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Fishery production system assessment in different water bodies of Guji and Borana zones of Oromia, Ethiopia

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Abstract

This study was conducted to assess the existing fisheries production systems in five different rivers namely; Ganale, Awata and Dawa (Guji zone) and Gidabo and Galana (Borana zone). Structured questionnaire was employed for data collection and interview. It was shown that three fish species viz. Bagrus, Mijligie/Eel (*Anguilla bengalensis labiata*), Barbus species were harvested by the fishermen. Fishery production system found was characterized as agro-pastoral systems. Cattle were the dominant livestock species, followed by goats. Some crop agriculture like teff, (*Ergrostis tef*), maize (*Zea mays*), tomato (*Lycopersicon esculentum*) and papaya (*Carica papaya*) were produced. The most important fishing gear used to catch the fish was hand line and/or long line. Fish processing method exercised by the fishermen were gutting and occasionally filleting. Salting of gutted fish was rarely practiced by some fishermen, however, the consumer do not prefer salted fish. The fishermen methodically screw the fish's labial with thread/twine then place back the fish underneath of water after collected to keep the fish fresh until consumer come to buy it. Fish processing (value addition) was rarely practiced and in most cases, the fisher sold whole fish which caused low price at landing sites as well as secondary markets. Fishermen sold there fish to fish trader, consumers or hotel owners. The fishermen indicated that, the amount of fish produced from the river was increasing but the time to set and haul hand line to catch a single fish was getting longer. The measurement unit to sell there fish was size of fish, so larger fish fetch higher price. It was identified that the reasons for the underutilization of the fishery resource in the studied areas were; rudimentary and labor intensive fishing gears, inaccessibility to potential market areas, absence of the use of methods that could prolong the shelf life of products for safe, transportation to distant potential market, absence of efficient fishing gears and lack of training and extension services. In all of the fishing areas fishermen were not able to increase their catch because of scarcity of modern fishing gears and poor road access to the potential markets.

Keywords: Rivers, Fishery, Production system, Guji and Borana.

1. Introduction

Rivers have formed nuclei for human settlement from the origins of mankind. Many of the earliest civilizations emerged upon the fertile floodplains and since about 5000 b.p., when the earliest systematic colonization of the Nile, Mesopotamic, Indus and Chinese rivers occurred [1].

Riparian fisheries in eastern and southern Africa tend to be small-scale, labor intensive, artisanal fisheries. They have received relatively little attention because they have limited commercial value compared to marine and lacustrine fisheries. However, they make an important contribution to subsistence income. Because they are highly seasonal, they tend to form part of a risk-spreading strategy, as one of several activities that households engage in. Fishing can provide a fallback source of food and income in years when local rainfall events lead to crop failure. Fisheries represent one of the most important benefits to society that aquatic systems provide, often sustaining the livelihoods of poor rural communities [1].

In Ethiopia, most of the fishing so far takes place in the lakes (85%) with only 15% in the rivers [2]. Riverine fishing activities are performed mostly on two of the rivers, the Baro near Gambela in the western part of the country [3] and the Omo in the southern area near the border with Kenya. Riverine fishery is not developed due to lack of access to suitable fishing grounds and also the food habit or culture of most of the rural community does not favor fish consumption. Fishing is done mainly with hooks and some gill net [4].

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Oromia's key assets are its diverse natural (water, soils, forests and wildlife) and human resources. The region has enormous water resources, with high potential for irrigation, hydroelectric generation, fishing, and other uses. The Oromia regional state has ample natural resources; water bodies constitute perennial and intermittent rivers, lakes, reservoirs and ponds with diversified fish species and potential for fish production. It appears that the potential for the development of riverine fishery is vast. The fishery sector's contribution to the local economy is tremendous. However, these potentials are now under estimated. There have been relatively few attempts at the comprehensive taxonomy of fish in the Ganale river [5], no information exist about the fishery of Dawa, Awata, Gidabo and Galana rivers. Despite significant contributions that fisheries make to employment, nutrition, and trade in the developing world, it is rarely included in national development policy and donor priorities [1]. This is largely due to problems with valuation of small scale fisheries, as policy makers often do not have access to data which reflect the importance of fisheries to development. The availability of information on riverine fishery production system is scanty. The government has hardly paid any attention to it.

Tropical freshwater commercial and artisanal fisheries provide extremely important sources of protein and incomes for millions of people in developing countries. Today, these fisheries are disrupted or under severe stress from changes in riparian structure and function. Resource assessments and economic evaluations of all inland fisheries resources are necessary in developing long-term, sustainable fisheries programs [6]. So, the objective of this study was to assess the

existing fisheries production systems in five different rivers of Guji and Borana Zones Oromia.

2. Materials and Method

2.1 Description of the study area

Guji Zone is one of the 18 zones of Oromia Regional State where Ganale, Awata and Dawa rivers are found. It is found in southern part of the Oromia Regional State and south eastern part of the country. The capital town of the zone is Nagelle, which is 586 km far away from both regional and national capital city of Ethiopia (Addis Ababa). Guji zone is bounded by Southern Nation, Nationality and Peoples Regional State in north, Somalia Regional States in south, Borena zone in west and Bale zone in east. Geologically, the zone is located between 38°– 40° East longitude and latitude 4°– 5° on the North, and the altitude ranges from 500 m up to 3500 m above sea level.

2.2 Ganale-Dawa river basin

The south western parts of eastern high land of Ethiopia is mainly drained by Genale and Dawa rivers [7]. Ganale-Dawa river basin has an area of 171,042 km², covering parts of Oromia, South Nations and Nationality People, and Somali regions (Fig. 1). It is the third largest river basin, after Wabi Shebelle and Abbay river basins. The river basin has a lowest elevation of 171m and a highest elevation of 4385 m. The total mean annual flow from the river basins is estimated at about 5.8 Billion Metric Cube. The basin falls mainly in the arid and semi-arid zone and is generally drought-prone with erratic rainfall [8, 9, 10].



Fig 1: Ganale Dawa river basin

2.3 Gidabo and Galana rivers and Lake Abaya

Gidabo and Galana are the main perennial rivers entering lake Abaya from Borena side, Oromia regional state and Bilate and Tafe also contribute to the filling of lake Abaya. Gidabo drains a large area of the eastern highlands south of the Awassa Basin; while the Galana drains the area between the Amaro Mountains and the eastern highlands [11]. Gidabo River which rises in the highland area of the Aleta Wondo escarpment, lies in Borana zone, Abaya district, joining numerous large streams, draining an extensive catchment and

flowing into the Lake Abaya as the Eastern tributary [9].

2.4 Methodology

The activity was conducted starting from July 2013 to June 2014. Five different rivers namely; Ganale, Awata and Dawa (Guji zone) and Gidabo and Galana (Borana zone) were assessed for fishing activities in the pastoralist communities of Southern Oromia. Structured questionnaire was employed for data collection and interview. Important socio-economic data such as house hold character, number of cooperative per

each selected water bodies, season of the exploitation, materials used for current production (quality and quantity), time and ways of setting, processing technique, transportation system, storage system, education level, land and livestock owner ship, income sources, fish species preference, fish handling, processing and preservation techniques, fish marketing, fish production trends, fishing efforts and fishery production constraints were collected. Simple descriptive statistics (frequency count, percentage, mean and standard deviation) was used to describe and summarize the data.

3. Results and Discussions

Table 1: Indicate that secondary data of livestock numbers obtained from districts of Adola, Shakiso and Galana livestock development and health agency (2013/14).

Livestock number in head	Adola	Shakiso	Galana
Cattle	124,648	120,662	247,837
Goats	102,653	21,524	76,475
Sheep	5,882	36,136	10,142
Donkey	18,051	12,969	5,739
Mule		5147	571
Horse		5,319	6,619
Poultry	59,422	117,000	94,276
Bee hive	18,419	10,320	74,207

3.1 Ganale river fishery production system

3.1.1 Socio-demographic characteristics of fishermen

All fishermen were male. The age of interviewee ranges from 20 to 52. The educational status of the fishermen was between 3-10th complete. The average number of family per fisherman was 6. Major staple food in the localities are porridge, injera (flat bread) of maize, teff, wheat and fermented corn of enset or false banana.

Ganale river which is 480 km long in Ethiopia, its fishery potential is 768 tonne/year based on the length but the actual landing is only 77 tonne in 2001. An assessment for fishery production system was started from Adola districts due to the fact that Ganale river flows through this districts. However there are no organized fishermen cooperatives. Ganale continues its flowing through Wadara districts. In addition to Ganale, there is Awata river in this districts. There are some fishermen claimed to be organized into legal fishermen cooperative without having any fishing gear. The assessment continued to Goro Dola districts were Ganale and Awata river flow through the district. An interview was made at the cross road from Nagelle (the capital of Guji zone) to Madda walabu districts at Ganale kebele. Fifteen de facto Gotu fishermen cooperative were participated during discussion together with Goro Dola pastoralist office and development agent working at Ganale kebele. Seven fishermen were asked about fishery production system along the river bank of Ganale. It was shown that three fish species viz. Bagrus, Mijligie/Eel (*Anguilla bengalensis labiata*) and Shoke/Barbus were harvested by the fishermen (Table 2). The Anguilla eels from the Indian Ocean appeared to be the only group of diadromous fish in Ethiopian fauna [5]. Fishery production system found was characterized as agro-pastoral systems. Cattle are the dominant livestock species, followed by goats. Some crop agriculture like teff (*Ergrostis tef*), maize (*Zea mays*), tomato (*Lycopersicon esculentum*) and papaya (*Carica papaya*) are produced. Traditional fishing systems of fishing communities, are not considered as agricultural production activities. They are condemned as

backward, even when compared with the system of crop cultivation, and subjected to forceful and ill-considered change. This perception has prevented pastoral communities as well as the government from benefiting from traditional livestock production as an important source of capital accumulation.

Table 2: Average number of three different fish species during active fishing season harvested by Gotu fishermen cooperative

Fish species	Average number of fish harvested by a fisherman per day
Bagrus	11
Shoke/ Barbus	12
Mijligie/Eel (<i>Anguilla bengalensis labiata</i>)	6

The most preferred fish by fishermen are Bagrus (57%) and Barbus species (42%). All the fishermen prefer the marine fish, Eel, after Bagrus and Barbus species. The market demand for different fish products by consumer is gutted fish the most preferred one followed by fillet and occasionally the consumer prefer whole fish without adding any value to the fish. Other value added fish products like drying and smoking is not known among the fishermen.

3.1.2 Income of fishermen other than fishery

Some fishermen get income from other sources other than fishing. Based on the interview made, the fishermen averagely own 4.1, 4.75, 7 and 3.25 of cattle, sheep, goats and poultry respectively per fishermen. Only one fishermen has mule. Concerning of crop production the fishermen mainly produce teff (2.3 quintals) and maize (19.25 quintals) annually. Very small number of the fishermen produce fruits and vegetable like papaya and tomato to support their livelihood.

3.1.3 Fishing gears and season of fish exploitation

Potential of fishery there is not completely developed because of bottlenecks related to lack of appropriate fishing gears, fish processing and fish marketing. The most important fishing gear used to catch the fish (Bagrus, Barbus species and Eel) was a single hook hand line. Hand line is made of polyamide monofilament line having a terminal sinker and a hook. Various sizes of hooks and different types of baits were used according to the targeted fish. On reaching the fishing ground, the fishermen throw the baited hooks with line. The line is released according the depth and current of the river. The gear was pulled back when the fishermen felt the hooked fish on the line and fish is collected. The commonly used baits were cuts of bagrus fillet, piece of bread, small barbus species, frog and worms. Riverine fisheries activity is exclusively traditional, highly seasonal and restricted to drier months of the year. Fishing is seasonal, and the supply of fish is largely available during drier period from December to May, however, occasional fishers catch fish during the wet season (June – October). The significance of fishing in terms of economics, food security and employment opportunity is enormous [12]. However, currently the available fish resource is not fully utilized to benefit the local people due to several factors. Fishery production of the area is untapped because there is no appropriate fishing gears suitable for riverine fishery despite the zone is plenty of different rivers. Having observed the current situation on the

low scale of fishing activities and the high potential yield, it is obvious that the resource will provides a favorable opportunity to engage more people and to increase catch/harvest, increases income and change the livelihood of a large segment of the local community provided that efficient fishing gear and methods are made available.

3.1.4 Fish handling, storage and preservation techniques

The most fish processing method exercised by the fishermen was gutting and occasionally filleting. Salting of gutted fish is rarely practiced by some fishermen, however, the consumer do not prefer salted fish. Other fish processing and preservation techniques like smoking, marinating, drying and freezing are hardly practiced. Even though there is no indigenous or modern fish handling, storing and preserving methods, however, the fishermen methodically screw the fish's labial with thread/twine then place back the fish underneath of water after collected to keep the fish fresh until consumer come to buy it.

3.1.5 Fish transportation and distribution

Fishing ground from which fish is harvested is nearby to Ganale kebele. Hence the mode of fish transportation is 'wasasa' where by two person carry the screwed fish on stick end to end. Occasionally fishermen sell their products at near town. Although the condition of the road is good, the public

transport service is poor and inconvenient to transport fresh fish from the landing site to nearby towns like Negelle Negelle (55 KM), Goro Dola and Wadara.

3.1.6 Fish marketing

Fish processing (value addition) is rarely practiced and in most cases, the fisher sales whole fish which causes low price at landing sites as well as secondary markets. Fishermen sell there fish to fish trader, consumers or hotel owners. The fishermen have stated that, the amount of fish produced from the river is increasing but the time to set and haul hand line to catch a single fish was getting longer. The measurement unit to sell there fish is size of fish, so larger fish fetch higher price. In this regards price of a single fish range from 25 to 700 birr for Bagrus, 5 to 50 birr for Barbus and 20 to 50 birr for Eel.

3.2 Dawa and Awata rivers fishery production system

Fishery production system assessment was done by interview with fishermen at Dawa town (Sabba boru district) for Dawa river and at Shakkiso town (Odo Shakkiso district) for Awata river (Table 3). Four each fishermen was interviewed. The age of fishermen ranges from 15-36. All the fishermen were male. Most of the fishermen (87.5%) were single indicating that the fishermen were, the local jobless youngsters.

Table 3: Average number and price of three different fish species during active fishing season harvested by Dawa and Awata river fishermen

Fish species	Average number of fish harvested by a fisherman per day (in number)		Price of fish based on size (in ETB)	
	Dawa river	Awata river	Dawa river	Awata river
Bagrus	1	-	15-20	20-23
Shoke/ Barbus	4	20	15-24	20
Mijligie/Eel (<i>Anguilla bengalensis labiata</i>)	1	-	50-100	90-100

Generally fishing activity has not laid its basic fishing gears and others, hence it is simple rudimentary performed by jobless youngster occasionally. The local consumers prefer to consume gutted fish and filleted fish rarely. No other fish processing techniques is practiced. The fishing gears used by the fishermen was hook and line to fish Eel, Bagrus, and Barbus. As the landing site is very close to nearby town (Dawa and Shakkiso), there is no problem in fish transportation, fish storage and preservation, the fishermen deliver fresh immediately to the respective towns.

The measurement unit to sell there fish is size of fish, so larger fish fetch higher price.

3.3 Galana river fishery production system

Fishery production system assessment for Galana river was done by interviewing fishermen at Tore town, Galana district (Table 4). The interviewed fishermen were all male, ranging from 18-25 aged. The average family size of the fishermen were three. The major food item is fermented corm of enset or false banana.

Table 4: Average number and price of two different fish species during active fishing season harvested by Galana river fishermen

Fish species	Average number of fish harvested by a fisherman per day (in number)	Price of fish based on size (in ETB)
Bagrus	6	80-200
Shoke/Barbus	15	10-20

The most common fishing gear was hook and line to fish both Bagrus and Barbus. The bait used to lure fish were snail, soap and cattle pancreas. Fish processing techniques practiced by the fishermen were, gutting, filleting and sometimes drying. Fishermen brings fish by themselves to Tore town, the capital of Galana district. There is serious problems during fish handling, transportation, storage and preservation techniques because there is no infrastructure at Tore town where fish marketing takes place.

3.4 Gidabo river and Lake Abaya fishery production system

Fishery production system assessment in the pastoralist communities of Abaya district, Borena zone was made by interviewing the cooperative members of Goro fishermen cooperative. An interview was made at Addise, Tuta kebele where the Gidabo river enters into Lake Abaya. The fishermen fish both from Gidabo river and lake Abaya. All the fishermen were male, aged from 20-50. The education status range from illiterate to 4th complete. The average

family size is 9. The major staple food in the survey area was maize and fermented corm of enset or false banana. Even though Gidabo river and Lake Abaya are inhabited by diversified fish species the fishermen harvest only *Bagrus*. Average number or weight of fish harvested by a fisherman is 26 or 3.5 Kg/day.

3.4.1 Income of fishermen other than fishery

The fishermen are totally pastoralist. They get major income from cattle rearing other than fishing. Based on the interview made, the fishermen averagely own 32, 8, 6 and 6 of cattle, poultry sheep, and goats and respectively per fishermen. Two fishermen possess each two donkeys. None of the fishermen participate on crop production.

3.4.2 Fishing gears, processing and marketing

Long line (410 in number) was fishing gear owned by eleven fishermen used to harvest *Bagrus* and most fishermen exploit the fish all the time, otherwise during fasting season. Fish processing techniques adopted by the fishermen was filleting (locally shishira) and drying. The fishermen prefers filleted (54.54%) and dried (45.45%) fish. There is serious problems in fish transportation as Tuta is 60 KM from nearby town Dilla. So, means of fish product transportation was motorcycle which is too hefty and donkey back. Fish handling, storage and preservation techniques is not practiced owing to lack of electric power and other infrastructure. The fishermen sell dried fish product at Gololcha or Dilla to fish traders, consumers or hotel owner at very low price. The price for (hidha) approximately 1 kg is 25- 40 Ethiopian birr. Fish production trend looks increasing due to increased numbers of long lines and gained awareness and experience of fish harvesting.

3.5 Fish production constraints

The main reasons for the underutilization of the fishery resource in the studied areas are; rudimentary and labor intensive fishing gears, inaccessibility to potential market areas, absence of the use of methods that could prolong the shelf life of products for safe, transportation to distant potential market, absence of efficient fishing gears and lack of training and extension services. Landing sites, storage and transportation facilities with refrigeration, processing capacity and marketing infrastructure is absent. Given the possibilities of developed infrastructure and adequate facilities for processing, handling and transportation, the locals of these areas can benefit from these resources by selling fish products to towns where there is a higher fish demand and a better purchasing power. The fishermen prepare different dish like fried fish (tibsi), fish sauce (shorba) and fish stew (wet) at reasonable price.

4. Conclusions and recommendations

Fishing activity is generally traditional, and is based on hand line. In all of the fishing areas fishermen are not able to increase their catch because of scarcity of modern fishing gears and poor road access to the potential markets. The major problems were no or limited supply of fishing nets, twine, lines, hooks etc and low skill in fishing gear making hence low fish production, lack of fish storage facilities/cold chain facility, lack of knowledge and skill on fish processing, preservation methods and value addition, market problem for the catch, lack of fresh fish buyer at the landing site and transport capacity of the fishermen, There are currently no

standard practices for handling, washing, sorting, grading, cleaning and icing of fish. The marketing infrastructures, including cold storage, ice and transport facilities, retail markets and credit accessibility are all non-existent.

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