E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.549
IJFAS 2020; 8(5): 148-156

www.fisheriesjournal.com
Received: 22-07-2020
Accepted: 24-08-2020

Abdulhakim Hussen Hebano
Batu Fish and Other Aquatic Life Research Center, East Showa Zone, Batu, Ethiopia

Alemayehu Abebe Wake
Batu Fish and Other Aquatic Life Research Center, East Showa Zone, Batu, Ethiopia

Corresponding Author:
Abdulhakim Hussen Hebano
Batu Fish and Other Aquatic Life Research Center, East Showa Zone, Batu, Ethiopia

Overview of Ethiopian fisheries production system and its challenges in different fish potential area: A review

Abdulhakim Hussen Hebano and Alemayehu Abebe Wake

Abstract
Fish farming has been practiced in different parts of the world including Ethiopia. In Ethiopia fishery production mostly concentrated in Lake Tana and great Rift-Valley Lakes that targeted on Oreochromis niloticus, Clarias gariepinus, Cyprinus Carpio and Carassius Carasius. Still its production is under-exploited with limited access and production status in food marketing system. This paper focused on the review on the current fishery production system and major Challenge. The country has a number of beautiful water bodies with the total surface area of 13,637 km^2 that have a potential to produce 94,541 tons annually. As literature show that having this potential the country produces only 45,610 tons in 2016 from both capture and Aquaculture fisheries. Fishery production system practiced with the combination of motorized gill net, traditional reed-rafts, chase and trap and processed in the form of gutting and filleting on the shore water bodies. Even the fishery sector highly contributes to sustaining livelihood of rural fishing community, it is mainly artisanal that characterized with low production and underutilization due to, high post-harvest losses, poor infrastructure and access to fishing materials, overfishing, agricultural expansion and wetland degradation, climate change and invasive weeds (Water hyacinth). Those problems need a critical and proper assessment or research in each specific area. Overall, the federal and regional government should be prioritized and taking a regular follow up and strength fishery research center in order to make them capable to resolve the problem through generating, adapting and transfer of appropriate fishing technologies that will ensure sustainable production, conservation, protection and management of the resource.

Keywords: Fishery production system, fish production challenge, fishermen, Lake, Ethiopia

1. Introduction

1.1 Background and Justification

Fisheries are one of the important and renewable natural resource bases for many developing countries, and the livelihood of many rural communities relies on the fishery sector. Accordingly, fisheries is a key sector for reducing poverty and it could be considered as a potential strategy because it helps to diversify house hold income directly and indirectly [44]. In the developing world, about 116 million people are benefited from the fishery sector and about 90% of them are working in the small-scale fisheries sector [55]. Historically, Africa's fisheries output is dominated by capture fisheries and the total amount of fish produced from aquaculture is grown from time to time over the past decade.

In Ethiopia fish production depend on the inland waters for the supply of fish as a cheap source of animal protein. It can also indirectly contribute by providing revenue for purchasing food for deficient areas [17]. The country has a different geological formations and climatic conditions, is endowed with considerable water resources and wetland ecosystems, including river basins, major lakes, many swamps, floodplains and man-made reservoirs. The fish supply in most cases comes from the major lakes and some reservoirs such as Fincha, Hawassa, Tana, Chamo, Ziway, Koka, Abaya, and rivers in the country. The benefits gained from the development of fisheries are significant. From local to global levels, fisheries play important role food supply, income generation, employment creation and nutrition security.

However, the Ethiopian lakes, is mainly practiced, are threatened by poor production system with catchment's deforestation (shore damage), water pollution and siltation, overfishing, habitat destruction, invasion of non-native species, illegal, unregulated fishing, and poor governance [33, 20] and it is far below its potential [37]. Improvements in fishery sector highly contribute to sustaining livelihood of rural fishing community and ensure environmental sustainability in Ethiopia.

Still Fisheries production in Ethiopia is under-exploited with limited access and supply to fish and fishery products, while the current and future demand projection is increasing in food marketing system. The rapid increases in fish supply required over the next decades will only be possible, if these fisheries are sustained and improved. So, this paper attempts to review the overview of Ethiopian fisheries production system and its challenges in different fish potential area that help to provide an organized information and drop a line that need an assessment or an intervention to maintain the resource in the sustainable manners.

2. Literature Review and Discussion

2.1 Concept, Definition and Overview Ethiopia fisheries

Fishery is a part of the sea or rivers where fish are caught in large quantities. Fisheries refer to an organized effort by humans to catch fish or other aquatic species, an activity known as fishing. All fishing activities is categorized in capture fishery and Aquaculture [22]. Capture fishery is the capture of usable aquatic organisms from the wild. Aquaculture, is the farming of aquatic organisms such as fish, crustaceans, mollusks and aquatic plants. It is a food production technology where by fish or other aquatic organisms are grown in managed system that produce greatly harvest than would naturally occur. Aquaculture involves cultivating freshwater and saltwater populations under controlled conditions.

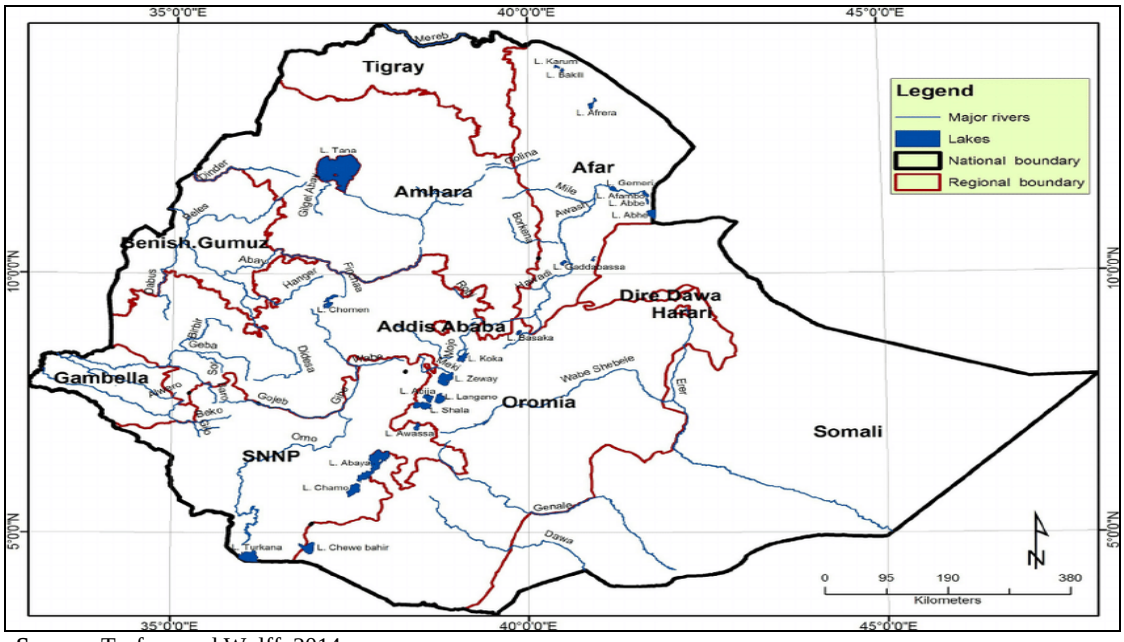
Ethiopia is endowed with inland waters for fish production as a cheap source of animal protein. It has a number of lakes and rivers with substantial quantity of fish stocks. Currently the fish supply in most cases comes from the major lakes such as, Tana, Ziway, Hawassa, Chamo, Abaya and reservoirs regularly Koka and Fincha and different rivers in the country. The fish production from these water bodies is supporting the livelihood of poor farmers living around water bodies in providing inexpensive, but high-quality protein and diversifying sources of income [28].

According to the report of EU (2011) the fish catch in Ethiopia in 2008 was estimated approximately 17,000 tons; the bulk of (74%) originated from the six main lakes (Tana, Ziway, Langano, Awassa, Abaya and Chamo) and a further 26% from other water bodies. Their fauna is dominated by the Nile tilapia (Oreochromis niloticus), the African catfish (Clarias gariepinus) and a few cyprinids mostly Barbus species. The two southern most lakes (Abaya and Chamo) and the major rivers, such as the Blue Nile and the Omo, have a much more diversified fauna reminiscent of that found in the Nile and the rivers and lakes of East Africa [22].

According to the contribution of Federal Democratic Republic of Ethiopia (Proc.1/195), land and water belongs the state and the people [25]. Meaning all the water and associated resource cannot be privately owned. The Federal fisheries proclamation was ratified by Parliament on 4th February 2003 and the proclamation is refers as the Fisheries Development and Utilization Proclamation No. 315/2003 [26]. This is the latest legal document specific to the fisheries sector and has the objective of "conserve fish biodiversity and its environment as well as prevent and control over exploitation of the fisheries resource increase the supply of safe and good quality fish and ensure a sustainable contribution of the fisheries toward food security and expand the development of aquaculture [23]. Based on these facts, Ethiopian fisheries might not seem to manage [35].

2.2 Current fishery production system in Ethiopia

Ethiopia is known as the water tower of Eastern Africa, which provides about 86% of the Nile water. The country has a number of beautiful lakes, reservoirs and small water bodies that distributed throughout the country andcoveringatotalsurfaceareaofabout13, 637km2[49]. Rivers Awash and Omo-Gibe terminate in to Lakes Abbe and Turkana, which are shared by Ethiopia with Djibouti and Kenya, respectively. The Baro-Akobobas in connects to the White Nile. The Blue Nile originates from Lake Tana joins the White Nileat Kartum, the capital of Sudan and forms the great Nile River which crosses Egypt and flows in to the Mediterranean Sea. In similar way Lak Tana and Ethiopian great rift-valley lake (Ziway, Langano, Hawassa, Chamo and Abaya) are help the county in socio-economic, ecological and scientific investigation [7].



Source: Tesfaye and Wolff, 2014

Fig 1: Map showing the major lakes and rivers in Ethiopia

The most fish product sources are fishery cooperatives from different lakes, street traders and brokers, fish shop, hotels and restaurant [6]. The total demand for fish in 2003 is about 67 thousand tones, which is envisaged to grow nearly to 95 thousand tons in 2015 and 118 thousand tons in 2025 [6]. Fish production potential of the country is estimated to be 94,541 tons annually for the main water bodies (Table 2).

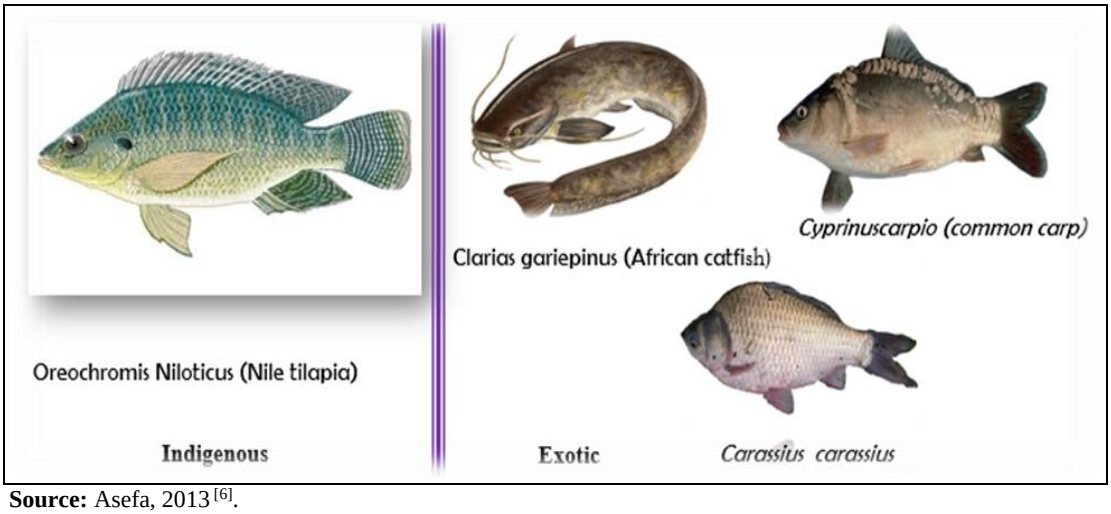
Table 1: Ethiopian water bodies and their fish potential and production status

Water bodies Types	Area(km^2)	Length (km)	Fishery potential (tone/year)
Major lakes	7740	-	39,262
Major reservoir	1447	-	7,879
Small water bodies	4450	-	25,996
Rivers	-	8065	21.405
Total	13,637	8065	94,541

Source: Tesfaye and Wolff, 2014[49]

The fresh water fish fauna of Ethiopia is a mixture of Nilo-Sudanic, East African and endemic forms [30]. Almost all the fish consumed in Ethiopia are collected from the wild using artisanal methods. Fresh fish is mostly consumed in the area of the Great Rift Valley lakes and around Lake Tana. Besides, outside of these areas, the domestic market for fish is insignificant. Form different species, Oreochromis Niloticus (Nile Tilapia) is one of the most important species for that highly produced in capture fishery and aquaculture in more than 100 countries. Similarly, in Ethiopian fisher, Nile Tilapiais predominantly targeted and the leading species caught and consumed in most fishery production areas [52].

As research done by B. Sal [10] indicate that, in Lake Hawassa Nile tilapia (Oreochromis niloticus) and catfish (Clarias gariepinus) are the most commercially abundant fish species that account62.5% and 25% from the total catch respectively. In all fishing area its production activities is done during morning, day and at night time with all season. At Lake Hawassa the large amount of fishes was harvested continuously during rainy season and morning time [10]. Fish species preference was depending on the availability of species at different water bodies, but as a whole Tilapia, Cat fish, Carp and Carassius carasius were the most preferred fish species successively [6].



Source: Asefa, 2013 [6].

Fig 2: Most landing and preferred Fish Species in different water bodies

Fish production system in Ethiopia is based on the principle of open access to resources that characterized with different fishing gears. In fish production system fishing gear technology commonly functioned in Ethiopian fisheries include gillnets, beach seines, long-lines, hook-and-line, and cast nets [14]. In addition to this different form of forms of traps, scoop nets and baskets made of plant materials and wires are also used, particularly in the rivers of Ethiopia [14]. The traditional gears particularly account for most of the fisheries in Baro-Akobo Basin in Gambella region. Moreover, there are uses of poisons, extracted from various plant types including Millettia ferruginea [39].

For instance, in the rift valley lakes of Ethiopia such as Lake Awasa, Langano, Chamo, and Abaya fishing activity is carried out with gears ranging from hand hooks to motorized fisheries association. The fishing activity of Lake Ziway was operated by three types of gears: beach seines, gillnets long-lines. In addition, hook-and-lines were utilized by occasional fishermen along the shoreline. The fishermen utilize wooden boats for casting beach seines and rafts for gillnets and long-lines. Steel boats were used only for collection of fishes from landing sites as well as for transportation [38].

Based on the study result held different rivers of at Ilu Abba Bora zone such as Sor Gabba, Dabana, Didhessa, Ganji, Barokela, Kabar, Gumero and other Rivers, the fishing gears commonly used are hooks of different sizes (Fig 3A), traps (fish basket) (Fig 3C) that locally made and rarely gillnet (Fig 3B) [51]. The fishing activities on these rivers are on subsistence basis by part-time fishermen for family consumption and sale on small scale during dry season. Fishing is commonly carried out mostly at the end of rainy season (starting from October) and continues to the beginning of the rainy season (April).

Source: Tujuba *et al*., 2017 [6].

Fig 3: Gear typed operating in Ilu Abba Bora Zone at different rivers

In all production system, most of the fish catches from the lakes reach the market by traditional means of transportation without any preservation facilities [14]. Some fishermen hook some of the fish together with a string and carry them by hand to the market for immediate cash income. Others put the fish in a basket, cover them with fresh leaves and carry them by hand. Still others collect their catch in sacks and carry it to the market by hand or on donkeys, taxis or Pickup trucks [14]. The most common forms of fish storage are the use of deep freezers of varying sizes and cold rooms in some cases at Arba Minch, Bahir Dar, Ziway and Addis Ababa. While Ethiopian consumers have preference to whole fresh fish, traditional drying of fish is performed on remote fishing sites.

From Ethiopia Lake, Lake Tana is one of the high shares in in supplying fish production to the country potential levels. Prior to 1986, Lake Tana fisheries consisted only of artisanal, predominantly subsistence reed boat fishery. Fishing in the Lake Tana fisheries is both artisanal and commercial that practiced the combination of motorized gill net, traditional reed-rafts, gillnet, chase and trap fishery. Fish which is produced on the Lake Tana is presented either as Gutted whole fish, filleted or dried [2]. Similar in central rift valley of Ethiopia the fish production is mainly use tradition system. Traditionally, small-scale or artisanal fisheries are used to characterize those fisheries that were mainly non-mechanized with low level of production due to constraints faced. The fishermen were gutting or filleting in the shore of the lake with poor quality [36].

Source: Ignatius and Zelalem, 2011[36].

Fig 4: Fish processing method in central Rift-valley Lake

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. Its fishing activities are performed mostly on two of the rivers, the Baro near Gambela in the western part of the country [35] and the Omo in the southern area near the border with Kenya [14]. Fishing is done mainly with hooks and some gill net. According to Alemu *et al*. [3] report, the fishery production systems in five different rivers namely; Ganale, Awata and Dawa (Guji zone) and Gidabo and Galana (Borana zone) is characterized as agro-pastoral systems with the of absence of efficient fishing and production system. There are three fish species viz. Bagrus, Mijligie/Eel (Anguilla bengalensislabiata), Barbus harvested by fishermen by using hand line and/or long line.

Fish processing method exercised by the fishermen were gutting and occasionally filleting. This is seldom practiced and frequently the fishermen sold whole fish which caused low price at landing sites as well as secondary markets. Related to its marketing system, the produced fish size and type of fish play an important role in the cost and price in the market. The price of a kilo of whole fish almost doubled within five years of time for instance in Lake Tana. But now a kilo of whole and filleted fish ranged from 15-20 Birr and 65-85 Birr, respectively including in rift valley area and even more than this in Addis Ababa [39]. Cost of production for a kilo of fish varies from season to season depending on the availability of fish around fishing areas.

2.3 Challenges of Fishery production systems in Ethiopia

Like other African country, Ethiopia is challenged with different events that pose serious constraints for overall fish development and Fishery production system.

2.3.1 Post-harvest losses

Fishes are perishable products they spoil very quickly by with high temperatures that increase the activities of bacteria and enzymes in fish flesh and resulted post-harvest fish losses. Post-harvest fish losses are often caused by biochemical and microbiological spoilage changes that occur in fish after death. A live fish has natural defense mechanisms that help to prevent spoilage. However, once a fish dies, its defense

mechanisms stop and enzymatic, oxidative and microbiological spoilage begins to cause quality deterioration. According to Getu *et al.* [31]. globally fish lose due to spoilage is estimated to be 10 to 12 million tons per year which accounts 10% of total production of fish.

The study conducted by Demeke, (2015) result indicated that, on Amerti and Fichawa reservoirs from the total annual 98, 784 kg tilapia catch the post-harvest loss constitutes 6,816 kg (6.9 %) of which 2,076 kg of tilapia due to size discrimination, 1,323 kg due to operational loss, 648 kg due to market access and 2,497 kg due to spoilage was discarded. In the same research from the total carp species catch 31,317 kg the post-harvest loss constitutes 3,539 kg (11.3%), of which 560 kg of carp species due to size discrimination, 2,143 kg due to species preference and 447 kg due to spoilage was discarded. As study report organized by Ayalew *et al.* [6] also reveal that, post-harvest fish losses in Northern Ethiopia the case of Lake Hayq and lake Tekez estimated monetary lose was found to be 10,934,000 ETB with in six years.

The determinant factors for fish post-harvest losses include less market access, size and species preference, inadequate infrastructure for fish handling, processing, storage and transportation and distance from the central market. On the other hand, in Lake Hashenge the post-harvest losses relatively small due to relatively cold air temperature (13 to 19 °C). Out of the total respondents (52.62%) replied that, the postharvest losses obtained due to; lack of consideration for the sector by the administration of the district, limited infrastructure facilities, lack of appropriate fishing equipment's and marketing constraints [40]. Research was done by Alemu *et al.* [6] Show that, in Genale River long distances involved in the transportation of fresh fish, high ambient temperature and the poor-quality packing materials are the root cause for the post-harvest quality.

2.3.2 Poor infrastructure, access to fishing materials and marketing constraints

Substantial potential fish marketing system exists in Ethiopia with ineffective marketing network. Fish marketing in Ethiopia is also influenced poor transportation and preservation facilities. According to study done by B. Sai [10] show that, in lake Hawassa lack of proper processing and storage facilities, lack of transportation, lack of permanent fish market place and lack of a wariness are the major marketing problem of the area.

Fishery production system assessment done Alemu *et al.* [10] approve that, in Gidabo river and Lake Abaya fishery production system there is serious problems in transportation and other necessary infrastructure. Fishermen in forced to transport their product for providing market by using motorcycle which is too hefty and donkey back. Fish handling, storage and preservation techniques is not practiced owning 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. In all landing areas the fishermen are face to different challenge due to scarcity of modern fishing gears and poor road access to the potential markets [10].

Due to lack of access to fishing equipment at different fishing areas the fishermen use a traditional gear that particularly account for most of the fisheries in Rivers. Material like Motors for boats, different size of net is not easily available in all fish production potential areas. Floats and lead rope used with nets are also difficult to obtain in Ethiopia. Overall, different literature confirms that, in most water bodies the major difficulties were inaccessibility to potential market areas (lack of permanent fish market places), absence of efficient fishing equipment's (production and processing material availability), lack of basic infrastructure, lack of training and extension services are the main reasons for underutilization of fishery resource from the existing potential [13, 10, 6, 3].

2.3.3 Overfishing

In Ethiopia fishery is an open access and consequently there has been localized overfishing that bring risk for some commercially important species and overall resources. In most case in different water bodies fishes are caught before reaching sexual maturity.As report done by Tesfahun [48] indicate that, in Koka reservoir high proportions of *Labeobarbus intermedius* caught were below length at first maturity. Similarly, there was immature fishing of (77.6%) for *Clarias gariepinus* and (23.0%) for *Oreochromis niloticus* in Lake Hawassa [43] and (15%) for *Labeobarbus* species in Lake Tana [18].

The problems may rise due poor awareness of fishermen on the length of first sexual maturity. According to Muluye *et al.* [43] report that, the majority (50.6%) of the fishermen did not know whether the catch fish is mature or immature as documented in Lake Hawassa. Only a few fishermen 1.3% know the correct length at the first sexual maturity of fish. The types and the mesh size of the fishing gears also bring overfishing and exploitation of the resource. The study conducted in Lake Ziway revealed that the most serious problems was using narrow mesh sizes which 43.33% it resulted over exploiting of the fish stock in the lake [42]. In all areas poor fishery resource exploitation emerge due to inadequate legal and policy frameworks and inadequately implementation of existing fishery laws and regulations.

On the other hand, cooperatives poorly performed in resource utilization and management that lead to an individual or private fisher are expanding that often accused of being illegal and exploit the resource. As Vijverberg *et al.* [52] and Desta *et al.* [21] reported that, the big challenges for overfishing is uncontrolled and excess fishing practices, using narrow mesh sized nets, lack of government control over fishing and lack sense of ownership on the resource.

2.3.4 Urbanization, agricultural expansion and wetland degradation

In Ethiopia, wetlands covered about (22,600 km^2) surface area of the total land [8]. These wetlands areas have contributed on protecting different pollutants, sediment, chemicals and fertilizer, human sewage, animal waste, pesticides, heavy metals [29]. Wetlands have provided habitat for fish breeding. Fish species such as *Clarias gariepinus*, *Garadembecha*, *Labeobarbus intermedius* and *Labeo barbusnedgia* are used the wetland areas for their breeding mechanisms; but in different Ethiopia lakes the water shade of was degrading more rapidly [50].

According to Wondie [56] reported the most outstanding threats of the shoreline wetlands stability are expansion of agriculture, industrial pollution, drainage activities and deforestation of wetland trees for home consumption and income generation. In lake Ziway, the actual production was 2300 tones/year in 2003 and it goes down to 1127 tons/year in 2011[32] due to fish breeding sites are being destroyed [34]. According to FAO, [6] sewage of factories and agriculture are

the sources of major pollutants affecting Ethiopian water bodies and their fishes that poses serious constraints fisheries. The extraction of minerals from Lake Abijata could have negative effect on fish stocks, just as the effluents from the tannery at Koka Reservoir and the textile industries at Awassa and Arba Minch can affect the fisheries status.

This due to local farmers and investors starting their farm in the country without doing proper Environmental impact assessment [42]. Nearly 6 million people live in the Abaya, Chamo, Hawassa and Chew-Bahir catchments and the population density is more than 160 people/km^2. In other report cultivation of teff (Eragrostistef), chickpea, grass pea and maize practices has been impacted around the shore in LakeTana [5].

As Mitike [42] reported that, the farm activities and factories had polluted Lake Ziway in 21.33% and 5.34% respectively. Due to its water availability, transport and suitable conditions, the investors prefer the rift valley for flower production in Ethiopia. In the area, the production status decrease from time to time, due high concentration pollution from waste disposal that increasing pressure on the fisheries sector and livelihoods of fishermen. For instance, one large flowery culture company in Ethiopia now occupies about 300 hectares in Ziway around the lake [29]. It exploits the lake water and release different pollutant nutrients to the catchment that lead to affect different Lake Biodiversity.

2.3.5 Climate change and Fish diseases

Ethiopia is facing a massive drought and food insecurity crisis as a result of shortage rains and droughts that have been resulted worse due to climate change by El Nino in 2015 [24]. Climate change seriously causes depletion of fishery activities in a certain country [46]. Higher inland water temperatures decline the availability of fish stocks by altering water quality and the trophic status of a given aquatic ecosystems. The climate change can also increase vulnerability of fishing households the severity of the impacts from climate change because of the agricultural crops were seriously affected for this reason the only option is to catch any size of fish and the fish population got overexploited in Lake Langeno [47].

Sometimes due to rainfall vibration the highest runoff happened in different areas that bring the sediment load in the water bodies. In Lake Tana sediment load and siltation are current problems [8]. Similarly, in Lake Zeway, the impacts of climate variability and change on fisheries resources has been observed with changes in fish species diversity, size and composition [1] species distribution [45] possible species extinction [15] and reduced productivity [1]. Siltation of the lake through soil erosion due to deforestation and chemical pollution due to runoff from irrigated lands also observed in the area [21].

The country fish production also affected by diseases. Meko *et at.* [40] noted that fish diseases are one of the problems of the fishery sector in the country. Parasites and disease associated conditions of the fish decreases fish production potential. It is the common and main problem for all the world in both capture fishery and aquaculture. It may lead to high mortality in a given water body or fishing site. For instance, according to Mengesha, [41] and Dadebo *et al.* [16] assessment result, *Labeobarbus intermedius* is declined due to overfishing and parasitic infection has resulted the less accessibility of the fish on the local fish markets. In lake Ziway as study assessment result done by Bekele and Hussien, [11] show that, Contracaecum was the most serious parasite that affecting of fish in Lake Ziway; Parasites like nematodes were also contributed (8.60%) for *Oreochromis niloticus* and (19.02%) for *Clarias gariepinus* in the gastrointestinal tract of the fish**.**

2.3.6 Water hyacinth

Water hyacinth (*Eichhorni acrassipses)* have been considered as the worst invasive weeds in relation to its negative impacts on aquatic ecosystems, agriculture, fisheries, transportation, living conditions and social structures [12]. Water hyacinth highly use and reduce the dissolved oxygen that led to fish kills caused by oxygen depletion [53]. Now a day, this weed are the main cause for declining fish production status in different lake. According to Wassie *et al.* [54] reported that, in Lake Tana water hyacinth infestation has been covered about 34,500 ha (15% of the Northern shore). Consequently, all the fishers changed their landing site because of water hyacinth expansion obstructs their fishing activities.

The same report concludes that, "if the expansion of water hyacinth continues in this trend, it can negatively affect the livelihood of fishers in both directions by increasing costs of fishing and reducing the amount of fish caught in Lake Tana" [5]. The same research reporte show that, due water hyacinth to, in 2010 the catch Per Unit of Effort (CPUE) of *Labeo barbus* is declined from 63 kg/trip in 1991-1993 to 6 kg/trip in 2010. In connection to this, a high infestation level of water hyacinth was also reported in some other Ethiopian rift valley lakes mainly in Aba-Samuel Dam, Lake Ellen, Lake Koka and Lake Wonji [27] that led the similar effect on the sectors.

3. Conclusions and Recommendations

3.1 Conclusions

In Ethiopia there are several rivers, lakes and reservoirs in different parts of the country that can be fish farming potential and contributing for the development. In Ethiopia in all fishing area most fishermen are organized in cooperatives, representing the communities around the lake, reservoirs on the islands, although a considerable number of individual fishermen are operating outside the framework of cooperatives, simply because it is open access resources. Fish handling in Ethiopia is at its lowest level and remains at its traditional stage.

Starting from the collection of fishes from the net or hooks, fish are processed/filleted on the floors of boats and mostly sell on the shoreline of the water bodies. As reviewed data indicate that, fishing production system in the country is mainly artisanal in its nature which makes use traditional technique and tools. Even though fish provides a great contribution to fishing community it characterized with low production and underutilization due to, rudimentary and labor-intensive fishing gears, inaccessibility to potential market areas, lack of developed processing technology, lack of government support, absence of strong and well functioned policy, over fishing, illegal fishermen, shore cultivation, deforestation, lack of training and extension services.

3.2 Recommendation

Based on the above-mentioned conclusion the following recommendation and direction forwarded;

- As literature indicate that, still the fishermen use traditional boat and with poor handling and transportation system in all fish potential areas. So, providing adequate basic fishing material and developing basic infrastructures like roads, transportation system,

electricity and storage facilities should be prioritized by both the Federal and Regional governments. Also, enforcement of management measures, effective training, extension work and continues support should be implemented which integrate active participation of the fisher community.

- Overfishing and expansion of illegal fishermen is resulted by poorly regulated high fishing effort by the commercial gillnet fishing.Thus, management tools like closed seasons, catch quota restriction, mesh size regulations, gear restrictions, limits on the number of fishers and/or boats, taxes on effort and licensing of the activity has to be put in place to keep the stock of the resource sustainable. So, the government should be taking a regular follow up of each fishing activities in different areas related to resource utilization and management.
- The production of fish is largely constrained by anthropogenic activities, increasing pollution from waste disposal, cultivating the shore of the lake, climate change and the newly emerged weed (water hyacinth) becomes a big threat for different water bodies and the fishery sector in particular. Therefore, the government and other concerned stakeholders must work together on the reducing methods and controlling mechanism in anthropogenic activities and water hyacinth.
- Finally, the current serious challenge water hyacinth highly expands on the main water bodies and most fishermen are not work as cooperative and fail in establishing strong teamwork to maintain and use the resource in the sustainable manner. Additionally, the sectors line on traditional system with the absence of modern and strong value chain-based fish production, processing and marketing coordination. This all mentioned problems are some of the research gap that needs a critical and proper assessment in all fish potential area to sustain the sector with its grate contribution for the whole economic activities of the country. So, any interested search organization or individual researcher should be conducting the research on indicated direction.

4. Acknowledgments

I would like to express my honest gratitude to my Adviser Mr. Tamiru Chalchissa (MA) for his valuable time, thoughtful and constructive comments, professional advice and all invaluable guidance for this review paper. I am also thankful for my instructor and this seminar coordinator Dr. Abayineh Amare (Assistant Professor, Jimma University) for providing supervision from starting to until the final day. Finally, I want to extend my appreciation to all my friends who were help me in different ways.

5. References

1. Abera L, Getahun A, Lemma B. Composition of commercially important fish species and some perspectives into the biology of the African Catfish *Clarias gariepinus* (Burchell), Lake Ziway, Ethiopia. International Journal of Advanced Research. 2014; 2(1):864-871.
2. Alayu Y. Fish production, processing and utilization in the Lake Tana fisheries; Polish development cooperation program; Implementation of Ecohydrology – a trans disciplinary science for integrated water resources and sustainable development in Ethiopia; Bahir Dar Fishery and Aquatic Life Research Center, 2012.
3. Alemu LA, Assefa MJ, Tilahun GA. Fishery production system assessment in different water bodies of Guji and Borana zones of Oromia, Ethiopia; International Journal of Fisheries and Aquatic Studies. 2014; 2(2):238-242.
4. Asmare E. Current Trend of Water Hyacinth Expansion and Its Consequence on the Fisheries around North Eastern Part of Lake Tana, Ethiopia. Journal of Biodiversity Endanger Species. 2017; 5:189.
5. Asmare E, Demissie S, Tewabe D, Endalew M. Impact of climate change and anthropogenic activities on livelihood of fishing community around Lake Tana, Ethiopia. EC Agriculture. 2017; 3(1):548-557.
6. Assefa M. Assessment of fish products demand in some water bodies of Oromia, Ethiopia: International Journal of Agricultural Sciences, 2013.
7. Assefa M. Fish Production, Consumption and Management in Ethiopia; Research Journal of Agriculture and Environmental Management. 2014; 3(9):460-466.
8. Awoke T, Melaku M. Challenges and possible mitigation of Ethiopia fishery: A review. International Journal of Fisheries and Aquatic Studies. 2017; 5(1):241-246.
9. Ayalew A, Fufa A, Wubet B, Samson L. Assessment of post-harvest fish losses in two selected lakes of Amhara Region, Northern Ethiopia, 2018; Heliyon 4; e00949. doi: 10.1016/j.heliyon.2018. e00949.
10. Sai BRP. Assessment of fish production and marketing system in Lake Hawassa at Amora Gedel, Ethiopia, 2016. Available online https://www.researchgate.net/publication/301888630 (accessed on May 25/2019).
11. Bekele J, Hussien D. Prevalence of Internal Parasites of *Oreochromis niloticus* and *Clarias gariepinus* Fish Species in Lake Ziway, Ethiopian Journal of Aquaculture Research Development. 2015; 6:308.
12. Bhattacharya A, Haldar S, Chatterjee P. Geographical distribution and physiology of water hyacinth (Eichhorniacrassipses) the invasive hydrophyte and a biomass. International Journal of Chemical Technology International Journal of Fisheries and Aquatic Studies, Research. 2015; 7:1849-1861.
13. Brook L. Introduction to Lake Ecology, Aquaculture and Fisheries in Ethiopia. Haramaya University, Haramaya, Addis Ababa University Printing Press, Addis Ababa, Ethiopia, 2008.
14. Brook L. Report on the Value Chain Assessment of the Fishery Sector in Ethiopia. Food and Agriculture Organization Sub-Regional Office for Eastern Africa Addis Ababa. 2012, 131.
15. Cheung WWL, Lam VWY, Sarmiento JL, Kearney K, Watso R, Pauly D. Projecting global marine biodiversity impacts under climate change scenario. Fish and Fisheries. 2009; 10(3):235-251.
16. Dadebo E, Tesfahun A, Teklegiorgis Y. Food and feeding habits of *African big barb* L. intermedius (Rüppell, 1836) (Pisces: Cyprinidae) in Lake Koka, Ethiopia, Journal of Agricultural Research and Development. 2013; 3:49-58
17. Dawit G, Asefa A, Gezahegn A, Fekadu B. Analysis of the significance of fishing on food security status of rural households around Lakes Ziway and Langano in Ethiopia. J Econ. Sustainable. Development. 2013; 4:1-10.
18. De Graaf GJ, Garibaldi L. The Value of African Fisheries. 2019. FIPS/C1093, FAO: Rome, Italy, 2014,

67, Available online: http://www.fao.org/documents/card/es/c/d155e4db-78eb-4228-8c8c-7aae5fc5cb8e/ (accessed on May 16/2019).
19. Demeke T. Determinant Factors for Wasted Fish during Harvesting at Amerti and Fichawa Reservoirs Oromia/Ethiopia; Journal of FisheriesSciences.com. 2015, 012-015.
20. Dereje T. Spatial and temporal distributions and some biological aspects of commercially important fish species of Lake Tana, Ethiopia, Coastal Life Med. 2014; 2(8):5.
21. Desta H, Lemma B. Farmers' awareness and perception of Lake Ziway (Ethiopia) and its watershed management Limnological. 2017; 65:61-75.
22. FAO (Food and Agriculture Organization). The state of world fisheries and aquaculture. Fisheries and Aquaculture department of food and agriculture organization of the United Nations, Rome, Italy. 2014, 75-76.
23. FAO (Food and Agriculture Organization. FAO Yearbook. Fishery and Aquaculture Statistic; Rome, Italy, 2015.
24. FAO (Food and Agriculture Organization. The State of Food Security and Nutrition in the World. Building Climate Resilience for Food Security and Nutrition; Rome, Italy, 2016.
25. FDRE (Federal Democratic Republic of Ethiopia). Constitution of the Federal Democratic Republic of Ethiopia Proclamation No. 1/1995, Addis Ababa, Ethiopia, 1995.
26. FDRE (Federal Democratic Republic of Ethiopia). Fisheries Development and Utilization Proclamation No. 315/2003, Addis Ababa, Ethiopia, 2003.
27. Firehun Y, Struik PC, Lantinga EA, Taye T. Water Hyacinth in the Rift Valley Water Bodies of Ethiopia: Its Distribution, Socioeconomic Importance and Management. International Journal of Current Agricultural Research. 2014; 3(5):067-075.
28. Gebrekidan A, Berhe M, Weldegebriel Y. Bioaccumulation of Heavy Metals in Fishes of Hashenge Lake, Tigray, Northern Highlands of Ethiopia. American Journal of Chemistry. 2012; (6):326-334.
29. Gebretsadik T, Mereke K. Threats and Opportunities to Major Rift Valley Lakes Wetlands of Ethiopia. Journal of Agriculture Research and Technology. 2017; 9(1):0010012
30. Getahun A, Dejen E, Anteneh W. Ethiopian Nile Irrigation and Drainage Project Coordination Office, Ministry of Water Resources. Fishery studies of Ribb River, Lake Tana basin, Ethiopia Final Report. 2013; E1573(2):26.
31. Getu A, Misganaw K, Bazezew M. Post-harvesting and Major Related Problems of Fish Production. Fisheries and Aquaculture Journal. 2015; 6:154.
32. Hailu M. Ecosystem structure, trophic link and functioning of a shallow rift valley lake: the case of Lake Ziway (Ethiopia). Addis Ababa University, 2011.
33. Hecky RE, Mugidde R, Ramlal PS, Talbot MR, Kling GW. Multiple stressors cause rapid ecosystem change in Lake Victoria. Freshwater Biolology. 2010; 55:19-42.
34. Heide F. Feasibility Study for a Lake Tana Biosphere Reserve, Ethiopia, 2012
35. Hussien A. National Aquaculture development strategies of Ethiopia: a road map to building a healthy and dynamic aquaculture sub-sector. In: Management of shallow water bodies for improved productivity and peoples' livelihoods in Ethiopia. Proceedings of the Second National Conference of the Ethiopian Fisheries and Aquatic Sciences Association (EFASA), Bahir Dar, Ethiopia. 2010, 31-39.
36. Ignatius M, Zelalem B. The role of fishery in livelihood security of fishing communities around lake Ziway, Eastern Showa Zone, Oromia Regional State, Ethiopia; Institute of Development Studies, Bindura University of Science Education, Zimbabwe, 2011.
37. Kebede A, Meko T, Hussein A, Tamiru Y. Review on Opportunities and Constraints of Fishery in Ethiopia. International Journal Poultry Fish Science. 2017; 1(1):1-8.
38. Lamma AH. Current status and trends of fishes and fishery of a shallow rift valley lake, Lake Ziway; Ethiopia, 2016.
39. Lemma AH. Fisheries production system scenario in Ethiopia; International Journal of Fisheries and Aquatic Studies. 2017; 5(1):79-84.
40. Meko T, Kebede A, Hussein A, Tamiru Y. Review on Opportunities and Constraints of Fishery in Ethiopia. International Journal Poultry Fish Science. 2017; 1(1):18.
41. Mengesha M. Heavy metal pollution in the rift valley Lakes of Awassa and Koka, M. Sc Thesis, University of Bremen, Germany. 2009.
42. Mitike A. Fishermen's willingness to pay for fisheries management: the case of lake Ziway, Ethiopia. MSc. thesis Submitted to the School of Agricultural Economics and Agribusiness. Haramaya University. 2015, 33.
43. Muluye T, Tekle-Giorgis Y, Tilahun G. The Extent of Immature Fish Harvesting by the Commercial Fishery in Lake Hawassa, Ethiopia. Momona Ethiopian Journal of Science. 2016; 8(1):37-49.
44. Olale E, Henson S. The impact of income diversification among fishing communities in Western Kenya. Food Policy report. 2013; 43:90-99.
45. Perry RI, Ommer RE, Allison E, Badjeck MC, Barange M, Hamilton L. The human dimensions of marine ecosystem change: interactions between changes in marine ecosystems and human communities, 2009.
46. Temesgen M, Getahun A. Fishery Management Problems in Ethiopia: Natural and Human Induced Impacts and the Conservation Challenges. Reviews in Fisheries Science and Aquaculture. 2016; 24(4):305-313.
47. Temesgen M. Length-weight relationship and condition factor of fishes in Lake Langena, Ethiopia, PhD dissertation, Addis Ababa University, Ethiopia, 2017.
48. Tesfahun A. Some Biological Aspects and immature fishing of the African Big Barb *Labeobarbus intermedius* (R.) in Lake Koka, Ethiopia. A part of MSc thesis submitted to Hawassa University, 2011.
49. Tesfaye G, Wolff M. The state of inland fisheries in Ethiopia: A synopsis with updated estimates of potential yield. Ecohydrology and Hydrobiology. 2014; 14:200-219.
50. Tessema A, Mengist A, Mejen EA. survey on fisheries in chefa wetland and around Kemissie, Oromia zone a Direct Research Journal of Agriculture and Food Science. 2014; 2(3):28-32.
51. Tujuba A, Simagegnew M, Tsegaye D. Assessing Fishing activity, Fish Production and demand outlook in Ilu Abba Bora Zone, Oromia Regional State, South West Ethiopia; Greener Journal of Agricultural Sciences. 2017; 7(1):009-

018.
52. Vijverberg J, Dejen E, Getahun A, Nagelkerke L. The composition of fish communities of nine Ethiopian lakes along a north-south gradient: threats and possible solutions. Animal Biology. 2012; 62:315-335.
53. Waithaka E. Impacts of Water Hyacinth ((*Eichhornia crassipses*) on the Fishing Communities of Lake Naivasha, Kenya. Journal of Biodiversity Endanger Species, 2013.
54. Wassie A, Minwuyelet M, Ayalew W, Dereje T, Woldegebrael W. Water hyacinth coverage survey report on Lake Tana. Technical Report Series. 2014.
55. WB (World Bank). The Hidden Harvests the Global Contribution of Capture Fisheries: Agriculture and Rural Development Department-Sustainable Development Network; the FAO and the World Fish Center: Washington, DC, USA, 2010.
56. Wondie A. Improving management of shoreline and riparian wetland ecosystems: The case of Lake Tana catchment. Bahir Dar University, Bahir Dar, Ethiopia. 2010; 10(2-4):123-132.