interviewed as sample respondents. There was no registered income or production volume for income of fishers. Hence, recall capacity (highly dependent on probing, fear of telling due to expected taxation and related attitudinal problems) was used to determine the income of fishers. Fishers were requested to inform the average amount of income gained from fishery for the past several years or the past year alone. Latter, it was confirmed from several other fishers, processors and wholesalers what we sampled fully represents the whole fishers of Lake Tana. They stated that major difference between fishers income is due to ownership of motorized boats otherwise all artisanal fishers using reed boats have equivalently similar annual income; which was captured in the survey.

Data analysis

Data was analyzed using descriptive statistics and an econometric model. The multiple linear regression equation was used to determine the factors affecting the total amount of fishery income derived by fishers.

Results and Discussion

Socioeconomic characteristics of the fishers

The fishery system in Lake Tana is dominated by artisan fishery activities. Private fishers (82.9%) dominate in Lake Tana fishing activity while 17% are members of different fishing cooperatives. Among them those who have formal education account for 41.5% of the fisher men including one year college training. This indicates that the fish industry is providing employment opportunity to the landless youth. Few (19.5%) have attended literacy campaign programs while the rest of fishers are illiterate. The major livelihood for 19.5% of the fishers depends on agriculture while 46.3% of the fishers depend entirely on fishing as the major livelihood source. Almost 34% of the fishers support their livelihoods both on fishing and partly on agriculture.

Fishing tradition and rationale

The majority (58.5%) of the fishers undertake fishing as a full time activity while few (14.6%) involve in fishing as a part time activity. There are also other group of fishers (26.8%) that involve in fishing seasonally. These are mostly farmers whose livelihood mainly depends on farming or agricultural activities. They involve in fishing during off seasons when agricultural

Table 1: Annual Fish catch of Lake Tana.

| No | Woreda | No of kebele's | No of fishers | | Annual fish Production (tone) |
|----|--------------|----------------|---------------|--------|-------------------------------|
| | | | Male | Female | |
| | Dembia | 11 | 421 | | 1587.28 |
| | Alefa | 3 | 160 | | 47.74 |
| | Takusa | 6 | 270 | | 9040.25 |
| | N/Achefer | 5 | 136 | 38 | 1483 |
| | B/Dar Zuria | 9 | 600 | | 2426 |
| | Libokemkem | 3 | 967 | 1 | 645 |
| | Dera | 3 | 235 | | 147 |
| | Fogera | 2 | 400 | | 2125 |
| | G/Zuria | 4 | 676 | | 117 |
| | B/Dar ketema | 10 | 515 | 37 | 1070 |
| | Total | 56 | 4380 | 76 | 18688.27 |

Source: own survey (June 2015).

activities are low or few and during high demand-price circumstances. Students from high school that occasionally (during breaks and summer time) go for fishing also belong to this category. People engage in fishing as source of income generation (34.1%), for food security (56.1%) and source of employment (2.4%). The fishers secure an average annual income of ETB 13492.86 (+1583.87) by providing whole, gutted and filleted fishes to different consumers and customers.

Fish abundance

The fishers ranked Nile Tilapia (75%) followed by Labeobarbus spp (25%) as the most abundant of fish in their daily catch throughout the year. According to them the second abundant of the catches are Cat fish (54.84%), Labeobarbus spp (38.71%) and Nile Tilapia (6.45%). The third abundant are Cat fish (44%), Labeobarbus spp (40%) and Nile Tilapia (16%). This shows that fish abundance is location and partly season specific. Seasonally, fish abundance according to local calendar is Tibi, kiremit, Gib and Bega from highest to lowest. The fish species caught mainly in the specified seasons accordingly are Nile tilapia, cat fish, tilapia as well as tilapia and Labeobarbus. The month of January has the lowest catch of all the months in the year. Labeobarbus is preferred in rural areas (where fish stew is preferably consumed) while tilapia and catfish are preferred in urban centres. Since the price of Lebeobarbus is cheap, fishers do not actually sell it to collectors or wholesalers as fresh.

Fish processing

Most of the fishers (65.9%) process their fish before selling. The major fish processing methods or processed products are gutting and filleting. Gutting, fillet and stripping account for 17.1%, 29.3% and 7.3% of the total sell of the fish. The gutted and filleted are sold in Bahir Dar markets while the filleted cat fish is dried for sun drying or salting to be sold for Sudanese market and other regional and outside the region markets in the lowland areas where people after two months of fasting use fish as the first meat for the enjoyment season. The Sudanese product is actually distributed to local markets and to consumers including to the landlords/investors that have huge farm lands or plantations which they need it for their laborers. Observation during the field work showed that the largest size Nile Tilapia was caught in Gonder Zuria while the largest Labeobarbus spp was seen in Kunzila (North Achefer). This might indicate higher suitability of the areas for the specific fish species or the low extraction rate.

Fish marketing strategies

63.89% of the fishers sell fish at landing sites while 36.11% do not sell at landing sites. The major fish marketing places for fishers are nearest market places (41.38%) (Kkunzila, Dengel Ber, Shawira, Delgi, Enfranz, Chuahit, Woreta), Bahir Dar (27.59%), number 1 fishers cooperatives (27.59%) and landing sites (3.45%). The fishers like to sell their catch in numbers as selling on weight has low income. The species sold mostly on weight basis are Cat fish and Nile tilapia.

Factors affecting income of fishers

Higher explanatory of the model indicates that the variables have fairly explained the majority of the determinants of income among the fishers (Table 2). Years of schooling and ownership of motorized boat are positively correlated while cooperative membership is negatively correlated to average annual income of fishers. Being a cooperative member showed not only a significant relation but also a higher coefficient of change. The result is in contrary not only to the findings in other areas rather also to the notion and basic objectives/ thoughts of establishing cooperatives.

The fishers during the FGDs noticed, that was also shared by the chairman of the No.1 cooperatives, which members are not providing fish to the cooperative as they are distracted by the Lake problem of net theft and mainly the inability to deliver production due to major engagement of most members in farming activities. These members not only do not supply produce daily or thereof but also they come in the days of sharing profits as they are registered members. They also account for majority of the members of the cooperative. This indicates that fishers should be specifically identified as farmers are seasonal fishers.

Incomes of fishers that process their produce before marketing were negatively correlated with total amount of annual income from fish. It should be either lack of processing skill resulting in huge loss or the fish size is small that the fillet is small. During the survey it was found that 5% of the fish filleted lost as it thrown away by 61% of the fishers. Similarly, one way sailing time shows positive correlation indicating the farther away from the shoreline of the lake that fish availability increases or is better. This shows that fishery population near the shoreline is depleted due to inappropriate extraction and some fish species whose habitats are these areas may be in danger of catastrophe. This is confirmed by the use of deadly fishing methods like bottom trawling/ "gafefa", use of poisons and monofilaments nets that allow catch of the entire population. Thus fishing methods near the shore line including the breeding sites should be properly managed in order not to devastate the resource.

Table 2: Determinants of fish income.

| Variables | Coefficient | Std. Err. | t-value |
|-------------------------|-------------|-----------|----------|
| Age | 21.30 | 228.23 | 0.09 |
| Years of Schooling | 645.52 | 300.97 | 2.14** |
| Fish primary livelihood | 2946.82 | 2518.70 | 1.17 |
| Fishing experience | 4.68 | 214.54 | 0.02 |
| Boat ownership | 15812.80 | 2756.08 | 5.74*** |
| One way sailing time | 12.11 | 17.21 | 0.70 |
| Processing | -997.28 | 2527.72 | -0.39 |
| Fish extension service | 134.37 | 219.67 | 0.61 |
| Member of cooperatives | -15166 | 3731.69 | -4.06*** |
| Constant | 2410.85 | 6046.33 | 0.40 |

No. of observation=24; F (9, 14) =6.54; Prob>F=0.001; R-squared=0.7871; Root MSE=4819.3

Fishing related problems

People in the value chain identified several problems, both production and marketing, in the fishery sector. The production problems include use of illegal nets, net theft, poor product handling, unorganized delivery, short of specific landing sites (ports) and entrance of any individual in the Lake at anytime, shortage of legal nets, lack of ownership of the Lake, asymmetric law enforcements in the different districts and sites, conflicts among fishers based on bordering, non-defined fishery population are bottlenecks that affected sustainable utilization of the fishery resource. The marketing problems identified include imperfect pricing system where mostly the buyers set the price and the wholesalers are the beneficiaries, absence product standards and legal enforcement, lack of coordination among producers to increase the bargaining power, inadequate availability of market information and research, shortage of processing women, shortage of working sites and electric power for storage, uselessness in licensing as non-licensed also involve in the fish trade, lack of government focus for better packaging and processing, transportation problems and lack of confidence in customer relationship due to unhealthy competition.

Conclusion and Implications

The theoretical extraction rate was way lower than the actual rate of extraction reported by each woreda indicating over extraction. This requires that regulation mechanisms on sustainable fishery extraction rate should be employed and such data be reported accordingly. Fishery supports not only people with no other income sources, rather individuals that also engaged in farming activities. Farmers are also beneficiaries from the fishery sector. While such condition facilitated distribution of resources among the community, it also created conflict as the resource is unwisely exploited. Being a cooperative member was a disadvantage as only few members' supply year round while most other members only come in the benefit sharing occasions resulting in withdrawal of active members. This also facilitated the abandoning of most active individuals from the cooperative membership resulting in chaos among the management of the resource. Thus, a clear rule and regulation on who to fish should be promptly designed and implemented to judiciously utilize the resource and avoid conflict. Further, fishery being a major contributor for income and food security in the adjoining woredas', it should be judiciously managed to continue to contribute such contributions to the society.

As boat ownership and years of schooling increase, the income of fishers was increasing. This may be facilitated by the indifferent catching of small fish that are not table size or the ability to locate the best places of fishery stock and the labor/power available to go distant places for better catch volumes.

The results indicated that fishers that process their fish produce obtained a lesser income to those compared to that do not process their fish. This indicates that either the processors lack market because knowing they process for a lesser income that selling whole fish, or they incur a huge postharvest loss as they may not be professional processors or use traditional

processing tools that result in huge loss. Hence, processing technologies and techniques should be provided to the fishery people otherwise, interventions aimed at maximizing the value chain should be implemented.

The marketing strategy for fishers is dominated by local markets or at landing sites. This may be due to the lack of link to the major markets or lack of sufficient retailers that properly process and sell to local, regional or national markets.

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