AUCTORES
Globalize your Research

Journal of Nutrition and Food Processing

Mahendra Pal *

Open Access

Review Article

Contribution of Fisheries to Food Security in Ethiopia: A Comprehensive Review

Mahendra Pal [1]*, Alemayehu Bekele [2], Tesfaye Rebuma [3], Tamasgen Ragasa [4]

[1]Narayan Consultancy of Veterinary Public Health, and Microbiology, Bharuch, Gujarat, India

[2]Wallaga University School of Veterinary Medicine Department of Clinical Studies

[3]Shaggar City administration Sebeta Sub-City Agricultural office, Sebeta, Oromia, Ethiopia

[4]East Wallaga Zone, Wayu Tuka district Agricultural Office, Wallaga, Oromia, Ethiopia

Corresponding author: Mahendra Pal, Narayan Consultancy of Veterinary Public Health, and Microbiology, Bharuch, Gujarat, India.

Received date: January 29, 2025; Accepted date: February 19, 2025; Published date: March 04, 2025

Citation: Mahendra Pal, Alemayehu Bekele, Tesfaye Rebuma, Tamasgen Ragasa, (2025), Contribution of Fisheries to Food Security in Ethiopia: A Comprehensive Review, *J. Nutrition and Food Processing*, 8(3); **DOI:10.31579/2637-8914/297**

Abstract:

Fishing is a vital resource for many developing countries, offering economic benefits and employment. In Ethiopia, aquaculture holds potential for improving food security and alleviating poverty, though it remains underdeveloped. Fish is a key part of the national nutrition strategy, providing essential nutrients like vitamins, minerals, and protein. However, traditional fishing methods, outdated equipment, illegal fishing, overfishing, and fish diseases hinder the sector's growth. The government is strengthening regulations to address these challenges and promote sustainable resource management. Postgraduate programs in fisheries and aquaculture aim to build expertise in the sector. To ensure long-term sustainability, efforts should focus on raising awareness, fostering local investment, and advancing research in fish production and lake management.

Key words: Ethiopia; fishery; fish production; nutrition; resource

1.Introduction

The fishery sector plays a crucial role in poverty reduction and serves as a potential strategy for diversifying household income, both directly and indirectly. Fisheries represent a vital and renewable natural resource base for many developing countries [1]. Since ancient times, fishing has been a significant source of food and a reliable means of income and livelihood for those engaged in the activity [2]. In Ethiopia, the fishery sector holds substantial potential, which can be harnessed through aquaculture, modern technologies, and the development of necessary infrastructure for fish harvesting [1]. Fisheries contribute to national economies in multiple ways, including increasing gross domestic product (GDP), generating employment for fishers and processors, serving as a source of foreign exchange, and boosting government revenue through fisheries agreements and taxes [3].

Fish has become an increasingly important source of protein and other essential nutrients required for maintaining a healthy body, making it a vital food component for a large portion of the global population [4]. It is particularly significant for children and pregnant women, as fish provides nutrients such as omega-3 fatty acids, which are crucial for early brain development. Due to its high nutritional value, even small amounts of fish can improve diets and play a vital role in combating hunger and malnutrition [5, 6]. Approximately, 116 million people in developing countries benefit from the fishery industry, with 90% employed in small-scale fisheries [7].

Ethiopia possesses numerous lakes and rivers that support fish production, hosting a wide variety of fish species. Each species adapts to specific aquatic environments, has unique market qualities, and together provides a diverse, protein-rich food source, surpassing the variety offered by animal agriculture [8]. Leveraging these resources for fishing offers an alternative pathway to achieving food security and poverty reduction in Ethiopia. Fisheries and aquaculture play critical roles in enhancing food supply, generating income, and improving nutrition from local to global scales [9].

Ethiopia, lacking a marine coastline, relies entirely on its inland water resources for fisheries. These include numerous lakes, rivers, and reservoirs, collectively covering an area of approximately 7,000 to 8,000 km², with over 7,000 km of major rivers and 400 km² comprising smaller water bodies such as crater lakes and reservoirs [10]. While aquaculture is one of the fastest-growing sectors globally within food animal production, its development in Ethiopia remains limited, hindered by a lack of information, experience, and infrastructure [8].

Despite the numerous challenges and constraints facing the fishery sector in Ethiopia, understanding its vital role as a source of food, employment, recreation, trade, and economic well-being underscores the importance of giving attention to this sector. This paper aims to review and present various literature on the contribution of fisheries to food security and the broader values of fisheries. Accordingly, the objectives of this paper are to review the contribution of fisheries to food security in Ethiopia and also to highlight the fish production system in Ethiopia.

2. Overview of Fisheries and Aquaculture as a Means of Addressing Food and Nutrition Security

A fishery refers to a specific area in a sea, river, or other water body where significant amounts of fish are harvested. Fisheries encompass human-organized efforts to catch fish or other aquatic organisms, broadly categorized into capture fishery and aquaculture [11]. Capture fishery involves harvesting aquatic species from their natural habitats, while aquaculture entails the controlled farming of aquatic organisms such as fish, crustaceans, mollusks, and plants in regulated environments to achieve higher yields than in the wild [1].

Physical, mental, emotional, and social well-being collectively contribute to overall health, often referred to as the "health triangle." One of the key factors in maintaining good physical health is the consumption of balanced nutrients. In Ethiopia's national nutrition strategy, fish is recognized as a vital component of food and nutrition security. The nutritional value of fish is determined by factors such as the type, quality, availability (post-processing and cooking), and digestibility of the nutrients it contains. Fish is a protein-rich food of high quality, which, though not a completely balanced diet, can complement a mixed (vegetarian) diet. When paired with rice, beans, or wheat, fish significantly enhances the nutritional value of meals [12].

Fish farming has been performed in numerous places globally, including Europe, Canada, East Asia, China, Africa, and developing countries such as Nigeria [11]. This practice stretches back to ancient civilizations like Egypt and China. Over 120 million people worldwide are thought to depend entirely or partially on fish for their livelihood. Knowing the number and distribution of species in a particular location is essential for the effective conservation of fish communities. Preserving species variety has emerged as a critical issue in conservation biology due to the continuous degradation of habitats around the world [13].

Aquaculture development in Ethiopia is minimal, and the country currently relies solely on inland freshwater capture fisheries following Eritrea's independence in 1993 and the subsequent loss of its coastline. Ethiopia’s inland fisheries include rivers, small water bodies such as reservoirs and natural ponds, as well as Rift Valley lakes like Lake Chamo, Lake Abaya, Lake Ziway, and the northern part of Lake Turkana. Additionally, Lake Tana, Ethiopia's largest lake, is part of the country's fishing resources, despite its shallow depth [14].

Ethiopia's annual fish production from its water bodies based on 14 major rivers, 25 major lakes, and 14 major reservoirs is estimated to be around 94,500 tons. However, fish demand is expected to rise from 95,000 tons in 2015 to 118,000 tons by 2025. Ethiopia is home to over 200 fish species, though only a few are commercially significant. This limitation is due to factors such as consumer preference, lack of awareness among fishers, and insufficient knowledge among extension agents and policymakers regarding the diversity and potential uses of these species [15].

3. Fish Production in Ethiopia

Fish has a long history as a food source in Ethiopia [16]. Traditionally, Ethiopian fisheries were artisanal and focused on subsistence fishing until the 1990s, when they began to commercialize, particularly in the Rift Valley lakes, including Lakes Koka, Ziway, Langano, Awassa, Abaya, Chamo, and Lake Tana. While subsistence fishing can take place in virtually any water body, commercial fisheries are mostly concentrated in the central Rift Valley lakes Koka, Ziway, Langano, and Awassa along with the southern Rift Valley lakes Abaya, Chamo, and Turkana and the northern lakes, including Lake Tana and the South Wollo Lakes Lugo (Hyiq) and Ardibo [15].

In Ethiopia, fish is exclusively sourced from inland water bodies, including lakes, rivers, streams, reservoirs, and large wetlands, all of which hold significant socioeconomic, ecological, and scientific value. While much of Africa is arid, Ethiopia is often referred to as the "water tower of Eastern Africa." The country boasts 7,000 km² of standing water and 7,000 km of flowing water. Ethiopia's freshwater fish fauna is particularly notable, encompassing a diverse range of Nilo-Sudanic, East African, and indigenous species [17].

Although estimates vary slightly, it is evident that Ethiopia has substantial fishery potential that could significantly enhance the livelihoods of its people if managed effectively. Of the country’s total annual fishery potential, 72% is attributed to lakes, 15% to rivers, and 13% to reservoirs and other small water bodies [18].

3.1. Fish Consumption Patterns in Ethiopia

Fish is an important food source for many animal species, including humans. It is particularly valued in wealthier parts of the world due to its polyunsaturated fatty acid-rich oils [19]. While per capita fish consumption in Ethiopia remains low, demand is steadily increasing due to factors like population growth, rising incomes, and changing tastes. Key consumption areas include Addis Ababa and the towns near major fish-producing regions. Fish consumption in Ethiopia is closely linked to the traditions of the Ethiopian Orthodox Church, where fish is typically eaten on days when meat is forbidden, such as Wednesdays, Fridays, and during fasting periods [14].

Fish consumption tends to spike during fasting days, especially in regions near production centers like the Rift Valley and towns such as Ziway, Arbaminch, Bahir Dar (Tana), and Addis Ababa. This suggests that fish consumption patterns are largely confined to areas where fish are produced. However, the country’s overall dietary diversity remains heavily reliant on cereal crops, with 96% of food consumed being cereals. Animal-source foods, including fish, remain the least consumed food group at the household level. An exception is found in Gambella, where fish consumption is notably higher, with 44.8% of households reporting regular fish consumption during the reference period [20].

3.2. Opportunities for Fish Production

Attractive fish prices in local markets, the availability of diverse fish species, and residents' traditional knowledge of fishing and healthy eating habits present significant opportunities for the expansion of the fisheries sector. Additionally, the use of gotera or kefo, a locally crafted fishing gear with a hive-like structure, is considered an optimal method for

harvesting fish [11]. Ethiopia is rich in a variety of wetlands, which are crucial resources for many Ethiopians' livelihoods [9].

Reservoir fisheries require minimal initial investment and offer quick returns compared to other economic activities. They also do not demand advanced skills or knowledge for small-scale operations. The land in Ethiopia is suitable for various aquaculture systems, such as earthen ponds, concrete ponds, and cages in lakes. Furthermore, the absence of social and cultural taboos surrounding fish consumption is another advantage that supports the growth of fish production in the country [10].

4. Socio-Economic Importance of Fish Production

4.1. The Role of Capture Fisheries in Food Security

Ethiopia, the second-most populous country in Sub-Saharan Africa (SSA), is experiencing rapid population growth. Agriculture employs over three-quarters of the population, primarily through subsistence farming, rain-fed agriculture, and animal rearing. Consequently, providing sufficient food for a rapidly growing population has become one of the country's most pressing challenges, compounded by both natural and man-made climate factors. In light of this, alongside boosting food production from land agriculture, it is essential to sustainably utilize aquatic habitats, given their high productivity. Ethiopia's fish resources could indeed offer a viable solution to the country's food security challenges [20].

Rising food prices, driven by decreased food production and climate change, further exacerbate food insecurity. As such, capture fisheries are viewed as a vital livelihood source for poor and vulnerable households, especially those affected by unemployment, lack of farmland, crop failure, or economic instability. The greater the fish production, the lower the prevalence of hunger and malnutrition, underscoring the role of fisheries in promoting food security [21]. Beyond its direct contribution to food security, fish also provides an indirect source of food security through income generation from labor and the commercialization of fish [22].

4.2. The Role of Capture Fisheries in Nutritional Security

Understanding the nutrient content of essential foods is crucial for examining the links between production, access, and nutrient intake. Fish is one of these foods, recognized for its importance in ensuring food and nutrition security in Ethiopia's national nutrition strategy [23]. To combat malnutrition in developing countries like Ethiopia, it is essential to implement proper and safe feeding practices for infants and young children. Providing optimal supplementary feeding is particularly effective in promoting child growth and reducing stunting in children aged 6 to 23 months [24].

The significance of the fishery sector for food and nutrition security is emphasized in two key national policies: the Plan for Accelerated and Sustainable Development to End Poverty (PASDEP) and the Rural Development Policy. Fish is rich in vital nutrients such as vitamin B12, calcium, iron, zinc, fatty acids, and animal protein, with smaller fish being especially high in vitamin A. When included in meals, fish enhances the absorption of iron and zinc from other foods. Essential fatty acids like DHA (Docosahexaenoic acid) and EPA (Eicosapentaenoic acid), which are found exclusively in fish, play a crucial role in the cognitive development of infants and young children, particularly during the first 1000 days, and are also essential for the health of pregnant and breastfeeding women [20].

The nutritional content of fish meat is on par with, and sometimes even higher than, that of meats like mutton, veal, cattle, hog, and poultry. A 300g piece of raw fish provides around 25% of the daily caloric intake for a balanced diet and about half of the protein and fat needs of an adult. All 10 necessary amino acids lysine, arginine, histidine, leucine, isoleucine, valine, threonine, methionine, phenylalanine, and tryptophan are present in fish in ideal levels for human consumption, making it a wonderful source of high-quality protein [12]. Additionally, it is a substantial source of vitamin D [25].

4.3. Fisheries as an Employment Opportunity

Ethiopia's capture fisheries provide significant employment opportunities, both directly and indirectly, and contribute to sustaining local communities. In 2010, the sector directly employed 4,052 people, while an additional 9,148 individuals benefited from indirect employment generated by the sector. As such, fisheries play a vital role in creating job opportunities for rural, pre-urban, and urban populations, particularly in regions around the Great Rift Valley and areas surrounding lakes, reservoirs, rivers, and small water bodies with active fishing operations [10]. Various studies have estimated the manpower needs of the fisheries sector, with numbers ranging from thousands to hundreds of thousands, depending on the level of training, education, and skills required [26].

4.4. Fish Meal as an Animal Feed Source

The increasing cost of animal feed, primarily due to the high expense of protein sources such as soybean and fish meal, drives many vulnerable livestock-rearing communities out of business. Protein is an essential dietary component for monogastric animals like fish, requiring high quality and quantity to meet their nutritional needs. Protein sources should have a high protein content, a balanced amino acid profile, good digestibility, acceptable taste, and minimal anti-nutritional properties to be effective. Fishmeal is widely regarded as one of the best protein sources for animal feed, but its rising cost poses a significant challenge to the sustainability of livestock and aquaculture industries [27, 28].

Fish offal can be processed and utilized as a valuable ingredient in animal feed. Currently, 40-60% of the fish body is discarded as offal daily and annually, despite a significant shortage of animal feed in the region. With the growing demand for fishmeal among poultry farmers, innovative solutions are emerging. For instance, Mr. Abawengelie in Bahir Dar has established a fishmeal processing facility that collects fish offal from fishers in an environmentally sustainable manner. This initiative has dual benefits: it prevents ecosystem pollution caused by discarded fish offal, which was previously dumped into the lake, harming both the environment and nearby communities, and it also provides an additional source of income for fishers [22]. Studies and practical applications in poultry farming have shown that fishmeal is a high-quality protein source, offering essential nutrients such as selenium and promoting growth through unidentified growth factors [29].

4.5. Sport Fishing as Recreational Value

Recreational fishing, particularly in the southern part of Lake Tana, has become increasingly popular. This activity began in Ethiopia during the 1970s when a foreigner working in Bale National Park introduced Brown trout and Rainbow trout from Kenya into the park's rivers. These fish have since attracted numerous tourists, significantly contributing to foreign exchange earnings. Tourists wishing to fish for trout must obtain a permit

from the local Agricultural Office or the Ministry of Agriculture, paying a fee in advance. Fishing licenses can be issued for daily, weekly, monthly, or annual durations, depending on the tourist's preference. However, there are strict regulations: a maximum of five fish per day per hook is allowed, and the activity is restricted to recreational purposes, not for commercial use [22].

4.6. Remedial or Medicinal Value of Fish

The eel fish group consists of 16 recognized species globally, many of which hold medicinal value. Beyond their use as food, various parts of these fish are traditionally utilized, either alone or combined with other plant or animal materials, to treat conditions such as anemia, burns, injuries, piles, and general weakness. Additionally, the regular consumption of fish, rich in polyunsaturated fatty acids, is known to reduce the risk of heart disease. One notable species, the Marbled Swamp Eel (*Synbranchus marmoratus*), plays a significant role in traditional Brazilian medicine, where it is used to treat ailments such as asthma, bronchitis, and hernia [30].

5. Fish Diversity in Ethiopia

Ethiopia is home to a diverse array of ichthyofauna, thanks to its abundant water resources, which include lakes, rivers, streams, reservoirs, and extensive wetlands. Despite being a landlocked country in the Horn of Africa, Ethiopia boasts over 20 natural lakes, 12 major river basins, 75 marshes, and 15 reservoirs. Additionally, the construction of micro and macro dams, along with river impoundments, has created numerous water bodies stocked with fish for fisheries [31]. The country's inland fish diversity encompasses 12 orders, 29 families, and 70 genera, with approximately 180 fish species, including 37 endemic species a diversity surpassing that of neighboring countries such as Sudan, Egypt, and Somalia [15].

5.1. Fishery Resource

Ethiopia possesses a wealth of native fish resources, highlighting the potential of these resources to contribute significantly to food security through aquaculture. With abundant land and water resources and a favorable climate, the country is well-suited for developing fish farming [32]. Known as the "water tower of East Africa," Ethiopia's fisheries remain underutilized, with only 50% of the available potential currently being tapped. The fisheries sector contributes a mere 0.02% to the national GDP, and fish supply stands at just 200 g per capita annually, far below the East African average of 2.6 kg and the global average of 20.2 kg [33]. In a nation facing chronic food shortages, utilizing its fishery resources offers a promising solution to help address this issue [34].

Although the current contribution of the fishery sector to food and nutrition security in Ethiopia is minimal, it has been acknowledged as a vital component in the country's national nutrition strategies [23]. Ethiopia's abundant fish resources present a significant opportunity to address the nation's persistent food shortages, offering a sustainable solution to improve food availability and nutrition [35].

5.2. Growth of capture fisheries in sub-Saharan Africa

Fish production in sub-Saharan Africa (SSA) has grown faster than any other agricultural commodity, driven by population growth and the increasing demand for fish to support human health. The total fishery catch in the region rose from approximately 2 million tons in 1960 to around 8 million tons by 2010, with an average annual growth rate of 3%. Some countries, including Ghana, Kenya, and Nigeria, have experienced above-average growth rates of 5%, while others, such as Côte d'Ivoire, Ethiopia, and the Democratic Republic of the Congo, have seen lower rates of 0%, 1%, and 2%, respectively [21]. In Ethiopia, the Baro basin exhibits the highest fish species diversity, followed by the Abay, Wabishebele, and Omo-Gibe basins [36].

5.3. Commercially Important Fish Species in Ethiopia

Commercial fishing involves harvesting fish and other aquatic organisms from natural fisheries for profit. While large-scale operations, often referred to as industrial fishing, are common, small family-owned businesses also play a significant role in the sector. To maintain profitability, the industry has continuously adapted and evolved [17]. In Ethiopia, key commercial species contributing to total fish landings include *Oreochromis niloticus*, *Labeo horie*, *Clarias gariepinus*, *Barbus* species, and *Lates niloticus*. Among these, Tilapia, particularly Nile Tilapia (*Oreochromis niloticus*), is the most frequently caught and consumed fish species in the country [37].

S.NO.	Scientific name	Common name	Vernacular name
1	*Lates niloticus*	Nile perch	Nechasa
2	*Oreochromis niloticus*	Nile tilapia	Qoroso/Chogofe
3	*Barbus species*	Barbus	Bilicha
4	*Labeo species*	Labeo	Barbo/Lebi
5	*Clarias gariepinus*	Cat fish	Ambza
6	*Bagrus dockmac*	Bagrus	Kerkero
7	*Polypterus bichir*	Nile bichir	Eguwella
8	*Gymnarchus niloticus*	Gymnarchus	Wit
9	*Malapterurus specie*	Malapterurus	
10	*Crussian carp*	Carp	Daba
11	*Distichodus niloticus*	Distichodus	Piro
12	*Hydrocynus forskali*	Hydrocynuseri	Weri
13	*Heteroticus niloticus*	Heteroticus	Ediwela
14	*Citharinus Citharinus*	Citharinus	Ajaka
15	*Synodontis species*	Synodontis	Akok

Table 1: Commercially important fish species in Ethiopia

Source: [18]

6. Major Challenges to Fish Production

Ethiopia is home to numerous rivers and lakes used for fish production; however, fish output and productivity remain insufficient to significantly boost private profits or the country's GDP. One contributing factor to this low yield could be the traditional fishing methods and equipment employed by local fishers, which may limit the industry's efficiency [31].

6.1. Water Abstraction and Land Use Around Fish Habitats

Many of Ethiopia's lakes, rivers, and reservoirs are currently facing severe ecological challenges. Habitat degradation is particularly prominent around some of the country's lakes. For example, water diversion for agriculture and floriculture in the catchment areas of Rift Valley lakes, such as Lake Awash, Zeway, and Koka, is significantly impacting these water resources. Additionally, the influx of organic and inorganic pollutants from nearby towns is harming the fish populations in Lake Hawassa [16]. Furthermore, many farmers and investors cultivating crops in Ethiopian water bodies are doing so without conducting proper environmental impact assessments, exacerbating these ecological issues [38].

6.2. Market Infrastructure to Address Post-Harvest and Income Losses

An assessment of post-harvest loss in artisanal fisheries identifies three main types of losses. The first is physical loss, which refers to fish that are discarded or thrown away. The second is quality loss, which occurs when improper handling leads to physical damage or changes that reduce the fish's value. The third is market loss, resulting from sudden market fluctuations that compel fish operators to sell their catch at lower prices. Supplying large quantities of fresh fish, however, requires robust infrastructure, including marketing spaces, insulated storage, ice and refrigeration facilities, reliable transportation, access from landing sites to main roads, potable water, and facilities for fish reception and cleaning [39].

6.3. Illegal fishing activities

As fish stocks decline and the demand for fish and seafood continues to rise, some operators resort to illegal fishing and trafficking of illegal fish as a last-ditch effort to maintain their livelihoods. Meanwhile, governments worldwide are increasingly collaborating to strengthen regulations on fishing vessels, fishing activities, fish transportation, and trade to combat illegal fishing and improve the management of fishery resources [37]. One of the most significant challenges in the fish value chain is the illegal fish trade, which has led to the use of harmful nets with small mesh sizes, posing a serious threat to the sustainability of fisheries [40].

6.4. Overfishing

In Ethiopia, the fishery sector operates as an open-access resource, leading to localized overfishing that threatens commercially important species and overall fishery resources. In several water bodies, fish are being caught before reaching sexual maturity. For example, in the Koka Reservoir, a significant proportion of *Labeobarbus intermedius* were caught before reaching the length at first maturity. Similarly, in Lake Hawassa, 77.6% of *Clarias gariepinus* and 23.0% of *Oreochromis niloticus* were caught while still immature, and in Lake Tana, 15% of *Labeobarbus* species were immature when harvested [1].

6.5. Fish Diseases

Fish diseases represent a significant challenge to the fishery sector in Ethiopia. Parasites and disease-related conditions reduce fish production, and fish diseases are globally recognized as one of the most severe threats to both commercial capture fisheries and aquaculture [9]. These diseases can lead to mass mortality, and as fish farming becomes more intensive and widespread, the risk of parasitic infections intensifying also grows, presenting serious economic and health concerns. For example, the decline of *Labeobarbus intermedius* has been attributed to both overfishing and parasitic infections, resulting in reduced availability of fish in local markets [36].

Additionally, *Contracaecum* has been identified as the most significant parasite affecting fish in Lake Ziway. Nematodes also contribute to parasitic infections in fish, accounting for 8.60% of infections in *Oreochromis niloticus* and 19.02% in *Clarias gariepinus*, particularly within the gastrointestinal tract of the fish [41].

7. Fisheries Management Practice

Fishery management is a coordinated process through which the fishery management authority regulates both current and future fishing activities to sustain the productivity of aquatic resources. This process involves gathering and analyzing information, planning, decision-making, resource allocation, and the formulation and enforcement of fishery regulations [42]. Many of Ethiopia's rivers are facing significant challenges, making effective management essential for addressing these issues and improving the health of the water bodies. Management strategies should take into account both biophysical and socioeconomic factors, emphasizing policies like adopting watershed or ecosystem-based approaches, integrating income generation with conservation efforts, ensuring equitable distribution of responsibilities and benefits among local stakeholders, and strengthening institutional frameworks to support environmentally and socioeconomically sustainable lake development [31].

A management system integrates a range of regulatory measures within a specific resource to achieve desired outcomes. The success of these regulations relies on the support from resource user groups, their definition of the problems, their involvement in decision-making, and their role in implementing and enforcing the regulations. Therefore, effective management must incorporate human responses and motivations as integral components of the system that need to be studied and managed [14].

Those involved in fisheries management must adopt strategies that ensure the long-term conservation and sustainable use of fisheries resources. These conservation and management practices are essential for maintaining fishery resources at sustainable levels, promoting their optimal use, and ensuring their availability for both current and future generations. The primary objective of conservation and management is the long-term sustainable use of fisheries resources [2].

8. Conclusion and Recommendation

Ethiopia has significant potential to produce and supply fish and fish products through both capture fisheries and aquaculture. Fisheries play a crucial role in food security, income generation, and nutrition at local and global levels. The country's freshwater bodies host over 200 fish species, classified into 70 genera, 29 families, and 12 orders. Of these, 194 species are native, 40 are endemic, and 6 are exotic. Despite this biodiversity, the

contribution of fisheries to Ethiopia's economy remains minimal due to factors such as inadequate management, low market acceptance due to quality concerns, and other structural limitations. With population growth, fish demand is expected to increase, necessitating strategic improvements in the sector.

Recommendations for Enhancing Capture Fisheries:

- ✓ Promote awareness of fish welfare and productivity through training and extension services.
- ✓ Identify and control key threats to fisheries, including water management issues, climate change, and overfishing.
- ✓ Encourage indigenous investment in technologically advanced and scientifically supported aquaculture.
- ✓ Conduct well-organized studies on fish production and lake fishery management to effectively address sector-specific challenges and opportunities.

Contribution of authors:

All authors contributed during the preparation of the manuscript.

Conflict of interest:

There was no conflict of interest.

Source of funding:

No financial grant received from any organization.

References

1. Hebano AH, Wake AA (2020). Overview of Ethiopian fisheries production system and its challenges in different fish potential area: a review. International Journal of Fisheries and Aquatic Studies. 8 (5):148-156.
2. Béné C, Macfadyen G, Allison EH (2007). Increasing the contribution of small-scale fisheries to poverty alleviation and food security. Food and Agriculture Organization. No.48. Rome,Italy.
3. Deng GT (2020). Assessment of factors affecting fish production and marketing in Gambella region, Ethiopia. Scientific World Journal.16:5260693.
4. Pal M, Ketema A, Anberber M, Mulu S, Dutta Y (2016). Microbial quality of fish and fish products. Beverage Food World. 43 (2):46-49.
5. Yazew T, Kumsa D, Daba A (2020). Health benefits of fish consumption and its contribution to poverty alleviation and food security in Ethiopia: a review. Int J Nutr Food Sci. 9(4):118-24.
6. Pal M (2018). Importance of hygienic processing of fish. Agriculture World. 4: 40-43.
7. Alemu AE, Azadi H (2018). Fish value chain and its impact on rural households' income: Lessons learned from Northern Ethiopia. Sustainability.10 (10):10103759.
8. Muktar Y, Tesfaye S, Tesfaye B (2016). Present status and future prospects of fish vaccination: a review. Journal of Veterinary Science and Technology. 7 (2):1000299.
9. Kebede A, Meko T, Hussein A, Tamiru Y (2017). Review on opportunities and constraints of fishery in Ethiopia. International Journal of Poultry and Fisheries Sciences.1(1):1-4.
10. Abraham S, Mitiku L (2018). Challenges and socio-economic importance of fish production in Ethiopia: Review. Journal of Economic Sustainability and Development .9:17-21.
11. FAO (2014). (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. pp. 75-76.
12. Acharya KV, Shandage A, Dadhaniya P (2018). Medicinal, nutritional and biochemical values of fishes. Journal of Emerging Technologies and Innovative Research. 5 (7): 343-347.
13. Levêque C, Oberdorff T, Paugy D, Stiassny ML, Tedesco PA (2008). Global diversity of fish (Pisces) in freshwater. Hydrobiologia. 595: 545-567.
14. Janko AM (2014). Fish production, consumption and management in Ethiopia. Research Journal of Agriculture and Environmental Management. 3 (9):460-466.
15. Tesfaye G, Wolff M (2014). The state of inland fisheries in Ethiopia: a synopsis with updated estimates of potential yield. Ecohydrology and Hydrobiology. 14 (3):200-219.
16. Kebede MT, Gubale AG (2016). Fishery management problems in Ethiopia: natural and human induced impacts and the conservation challenges. Reviews in Fisheries Science and Aquaculture. 24 (4):305-313.
17. Teshome G, Getahun A, Mengist M, Hailu B (2015). Some biological aspects of spawning migratory Labeobarbus species in some tributary rivers of Lake Tana, Ethiopia. International Journal of Fish and Aquatic Studies. 3:136-141.
18. Wakjira M, Habtamu T (2011). Fisheries and Aquaculture. Department of Biology, Jimma University, Ethiopia. June 2011.
19. Mohanty BP, Mahanty A, Ganguly S, Mitra T, Karunakaran D, Anandan R (2019). Nutritional composition of food fishes and their importance in providing food and nutritional security. Food Chemistry. 293:561-570.
20. Berhe H, Bezabeh E (2021). Understanding fisheries' contribution to food and nutrition security in Ethiopia: A review Study. Global Scientific Journals. 9 (4):1076-1092.
21. Temesgen M, Getahun A, Lemma B (2019). Livelihood functions of capture fisheries in Sub-Saharan Africa: Food security, nutritional, and economic implications. Reviews in Fisheries Science and Aquaculture. 27(2):215-225.
22. Chekol AA (2013). Management and livelihood opportunity of Lake Tana fishery, Ethiopia (Master's Thesis, The Arctic University of Norway).
23. Asefa BG, Tsige FH (2021). Nutritive value of commercially important fish species from selected lakes in Ethiopia. Science Research. 9 (3):41-45.
24. Feleke FW, Mulaw GF (2020). Minimum acceptable diet and its predictors among children aged 6-23 months in Mareka District, southern Ethiopia: community based cross-sectional study. International Journal of Child Health and Nutrition. 9(4):202-211.
25. Holick MF (2008). The vitamin D deficiency pandemic and consequences for nonskeletal health: mechanisms of action. Molecular Aspects of Medicine. 29 (6):361-368.

26. Agrawal R, Darapuneni RR, Rao BV, Nanda SK, Bhattacharya S (2016). Assessment of employment potential for fisheries professionals in India. Indian Journal of Fisheries. 63 (2):102-109.
27. Onsongo VO, Osuga IM, Gachuiri CK, Wachira AM, Miano DM, Tanga CM, Ekesi S, Nakimbugwe D, Fiaboe KK (2018). Insects for income generation through animal feed: effect of dietary replacement of soybean and fish meal with black soldier fly meal on broiler growth and economic performance. Journal of Economic Entomology. 111(4):1966-1973.
28. Sánchez-Muros MJ, Barroso FG, Manzano-Agugliaro F (2014). Insect meal as renewable source of food for animal feeding: a review. Journal of Cleaner Production. 65:16-27.
29. Rumsey GL (2015). Fish meal and alternate sources of protein in fish feeds update 1993. Fisheries. 18 (7):14-19.
30. Kabir A, Hawkeswood TJ (2020). Remedial/medicinal value of Cuchia fish: a mini review. Calodema. 834: 1-5.
31. Desalegn T, Shitaw T (2021). Fishery resources, conservation challenges and management strategies in Ethiopia. Fisheries and Aquaculture Journal. 12 (3):1-5.
32. Lakew A, Tadesse Z, Dagne A (2016). Technologies suitable for aquaculture development in Ethiopia. Ethiopia Fish and Fisheries Association. Pp.20-37.
33. Alemu A (2021). Awareness of Community on Fishery and Aquaculture Production in Central Ethiopia. Journal of Aqua Fisheries. 5 (039):1-4.
34. Geremew A, Getahun A, Rana K (2015) Digestibility of soybean cake, niger seed cake and linseed cake in juvenile nile tilapia, Oreochromis niloticus L. Journal of Aquaculture Research and Development. 6 (5):1-5.
35. Birhanu K (2019). Assessing fish production, demand, and supply in the selected districts of North Shewa Zone, Ethiopia. African Journal of Agricultural Research. 14 (32):1520-1531.
36. Mengesha TA (2015). Fish species diversity in major river basins of Ethiopia: A review. World Journal of Fish and Marine Sciences. 7 (5):365-374.
37. Tilahun A, Alambo A, Getachew A (2016). Fish production constraints in Ethiopia: A review. World Journal of Fish and Marine Sciences. 8 (3):158-163.
38. Tesfahun A (2018). Review in current problems of Ethiopian fishery: In case of human and natural associated impacts on water bodies. International Journal of Fish and Aquatic Studies. 6 (2): 94-99.
39. Mohammed EY, Uraguchi ZB (2013). Impacts of climate change on fisheries: Implications for food security in Sub-Saharan Africa. Global Food Security, Nova Science Publishers, Inc. Pp.114-135.
40. Getahun A, Wakjira M, Nyingi DW (2020) Social, economic and management status of small-scale fisheries in Omo River Delta and Ethiopian side of Lake Turkana, southern Ethiopia. Ecohydrology and Hydrobiology. 20 (3):323-332.
41. Bekele J, Hussien D (2015). Prevalence of internal parasites of Oreochromis niloticus and Clarias gariepinus fish species in Lake Ziway, Ethiopia. Journal of Aquaculture Research and Development. 6 (2):1-4.
42. FAO (2010). Report of the Expert Consultation on Guidelines for Responsible Fisheries Management, Wellington, New Zealand. FAO Fisheries Report No. 519 100.
43. Lévêque, C., Oberdorff, T., Paugy, D., Stiassny, M.L.J. and Tedesco, P.A. (2008) Global Diversity of Fish (Pisces) in Freshwater. Hydrobiologia, 595, 545-567.

DOI:10.31579/2637-8914/297