

Fish Production, Consumption and Management in Ethiopia

Assefa Mitike Janko*

Zeway Fisheries Resources Research Center, P.O Box 229, Zeway/Ethiopia

*Corresponding author: Assefa Mitike Janko, Zeway Fisheries Resources Research Center, P.O Box 229, Zeway/Ethiopia, Tel: +61 3 9017 5033; E-mail: asemit2010@yahoo.com

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Abstract

This review paper was conducted to analyses the fish production, consumption and management trends in Ethiopia. The data was collected from primary and more secondary data. Following Eritrea's secession from Ethiopia in 1993 and the consequent loss of its coastline, Ethiopia has only inland freshwater capture fisheries. There are 180 different species of fish in Ethiopia and 30 of those are native to the country. The total area of the lakes and reservoirs stands at about 7000 to 8000 km² and the important rivers stretch over 7000 km in the country. Fishing contribution for country's GDP is very low. Fish production potential of the country's estimated 51,000 tonnes. Fresh fish are consumed in the vicinity of the lakes. Outside these areas, the domestic market for fish is small. Since fishery production is overexploited due to inappropriate fishing practice the potential of fish was underdeveloped and the management rule and regulation at federal level and regional level to control the devastation was very poor.

Keywords: Demand and Supply; Co-management; Water bodies; Fish species

Introduction

Water covers 71% or $\frac{3}{4}$ of the Earth's surface from that 97.5% water on Earth is salt water and only 2.5% is fresh water. 98.8% of that water is in ice and groundwater. Less than 0.3% of all freshwater is in rivers, lakes, and the atmosphere Sub-Saharan Africa is the poorest region in the world. Average real per capita income in 2010 was \$688 (in constant 2000 US\$) compared to \$1717 in the rest of the developing world. Over the past 30 years, GDP growth per capita in SSA has averaged 0.16 percent per year. This failure of growth over the long term has resulted in high levels of poverty in the region [1].

It is estimated that the inland fisheries of Africa produce 2.1 million tonnes of fish, which represents 24% of the total global production from inland waters [2]. In comparison to marine fisheries, inland fisheries production is relatively small, representing only 6% of global production. In Africa, marine fisheries production (4.7 million tonnes) is also much larger compared to inland fisheries (2.1 million tonnes) but in a smaller scale than at the global level.

Ethiopia has an agrarian dominated economy, with 85% of the total employment, 98% of the total calorie supply, 70% of industrial raw material supplies, over 45% of GDP and 90% of the foreign currency earning. Despite its important roles, however, it fails to meet the minimum food requirements of the population [3].

Ethiopia is the largest livestock populations in the Africa. The livestock sector accounts for over 26 percent of agricultural GDP (2009/10) and 8 percent of export earnings in 2010 [4] and can produce over 51,500 t of fish per annum. However, their exploitation and consequently their contributions to food security and growth in the country are minimal despite the technologies capable of resolving the problems of livestock and fisheries production.

Artisanal freshwater fishery is one of the most important economic activities in Ethiopia, [5]. Improvements in fishery sector would

contribute to poverty alleviation and environmental sustainability in Ethiopia [6].

Ethiopia is a land locked country depending only on inland water resources for the supply of fish as a low cost protein source. The inland water body of Ethiopia is estimated to encompass about 7,400 km² of lake area and a total river length of about 7,000 km. As many other countries challenged in the world, population rise urbanization, agricultural development, industrialization and other water resource development activities have resulted in a decrease in the species diversity of freshwater fish species [7].

Fishing contributed less than 1 percent of the gross domestic product in 1987. A study reported that 15,389 tonnes were caught in 2001, only 30% of an estimated potential of 51,481 tonnes [8].

Fisheries production is also under-exploited while current demand exceeds supply by about four-fold. One of the big and immediate challenges of our country is addressing the problems of food security and poverty. Currently, about 45% of the total population is living under poverty and the level of impoverishment is worse in rural areas, where 85% of the total inhabitants dwell [3].

Objectives

Generally the objective is that to know the status of the Fish Production, Consumption and Management in Ethiopia.

Production and supply potential of major Ethiopian water bodies

Following Eritrea's secession from Ethiopia in 1993 and the consequent loss of its coastline, Ethiopia has only inland freshwater capture fisheries. It has no significant aquaculture development. The inland capture fishery comprises: Rift Valley lakes (for example, lakes Chamo, Abaya and Ziway and the northern part of Lake Turkana) and Lake Tana, which although shallow, is the largest lake in Ethiopia; rivers; and small water bodies (reservoirs, natural ponds). There is

fishing on all these water bodies, but commercial production (i.e. serving markets other than the local communities) is concentrated on the five lakes, with Chamo, Ziway and Tana particularly dominant.

The main species are Nile tilapia, representing 60% of the catch, [9,10], Nile perch (favored but increasingly scarce), barbus (two species) and catfish.

There are seasonal variations in the availability of different types of fish, but as there are some differences between the lakes, traders can smooth out supply to some extent.

There are 180 different species of fish in Ethiopia and 30 of those are native to the country [11]. For the sake of convenience, the country's water bodies are classified into four systems: lakes, reservoirs, rivers and small water bodies. The lakes and rivers support highly diverse aquatic life, ranging from giant mammals like the African Hippopotamus, to microscopic fauna and flora.

Table 1 shows that the major lakes in Ethiopia with their altitude, mean depth, area, production potential and their catch per year.

Water bodies	Altitude(m)	Mean depth (m)	Area	Fishery Potential	Catch
			(km ²)	(tonne/yr)	(tonne/year)
Tana	1,829	8	3,500	10,000	1,454
Ardibo and Lugo	670	37	51	400	330
Ziway	1,848	2.5	434	2,941	2,454
Langano	1,585	12	225	240	151
Abijata	1,578	7.6	205	2,000	500
Shalla	1,558	87	250	1 300	10
Awassa	1,708	11	97	611	853
Abaya	1,285	7	1,070	600	412
Chamo	1,282	6	551	4,500	4,359
Turkana (1.3%oftotal area)	365	33	94	750	75
Sub total			6,477	23,342	10,598

Table 1: Major Lakes and fish production potentials

The major reservoirs and small water body's area, potential for fishery and catch tonne per year showed in the Tables 2 and 3 respectively.

Reservoir or dam	Area	Fishery potential	Catch
	(km ²)	(tonne/year)	(tonne)
Koka	255	1,194	625
Fincha-Amerti	250	1,330	333
Beseka	39	205	41
Denbi	72	383	77
Melka Wakena	82	434	109
Aba-samuel	44	234	59
Alwero dam	74	394	79
Hashengie	20	106	21
Small Abya	12	66	13
Wedecha	10	53	11
Subtotal	857	4,399	1,366

Table 2: Major reservoirs and dams.

Waterbody	Area	Fishery potential	Catch
	(km ²)	(tonne/year)	(tonne)
Southern region (Cheleloka Swamp)	100	423	21
Gambella (swamps and flood plains)	125	529	132
Small reservoirs and ponds	50	1,000	150
Subtotal	275	1,952	303

Table 3: Small water bodies.

Table 4 which show that the production is less than the potential of the water bodies but the due to inappropriate fishing the fish was over exploited.

The total area of the lakes and reservoirs stands at about 7000 to 8000 km² and the important rivers stretch over 7000 km in the country [12]. In addition, minor water bodies such as crater lakes and reservoirs make up about 400 km² [13].

Demand and consumption of fish

Fish Demand

Fish as a source of human food has a long history in Ethiopia. People consume large amount of fish in fasting days, in big cities, around production areas and towns, especially in Zeway, Arbaminch, Bahir Dar and Addis Ababa.

Water bodies type	Extent	Fishery potential (tone/year)	Catch (tone/year)
Major lakes	6,477 km ²	23,342	10,598
Major reservoirs and dams	857 km ²	4,399	1,366
Small water bodies	275 km ²	1,952	303
Rivers	7,185 km ²	21,788	3,121
Total		51,481	15,389

Table 4: Summary of Ethiopian water bodies and their fisheries.

Outside these areas, however, the domestic market for fish is small. The factors which account for this low level of local fish consumption are the following.

- First, fish has not been integrated into the diet of most of the population.
- Second, because of religious influences on consumption patterns, the demand for fish is only seasonal. During lent, for example, Christians who abstain from eating meat, milk and eggs consume fish.
- The other factors that contribute to the low level of consumption are the limited supply of the product and its high price.

Fresh fish is produced in the Great Rift Valley lakes and in some other northern parts of the country. Price wise, too, fish is relatively expensive compared with the local prices of vegetables and grains on a unit weight basis, but it is frequently less costly than alternative animal protein sources. With increased marketing efforts and increase in supply, the demand for the fish product could be tremendously increased from the current level.

The demand for fish is higher than supply especially, in Ethiopian fasting season and if it not fasting season supply is higher. This is because of religious influences on consumption patterns; the demand for fish is only seasonal. During lent, Christians who abstain from eating meat, milk, and eggs consume fish, since fish is the substitute of meat [14].

Even if the available stocks of these fishery waters will be fully exploited in the near future, both current and future demand for fish by the population cannot be met. For instance, total demand for fish in 2003 is about 67 thousand tonnes, which is envisaged to grow nearly to 95 thousand tonnes in 2015 and 118 thousand tonnes in 2025 (Table 2). To fill this gap, therefore, new alternative fish supply sources must be found [15].

Consumption trends

Fish is one of the known aquatic animals used for human consumption as food. Aquatic animals in general do contain a high level of protein (17-29%) with an amino-acid profile, similar to that of the meat of land animals. The flesh of a fish is also readily digestible and immediately utilizable by the human body, which makes it suitable for complementing the high carbohydrate diets. Compared with land animals (with some exceptions, such as shellfish), aquatic animals have a high percentage of edible flesh, and there is little wastage.

Years	Demand in tonnes
2003	67,000
2015	95,000
2025	118,000

Table 5: Projected demands for fish. Source: Ethiopian Investment Authority, 2005.

Aquatic animals are a source of minerals such as calcium, iron and phosphorus as well as trace elements and vitamins. Marine species are particularly rich in iodine. The fatty acid content is high in poly unsaturated and particularly those which are attributed to reduce blood cholesterol. There are also some indications that certain fatty acids in fish may provide protection against renal disease. Increasing the per capita consumption of fish and shellfish in any country can benefits health standards.

Fish properly preserved, prepared and presented in the right form is popular in most households, particularly in big towns. The appeal of an otherwise tasteless diet is greatly improved, and much use is made of fish and shellfish as soups and condiments, especially when smoked or dried. Among some religious groups, such as the Coptic Orthodox Church in Ethiopia, fish plays an important role in fasting days when the eating of meat Products is forbidden.

The fish consumption per head per year of the country is very low [16]. However the rapid growth of population and the progressive shortage of livestock products had changed the situation to a growing demand of fish [17,18].

Fishery management

Management system combines a set of regulatory scheme within a particular resource to achieve a management outcome [19]. The effectiveness of this regulatory measures depends on the support gained from the resource user group [20] and the way they themselves define their problem, their involvement in the decision-making process, in installing and enforcing the regulations [21]. Hence, management principals have to include human responses and motivation as part of the system to be studied and managed [22]. Particularly, their attitudes and perceptions towards management, compliance and enforcement as these are vital to the effectiveness of any regulatory effort [23].

The artisanal fishery of Ethiopian fishery is undeveloped due to low level of economy, lack of fisheries' legislation implementation, ineffective administration set-up and lack of expertise. Based on these facts, Ethiopian fisheries might not seem to manage. But some stocks

(Nile perch & Tilapia) on some lakes (Chamo & Awassa) show signs of over-fishing and Tilapia of lake Ziway are probably at full exploitation.

Currently there is fishery management legislation enforced at the Federal level, proclamation No.315/2003 in 2011. It provides broad guidelines relating to resource conservation, food safety and aquaculture. This document puts considerable emphasis on regulation, permits and the role of the fishery inspector. It is intended that the regional administrations should then use this as the broad framework within which their own proclamations are developed.

Although not all of the regional proclamations have been finalized, the proclamation for Amhara and Oromia Region was developed in 2011 and 2012 respectively. It covers the same areas as the national policy, but has an additional objective relating to the creation of employment opportunities in fishing communities. It also states that information, including research findings, should be made available to the fishing communities. As with the National Proclamation it relies heavily on regulatory measures ('command and control') and the role of the fishery inspector. There is no mention of co-management, though one of the stated objectives ('...to prevent and control over-exploitation of the fisheries resource') would seem to leave open this option.

At both national and regional level, the proclamations reflect concern that fish products should conform to prescribed standards [24].

There are no guarantees that we can continue along our present trends of catching fish from the wild. Fish, the last wild food man has, are not going to keep up for many reasons including climate change and population increase.

Since this Federal and Regional fishery management proclamation is not active, another way of fishery management which is called fishery co-management was developed for most of lakes and reservoirs in 2013. The following fisheries management measures, which could be implemented using a co-management approach, are proposed:

1. Licensing a certain number of fishermen and fishing gears according to biological limits
2. Closed season (June –July) – to prevent fishing during one of the tilapia breeding seasons
3. Mesh size limitation of minimum 10cm stretched mesh for gillnets and 8cm for beach seine
4. Progressive reduction in number of beach seines by 50% in 2 yrs leading to total eradication
5. Prevention of beach seining in certain areas by placing obstacles in the near shore areas and planting of inshore vegetation
6. Closed areas to prevent fishing in designated areas where fish are known to breed

A, b, d and f are measures which can be adapted if need be within a short time frame or on an annual basis. C and e are more long term measures which are more difficult to change in the short term. D can be achieved with the help of licensing (a) as gradually the number of annual licences for beach seines is reduced (Table 6).

Generally, what are the options for SUSTAINABILITY IN FISHERY PRODUCTION for food security, particularly in Ethiopia?

According to professor Brook Lemma [25], some adaptation alternatives

Setting the environment

- Delineate fish sanctuaries, such as protection of breeding grounds
- The fishery sector should engage in land use planning with other stakeholders in the watershed to make water use sustainable
- Free access to fresh waters, as in Ethiopia, should be regulated (know at least who does what).
- Restock freshwater systems, work done at Lake Tana, Ethiopia
- Create value addition at each market chain
- Cutback on external nutrient load and eutrophication
- Capture free nutrients
- Cutback on pollution from aquaculture practices and others
- Use ephemeral waters (e.g. new dams) with fast growing and flexibly feeding fishes
- Harnessing flood waters for irrigation and fish farming as in Malawi (Mkoka 2008)

The last best opportunity for fish to have a future is AQUACULTURE [26] and the specialized of aquaculture is aquaponics. Fish farming maximized and made environmentally friendly by integrating different production modalities.

Conclusion and recommendation

Ethiopia's fisheries are entirely fresh water, in its many lakes, rivers and reservoirs, as it has no marine coastline. The total area of the lakes and reservoirs stands at about 7000 to 8000 km² and the important rivers stretch over 7000 km in the country. In addition, minor water bodies such as crater lakes and reservoirs make up about 400 km².

Although per capita consumption of fish is very low in Ethiopia, there is steady growth in demand reflecting population increase, rising incomes and a shift in preferences. The main areas of consumption are Addis Ababa and the populations and towns close to the main production areas. Fish consumption is strongly linked to the fasting traditions of the Ethiopian Orthodox church: most people consider that fish can be eaten on days when meat is not allowed (Wednesdays, Fridays and during the fasting months).

Goals	Objectives	Management standards		Management measure
		indicators	Reference points	
1. Economic				
To maximize income of the fishermen and other resource users	To maintain the net income of fishermen at or above the minimum desired income (200 USD in 2013)	Net income of fishermen from socio-economic survey	Data on national minimum income level	Optimum catches, Value addition on the products, Alternative income generating activities

2. Social				
To maximize the contribution of fishery in food security	Maintain at least 15% of the total catch for local consumption by community and the rest to national market	Supply of fish to local community assessed using market or value-chain analysis	Total catch from official landing data	Aware the local community to consume the fish by giving awareness on the nutritional value of fish food to fishery cooperatives, students in school and others.
To create sustainable employment opportunities for local community	To maintain the optimum number of fishing and post-harvest employment opportunities	Current fishing and post-harvest employment opportunities. Lakes' chemical physical and biological property altered by human activity	Optimum number of employment opportunities. National standard	Economic planning. Licensing. Micro-enterprise office assist displaced fishers
3. Ecological				
To keep the lake environment healthy (chemically, biologically and physically)	Maintain agrochemical levels in lake environment below national standard	Land use within buffer zone measured using GIS imagery/ survey	EP law	Increase the awareness of the community and administrative bodies to collaborate the wetland management
	Prevent land use within buffer zone which contravenes environmental protection law. Reduce the rate of sedimentation to 25% of the current level	Sedimentation rate	25% of current sedimentation rate	Preventing growing of crops in lake shore in collaboration with concerned bodies as per the EPA regulation. Protecting the vegetation in the buffer zone. Advising farmers to grow perennial fodder plants like Sesbania sesban next to their farm land as a buffer area in the shore trapping chemical and physical pollutants

Table 6: FMP goals, objectives and management measures.

In communities where fish farming is not practiced, e.g. Ethiopia, aquaculture creates new jobs,

Contributes to food security and protects wild fish. Adopting fish production systems to current Climate changes help billions of people around the world to secure their protein supply. This is particularly true in Africa.

Fisheries management in Ethiopia would have great contribution to the economy. This is because fisheries provide employment, food & income and it makes possible evaluation of overexploitation of the fisheries. Since fishery production is overexploited due to inappropriate fishing practice the potential of fish was underdeveloped and the management rule and regulation at federal level and regional level to control the devastation was very poor. This shows that the government attention for fish management was very poor.

In another ways the new upcoming lake management system co-management system which consists of end users, policy makers and all stake holders is promising for sustainable lake management.

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