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Community Knowledge, Awareness, and Fishing Practices on Fishing Management around Fincha'a, Amarti, and Nashe Reservoirs, Oromia, Ethiopia

Firisa Woyessa*[1,2], Geremew Bultosa[3], Diriba Diba[2] & Tilahun A. Teka[3]

[1]Department of Post-harvest Management, College of Agriculture and Veterinary Medicine, Jimma University, Jimma, Ethiopia
[2]Department of Animal Sciences, Faculty of Agriculture, Wollega University, Shambu, Ethiopia
[3]Department of Food Sciences and Technology, Botswana University of Agriculture and Natural Resources, Gaborone, Botswana

Abstract

The study investigated fishing practices and productivity in Fincha'a, Amarti, and Nashe Reservoirs in the Oromia region, Ethiopia. Data were collected from 160 households across Jimma Geneti, Horro, Abay Chomman, and Guduru Districts. Most respondents (60%) had 2–10 years of fishing experience, and fishing was primarily for household consumption (92%), with only 8% sold for income. Nile tilapia (55%) and common carp (36.9%) were the dominant species, while catfish (8.1%) are less common. Nile tilapia was preferred by 96.3% of respondents due to its availability and market value. Reservoir productivity was estimated at 49–51%, with seasonal fluctuations influenced by nutrient availability (91.3%), fishing efforts (6.3%), and fish behavior (2.4%). Morning was considered the best time for harvesting by 36.9% of respondents. Fishing spans 2 over 20 years, and 73.8% identify fishing as their primary occupation. Most fishermen (76.3%) traveled on foot and transported fish by hand or donkey due to transportation challenges. The study highlights the need for improved infrastructure to improve fish distribution. Overall, fishing in the area is for subsistence, with limited market participation. Nile tilapia remains the most favored species, and there is a need for better infrastructure to support fish distribution.

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*Corresponding Author:
Firisa Woyessa

E-mail:
firisafi@wollegauniversity.edu.et

INTRODUCTION

Ethiopia, a landlocked country in the Horn of Africa, relies solely on freshwater fisheries from its lakes, rivers, and reservoirs (Delilo, 2020). However, the country faces several challenges that contribute to the decline in freshwater fish populations, including overfishing, habitat degradation, climate change, biodiversity loss, siltation, water shrinkage due to encroachment, and the construction of dams that create migratory barriers (Sarkar et al., 2020). Catching immature fish disrupts their growth and reproductive cycles, ultimately reducing future fish productivity. Additional pressures, such as habitat destruction and pollution, further compromise the overall health and sustainability of fish populations (Mitra et al., 2023).

The destruction of critical habitats, such as breeding and nursery areas, reduces reproductive success, often leading to a decline in aquatic plants and organisms that serve as food for fish, stunting their growth (Siddique et al., 2022). Additionally, polluted and degraded environments create stress that compromises fish health, increasing mortality rates.

Urbanization in cities like Addis Ababa and regional capitals has driven growing demand for freshwater fish sourced from reservoirs such as Fincha and Amerti. This shift from subsistence fishing to commercialized fisheries reflects the growing reliance on aquaculture and marketed fish to meet the demands of urban markets. Urban consumers, often lacking direct access to fishing activities, purchase fish from retailers, thereby fueling a market-driven fishing industry (Mbegallo et al., 2025). Increased demand pressures have compelled fishermen to catch undersized fish. This can happen in Ethiopia or any region under similar circumstances. Factors such as population density, poor fisheries management practices, and inefficient or unsustainable fishing technologies exacerbate the issue (Han & Chen, 2024). For instance, the use of gill nets with a mesh size of at least 50 mm has been recommended to capture fish weighing over 1.0 kg, promoting sustainable fishing by allowing smaller fish to grow and reproduce. Overfishing risks have been noted in Ethiopian towns such as Bahir Dar, Zuway, Hawassa, Arbaminch, and Bishoftu (Wendimu et al., 2024). These areas, located near significant water bodies, are vulnerable due to their growing urban populations and increasing market demand for fish. Sustainable fishing practices, stricter enforcement of regulations, and community awareness programs are essential to address these challenges (Nguyen, 2024).

Since the 1980s, Ethiopia's reservoirs, such as Fincha, Amarti, and Nashe, have been suitable for the introduction of various fish species, including common carp (*Cyprinus carpio*), grass carp (*Ctenopharyngodon idella*), and Nile tilapia (*Oreochromis niloticus*). By 1998, Tilapia zillii, also known as redbelly tilapia or Coptodon zillii, had established itself in the Fincha reservoir. The Amarti reservoir, downstream of the Amarti River, was designed to increase the water storage capacity of the Fincha'a reservoir for hydroelectricity generation, supporting the aforementioned fish species. In 2003, 30 Nile tilapia (Oreochromis niloticus) were introduced into the Nashe reservoir. Together, these three reservoirs currently have the potential to produce 1,822 tons of fish annually (Anteneh et al., 2023).

Statement of the problem

Despite the potential of over 1800 tons annually from reservoirs such as Fincha'a, Amarti, and Nashe, fisheries productivity remains low and inconsistent. Local communities in the study areas have historically lacked knowledge and proper practices related to fishing and fish consumption, as fish were not traditionally a staple diet. Additionally, there is a lack of assessment and documentation regarding fish production and fishing practices for the various fish species in the Fincha'a, Amarti, and Nashe areas, as well as their overall productivity. Therefore, this study aims to evaluate community knowledge, fishing practices, and productivity in the Fincha'a, Amarti, and Nashe reservoirs in the Horro Guduru Wollega Zone of the Oromia Region.

Research Questions

1. What are the current fishing practices in the Fincha'a, Amarti, and Nashe reservoirs?
2. How do they affect fish productivity and sustainability?
3. What are the key environmental, technological, and socio-economic factors contributing to the decline of freshwater fish populations in these reservoirs?

MATERIALS AND METHODS

Description of the study area

The study focused on the Fincha'a, Amarti, and Nashe reservoirs in the Horro Guduru Wollega Zone of the Oromia Regional State, across four Woredas: Jimma Geneti, Horro, Abay Chomman, and Guduru. These reservoirs are approximately 310–320 km northwest of Addis Ababa, as shown in Figure 1.

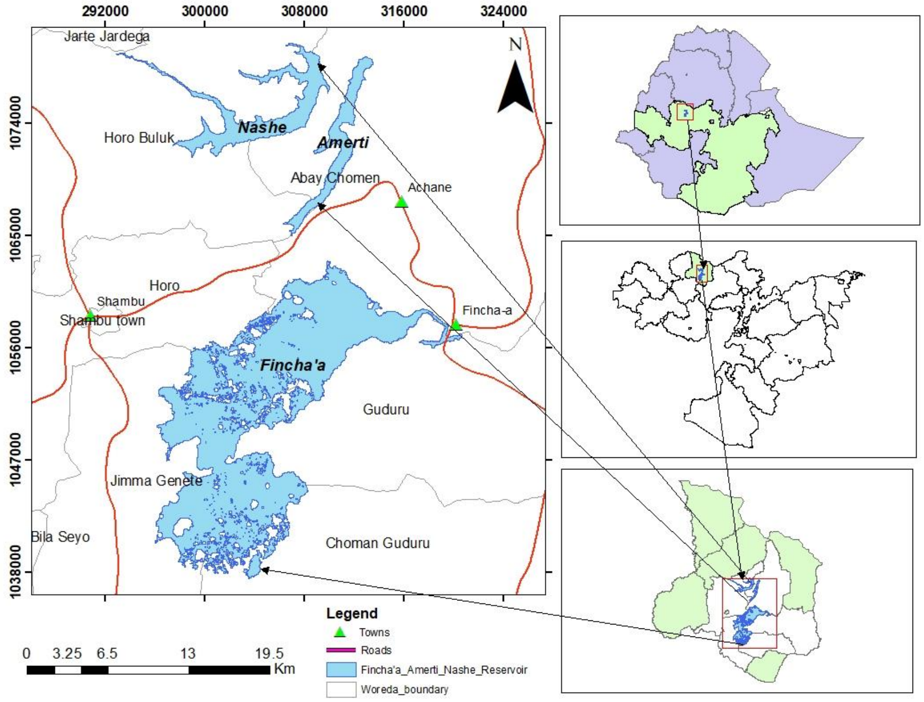

Figure 1. *Location of three reservoirs*

The Fincha'a reservoir (≈1,318 km²) accounts for the majority, whereas Amarti (≈172 km²) lies downstream and supports both hydropower generation and fisheries. Nashe reservoir (≈102 km²) covers the smallest and most recently established area, introduced with Nile tilapia in 2003. The climate is temperate-humid, with mean annual rainfall of approximately 1,800 mm and temperatures ranging between 31.5°C and 19.5°C (Kenea et al., 2021). The primary rainy season is from May to August, with shorter seasons from November to February, as noted by Tefera and Sterk (2008).

Research Design

We employed a mixed-methods, explanatory sequential design to integrate both quantitative and qualitative approaches. The quantitative phase measures fishing productivity, resource utilization, and community awareness through structured surveys and ecological assessments. The qualitative phase (focus group) interviews help interpret and contextualize quantitative findings. This design ensures data triangulation, enhances validity, and provides both breadth and depth of understanding regarding fishing practices and management awareness.

Sampling Frame and Techniques

The target population includes fishing households residing within 5 km of the reservoir shoreline, fishery officers and cooperative leaders engaged in reservoir management, and local government and agricultural bureau representatives who influence fishery regulation. A multi-stage stratified sampling technique was used: stratified by reservoir (Fincha'a, Amarti, and Nashe) and by stakeholder type (fishers, traders, and officers), with systematic random sampling used to select households proportionate to stratum size. The sampling frame was developed using fishery registration lists, community records, and kebele administrative rosters to ensure representation and minimize selection bias.

Data Collection Methods

Household Survey

A structured questionnaire was administered to 160 respondents to collect data on fishing experience, techniques, and frequency; gear type, catch volume, and seasonality; awareness of management rules, conservation attitudes, and market linkages; and socio-economic indicators (income, education, household size) on Fincha'a, Amarti, and Nashe reservoirs. Data were collected through household surveys. The questionnaire was pretested for clarity and translated into Afan Oromo for consistency.

Ecological Assessment

To validate productivity claims, biophysical sampling was conducted using catch-per-unit-effort (CPUE) measurements with standardized gillnets (mesh sizes >50 mm) and fish species identification and size distribution (Nile tilapia, common carp, and catfish). These data establish correlations between environmental variables and fish productivity, addressing a key methodological gap from prior studies.

Focus group discussions (FGDs)

FGDs with 8 participants explore their traditional ecological knowledge; perceptions of sustainability and regulatory compliance; gender roles in fishing, processing, and marketing.

Key informant interviews (KIIs)

KIIs were conducted with fisheries officers, cooperative leaders, local administrators, and experts from the Environmental and Agricultural Bureau.

Sample size determination

The sample size was calculated using Yamane's (1967) formula for finite populations:

$$n = \frac{N.Z^2.P.(1-P)}{e^2.(N-1) + Z^2.P.(1-P)}$$

Where N = sample of fishermen in study area = 270, Z = confidence level: 95% (Z = 1.96), e = margin of error: 5% (e = 0.05), and P = proportion: p = 0.5 (for maximum variability)

Using the finite population correction formula:

$$n = \frac{270.1.96^2.0.5.(1-0.5)}{0.05^2.(270-1) + 1.96^2.0.5.(1-0.5)}$$

$$n = \frac{270 * 3.8416 * 0.25)}{(0.0025 * 269) + (3.8416 * 0.25)}$$

$$n = \frac{259.01}{0.6725 + 0.9604} = \frac{259.01}{1.6329} = 158.6 = 159$$

This yields approximately 160 respondents, distributed proportionally among the three reservoir communities. Additionally, 15 key informants and 6 focus groups were purposively selected to capture qualitative perspectives.

Statistical Analysis

The quantitative data were analyzed using the Statistical Package for Social Sciences (SPSS) version 23.0. Descriptive statistics: percentages, frequencies, means, and standard deviations. We use correlation and regression analyses to examine the relationships between fishing efforts, awareness, and productivity. We use ANOVA to compare productivity across reservoirs and seasons, and chi-square tests to examine the associations between categorical variables, gear types, and awareness. We used Principal Component Analysis (PCA) to break down multidimensional socio-economic variables into key factors. Qualitative analysis of FGDs and FactingIIs was conducted based on patterns of belief, governance, and gender participation.

RESULTS AND DISCUSSION

Results

Biography of the respondents

Table 1 presents an overview of the general characteristics observed within the study area's community.

The results indicate that 78.8% of respondents were within the productive age range of 18-50 years, with 48.8% aged 18-30, indicating that the data largely reflect insights from active and experienced fishers. All participants were male, reflecting the gender-segmented nature of the fishery sector, where fishing is culturally considered a male occupation.

Table 1

Age, marital status, and education attributes of the participant

Variables		Resp	%	F	X^2	Sign
Age	18-30	77	48.4%	18.360	51.745[a]	NS
	31-50	49	30.4%			
	<18	28	17.4%			
Marital status	Single	74	46.3	13.951	35.783[a]	NS
	Married	85	53.1			
	Divorced	1	0.6			
Education level	Primary education	77	48.1	4.193	25.913[a]	0.007
	Secondary education	52	32.5%			
	post-secondary	17	10.6%			
Gender	Male	160	100%			

Where a indicates the chi-squared statistic reported, it is the likelihood ratio; NS is non-significant.

Nonetheless, focus group discussions revealed women's indirect involvement in post-harvest activities, such as processing, sorting, and marketing, thereby demonstrating that the mixed-methods design effectively captured the gendered division of labor within the reservoir communities. The age cohort with the highest prevalence among respondents was 18–30 years, accounting for 48.4% of the total (Figure 2).

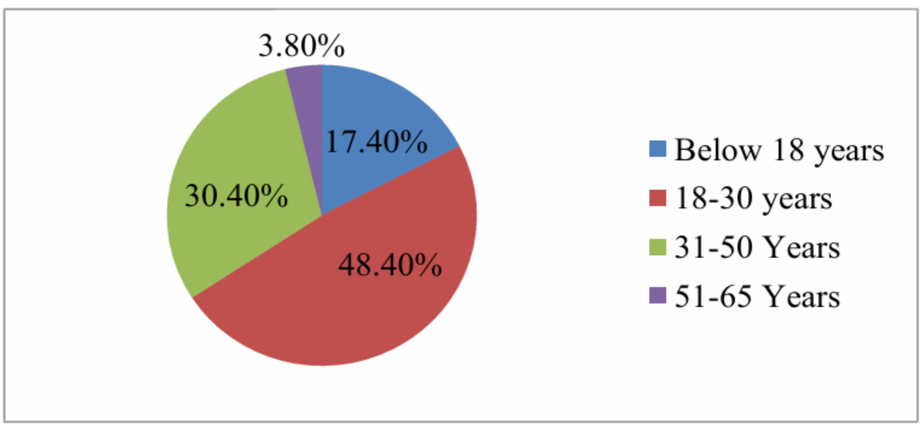

Figure 2. *The age category of the respondent*

The mean age of respondents was 29.6 ± 6.8 years, indicating that young and middle-aged men predominate in the fishery sector. Chi-square tests revealed no significant variation across age ($X^2 = 18.36$, $p > 0.05$) or marital status ($X^2 = 13.951$, $p > 0.05$). Over half (53.1%) were married. Nearly half (48.1%) had only primary education, which emphasizes the value of education as a key socio-economic indicator. A significant relationship between education and awareness ($\chi^2 = 25.913$, $p = 0.007$) confirmed that higher education is associated with greater knowledge of sustainable fishing and regulatory compliance. Interviews revealed that education supports conservation-oriented behaviors and adherence to community norms.

The dominance of young, active male fishers explains high participation and frequent fishing trips. Conversely, limited land access and low educational levels reduce livelihood options, reinforcing dependence on subsistence-based fishing, with 92.5% of the fish primarily used for household consumption. By integrating socio-economic indicators (income, land access, and education) with behavioral variables (technique, frequency, and seasonality), the study provides a comprehensive view of fishing practices and their economic and ecological implications.

Table 2

The landholding capacity of the respondent

Land size (hectare)	Frequency	Percent	X^2	Sign.
No land	114	71.3	24.539[a]	Ns
1	25	15.6		
2	14	8.8		
3	6	3.8		
4	1	0.6		

Where a indicates the chi-squared statistic reported, it is the likelihood ratio; NS is non-significant.

The socio-economic survey assessed land access and ownership to evaluate livelihood dependence on fisheries. As shown in Table 2, 71.3% of respondents were landless, and 15.6% owned only one hectare, highlighting severe land scarcity that drives reliance on fishing. Most (63.7%) rented land, while 32.5% cultivated family plots; landless households often engaged in small-scale trading that was insufficient for subsistence.

Descriptive analysis (mean landholding = 0.42 ± 0.73 ha) confirmed heavy dependence on fishing. At the same time, chi-square tests ($\chi^2 = 24.539$, $p > 0.05$) showed uniform land scarcity across reservoir sites, and Pearson's correlation ($r = -0.41$, $p < 0.01$) indicated that smaller landholdings corresponded to higher fishing frequency. By cross-referencing land size with fishing experience and income, the study examined how limited access to arable land increases fishing frequency and effort. This correlation supports the inclusion of fishing effort and catch volume as key indicators of economic dependence on fisheries under conditions of agricultural constraint.

A multiple regression ($F = 5.73$, $p < 0.01$; adjusted $R^2 = 0.34$) revealed that land size and education awareness together explained 34% of the variation in fishing effort, underscoring the link between socio-economic constraints and fishing intensity. Principal Component Analysis (PCA), combining income, landholding, household size, and education, produced a socio-economic index showing that 38.2% of households in the lowest income quartile also lacked land and had minimal education. Qualitative interviews corroborated these findings, indicating that households without land and with lower levels of education fish more frequently for subsistence and small-scale trade. Overall, the findings confirm that socio-economic vulnerability, driven by land scarcity and limited livelihood options, is a key determinant of fishing intensity across the Fincha'a, Amarti, and Nashe reservoirs.

Available fish species

The study identified three dominant fish species across the Fincha'a, Amarti, and Nashe reservoirs: Nile tilapia (55%), common carp (36.9%), and catfish (8.1%) (Table 3). Nile tilapia was the preferred species for consumption among 98.1% of respondents. Participants also reported significant differences in fish population composition across the study sites ($p<0.05$) (Table 3). Observed interspecific variation ($F = 4.846$, $p = 0.009$) supports the application of biophysical sampling to quantify productivity differences. To validate community-reported abundance patterns and address methodological gaps in previous studies, Catch per Unit Effort (CPUE) was measured using standardized gillnets (mesh size >50 mm).

Table 3

The abundance of fish species in the reservoirs

S/N	Fish species	Freq	Percent	Stand	SE	F. value	SL
1	Nile tilapia	88	55%	0.869	0.080	4.846	0.009
2	Common carp	59	36.9%	0.571	0.104		
3	Catfish	13	8.1%	1.068	0.296		

SE = standard error; SL = significance level

These field-based data confirmed species-level distribution patterns and provided an empirical foundation for comparing productivity among reservoirs. Complementing the biophysical data, Focus Group Discussions (FGDs) were conducted with eight participants per reservoir, including active fishers, traders, and community elders. These discussions captured traditional ecological knowledge, perceptions of trends in fish abundance, and the community's perspectives on sustainability and regulatory compliance. Participants emphasized the central role of Nile tilapia as the most resilient and economically valuable species, while noting the recent proliferation of catfish, an unmanaged species with rapid reproductive rates. FGDs also highlighted gender-differentiated roles; men primarily engaged in capture fishing, while women contributed to post-harvest processing and local marketing, corroborating the demographic insights derived from the household survey.

Key Informant Interviews (KIIs) with fisheries officers, cooperative leaders, local administrators, and experts from the environmental and agricultural bureaus provided an institutional perspective on stocking practices, gear regulations, and ecosystem management. Stakeholders confirmed the absence of routine ecological monitoring and recommended implementing annual fish population assessments to guide sustainable resource management.

Collectively, CPUE data, FGDs, and KIIs offer triangulated validation of fish abundance and productivity patterns. Quantitative CPUE results establish empirical accuracy, while qualitative evidence contextualizes the socio-ecological factors that influence species distribution and preferences. This integrated methodological approach effectively bridges biophysical and community-based evidence, enhancing the reliability of conclusions regarding reservoir fish productivity and management priorities.

The dominance of Nile tilapia across all reservoirs, reinforced by its wide availability and strong consumer demand, contrasts with the opportunistic proliferation of catfish, whose productivity is favored under supplemental feeding conditions. Variations in species composition likely reflect differences in physiological and reproductive performance, as well as the timing of species introductions within the Fincha'a, Amarti, and Nashe reservoirs.

In the present study, Nile tilapia (55%) and common carp (36.9%) were identified as the dominant species in the reservoirs, accounting for 91.9% of the total fish population (Figure 3). However, the reservoirs currently lack systematic ecological monitoring, limiting the ability to track long-term population dynamics. Respondents reported the recent emergence of catfish populations, which appear to be reproducing rapidly and spreading without deliberate introduction, suggesting potential ecological shifts within the reservoir systems.

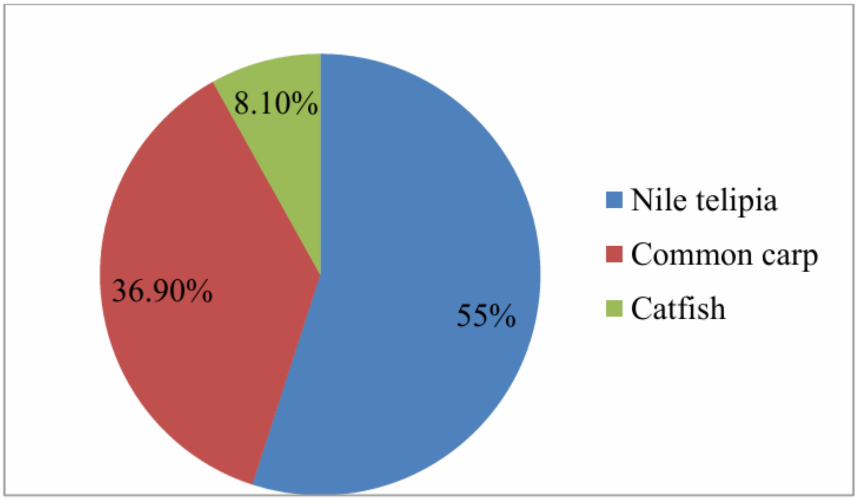

Figure 3. *The proportion of fish species in the study area*

Status of Fish in the Reservoirs

Although the study area comprises three reservoirs, Fincha'a, Amarti, and Nashe, the status of fish resources remains contested. In Fincha'a reservoir, respondents expressed divergent views: 50.6% perceived an increase in fish abundance, while 49.4% reported a decline (Table 4). This divergence in perceptions illustrates the difficulties associated with assessing trends in aquatic resources within reservoir systems. Positive views of fish stock improvement were attributed to enhanced water management, restocking efforts, natural population growth, and favorable environmental conditions. In contrast, negative perceptions reflected concerns about overfishing, habitat degradation, and the effects of climate variability.

Table 4

Status of fish in the three reservoirs

Reservoir	Do not know the status.	Increasing status	Decreasing status	X^2	Sign	Remark
Fincha'a	No value	50.6	49.4	5.545[a]	0.63	Ns
Amarti	59.4	21.3	19.4	3.432[a]	0.488	Ns
Nashe	88.8	2.5	8.8	5.545[a]	0.63	Ns

Where a indicates the chi-squared statistic reported, this is the likelihood ratio; NS is non-significant.

In contrast, respondents from the Amarti (59.4%) and Nashe (88.8%) reservoirs expressed uncertainty regarding fish stock status, highlighting the limited ecological monitoring and persistent data gaps. These discrepancies illustrate the challenges of relying solely on perception-based evaluations of aquatic resource dynamics.

To reconcile these differing community perspectives, the study employed triangulation to validate data. Catch per Unit Effort (CPUE) measurements provided quantitative evidence of fish abundance, confirming moderate productivity variations among reservoirs, while Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) contextualized these patterns: FGDs indicated that fishers associated improved catches with recent rainfall and informal restocking, while KIIs with fisheries officers and cooperative leaders attributed observed declines to unregulated mesh sizes, weak enforcement mechanisms, and inadequate habitat restoration.

This integration of quantitative CPUE data with qualitative community perceptions enhanced the credibility and internal validity of findings. This mixed-methods approach ensured that assessments of fish resource status reflected empirical measures of productivity and community-informed ecological insights, providing a comprehensive understanding of fishery dynamics across the Fincha'a, Amarti, and Nashe reservoirs.

Seasonal variation of fish abundance

Fishing schedules were flexible, adapting to daily routines rather than following fixed patterns. Most fishermen (36.9%) preferred fishing in the morning, citing higher catches and fewer conflicts with agricultural or community activities, while 19.4% cited greater fish activity during early hours. However, concerns were raised about the use of unrestricted mesh sizes, particularly in evening "tirimala" net fishing, which risks capturing juvenile fish.

Respondents identified fish availability (45.0%), visibility (34.3%), and environmental stability (13.8%) as key factors influencing fishing times (Table 5). Nearly all (91.9%) agreed that fish harvests vary seasonally, while a small fraction (6.2%) reported no seasonal effect. Most fishermen (91.3%) identified winter as the peak harvest season, while 8.8% selected summer, a statistically significant difference ($P<0.05$).

Both ecological and social assessments reinforced the observed seasonal patterns in fish abundance. Most fishermen (36.9%) preferred morning fishing due to higher catches, while 19.4% noted increased fish activity early in the day. CPUE data from the ecological assessment showed higher catch rates in the early hours, particularly for Nile tilapia, common carp, and catfish. These findings quantitatively confirmed that environmental variables, especially light availability and water stability, are closely correlated with fish activity and abundance. This evidence helps address prior methodological gaps in assessing fishing productivity.

Findings from FGDs and KIIs supported these results, indicating that environmental variability and human practices jointly shape fishing patterns. Overall, integrating quantitative and qualitative data underscores the need to align ecological assessments with traditional knowledge to promote sustainable freshwater fisheries management. Activities corroborate the quantitative findings that nearly 92% of fishers perceive strong seasonal effects. FGDs also raised sustainability concerns about evening or nighttime "trimala" net fishing and echoed ecological findings on the risks of capturing undersized fish.

Key informant interviews (KIIs) with fisheries officers, cooperative leaders, and environmental experts further validated these observations. They confirmed that winter months consistently yield higher catches, while summer yields remain lower. These qualitative insights reinforce the statistically significant perceptions of seasonal variation among fisheries ($P<0.05$).

Impact of feed on fish production

Respondents reported diverse seasonal preferences: 50.0% favored winter (January - April), citing reduced water volume and easier fishing aggregation, while 45% attributed their preference to limited feed availability. A smaller proportion preferred summer (June, July, and September), emphasizing environmental stability (Table 5).

Table 5

Possible reasons for the harvesting time variation

Reasons	Frequency	Percent
Availability of feed	72	45.0
Stability of the environment	11	6.9
Other	55	34.3
Visibility	22	13.8

43.1% of respondents reported fish mortality, with 56.8% attributing the losses to predators such as birds and children. Feed availability, habitat conditions, and temperature dynamics strongly influenced seasonal variations in fishing activity. Unlike other reservoirs, the Fincha'a reservoir contains submerged grasslands grazed by animals. The movement of grazing grass with reservoir water, facilitated by wind, affects the potential for fish harvesting, thereby influencing overall productivity.

This finding underscores the need to integrate local ecological knowledge with scientific assessments to understand fishing dynamics better. The Fincha'a reservoir presents a unique environmental context. Unlike other reservoirs, it contains submerged grasslands grazed by livestock. The movement of these grasses, driven by wind and water currents, influences fish distribution and the potential for harvesting.

Overall, interactions among feed availability, seasonal and habitat conditions, fishing methods, and human-induced disturbances shape fish production in the reservoirs. Integrating ecological measurements with local knowledge is therefore critical for sustainable fisheries management strategies.

Fishing practice

Fishing practices in the study area are essentially individualistic, with 91.9% of respondents reporting that they fish based on personal preference rather than collective effort. Respondents reported having 2–20 years of fishing experience. More than half (51.9%) had 2–5 years of experience, 36.3% had 6–10 years, 10.6% had 11–20 years, and only 1.3% had over 20 years of experience (Table 6).

Table 6

Fishing experience of the respondent

Fishing experience	Frequency	Percent	F value	X^2	Significance
2-5 years	83	51.9	0.942	1.750[a]	0.333
6-10 years	58	36.3			
11-20 years	17	10.6			
> 20 years	2	1.3			

Where a indicates the chi-squared statistic reported is the likelihood ratio

Fishing in the study area is predominantly subsistence-based. A total of 92.5% of respondents fish primarily for household consumption, while only 7.5% fish primarily for income (Figure 4). Although primarily subsistence-oriented, respondents recognized the economic potential of fishing. Half (50%) viewed fishing as a source of income, 31.1% considered it their main livelihood, and 18.8% saw it as a supplementary income source. Furthermore, 18.8% believed fishing could become a leading livelihood with effective resource management, while 50% did not prioritize it as their primary occupation.

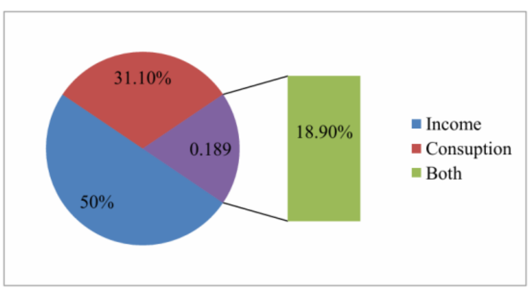

Figure 4. *Purpose of fishing in the community*

Fishing effort varied considerably: 73.8% of respondents fished throughout the day, while other responsibilities constrained 26.3%. Market access emerged as a significant challenge; 76.3% walked to sell their catch. More than half (55.9%) estimated the market distance at 5–10 km, while 36% reported a distance of about 5 km. Gear and vessel use reflected resource limitations. Most fishers (71.3%) relied on metal gear without boats, and those with boats mainly used traditional wooden types.

94.4% of those with government support or boat rental options did not actively engage in fishing, despite many expressing interest. However, 90.6% lacked awareness of alternative livelihood options. The majority (95.6%) stressed that establishing sustainable market systems, rather than merely increasing inputs, should be prioritized. Significant constraints included rapid fish spoilage due to the tropical climate, long travel distances (averaging 15.7 km to Lake Langano), and limited adoption of modern fishing technologies.

According to the respondents, their involvement in uncooperative fishing spans 2–20 years. The majority (51.9%) have practiced fishing for 2-5 years, while 36.3% have a fishing tenure of 6-10 years (Table 6). Additionally, 10.6% have engaged in fishing for 11–20 years, with only 1.2% having had fishing experience exceeding 20 years.

In practice, 73.8% fished throughout the day, while other commitments restricted 26.3%. While some relied on government support or rentals, 94.4% did not engage in fishing, despite showing interest, and 90.6% were unaware of alternative activities. Unlike other sectors, 95.6% valued a sustainable market system over more inputs.

Fishing materials used in catching fish

The fishing technology employed significantly influences fish productivity and overall production in fishing activities. The choice of fishing materials is based on their handling ability and cost (Table 7). This phenomenon is evident in the local market, where various fish sizes and types are available, reflecting the diverse fishing methods used.

Fish of all sizes, including larger bottom species (40), now flood local markets. Fishing technology plays a critical role in determining fish productivity and overall catch efficiency. Ease of handling and cost primarily influenced the selection of fishing materials in the study area (Table 7). The majority of respondents (86.5%) used conventional fishing gear, while smaller proportions employed mosquito protectors ("Agobar," 6%), trimala nets (3.8%), or homemade sharp metal tools (3.7%).

Analogous patterns have been observed in marine systems; for example, the decline of coastal cod populations has released prey species such as lobsters, crabs, and sea urchins from fishing pressure, demonstrating how gear selectivity can indirectly affect ecosystem dynamics. Nevertheless, without regulated use, such improvements may exacerbate overexploitation, habitat degradation, and ecosystem imbalance. These findings underscore the need to integrate sustainable gear management into fishing practices to balance productivity with ecological conservation.

Table 7

Fishing materials used in catching fish

Fishing materials	Frequency	Percent
Fishing gears	138	86.5
Mosquito protector (Agobar)	10	6
Trimal	6	3.8
Homemade sharp metal	6	3.7

Discussion

Biography of the respondents

These findings align with earlier studies showing that both freshwater and marine fisheries are predominantly occupied by young adult males (Devenport et al., 2021). This demographic dominance is often attributed to the physically demanding nature of fishing and to its perception as a male-oriented occupation in many rural communities. The concentration of men in active fishing roles reflects broader sociocultural norms that associate masculinity with physical labor and risk-taking, attributes commonly linked to fishing and seafaring professions. Similar to Onumah et al. (2020), this study found that married respondents were more likely to prioritize fish consumption within their households. This trend may result from greater family responsibilities and a preference for nutrient-rich, locally available protein sources such as fish, which supports household food security and dietary diversity.

Moreover, prior studies have consistently highlighted that, while women are largely excluded from direct fishing, they play critical, yet often undervalued, roles in post-harvest stages such as processing, sorting, drying, and marketing (DN & PVS, 2025; Tran & Guzey, 2024). Their involvement ensures the economic circulation of fish products and contributes significantly to household income generation. However, entrenched cultural perceptions portraying fishing as too physically demanding for women have reinforced gendered divisions of labor, confining women's participation to indirect or supportive roles within the fisheries value chain. These dynamic underscores the need for gender-inclusive fisheries management policies that recognize and strengthen women's economic contributions beyond the capture stage.

Available fish species

These results correspond with Wake et al. (2020), who reported that limited access to arable land and declining agricultural productivity often compel rural households to diversify their livelihoods toward fisheries-based activities. In contexts where crop cultivation and livestock rearing are constrained by land scarcity, erratic rainfall, or soil degradation, fishing emerges as a more reliable and accessible source of income and nutrition. Similarly, in the present study, the predominance of landless or smallholder households indicates that fishing is not merely a cultural practice but a livelihood necessity shaped by environmental and economic pressures. This alignment underscores the interdependence between agricultural limitations and increased fishing intensity within resource-constrained rural settings.

These observations are consistent with Mirera et al. (2023) and Bulengela et al. (2020), who documented the dominance of Nile tilapia in regional fish markets and its strong consumer preference due to its affordability, mild flavor, and adaptability to diverse aquatic environments. The widespread market appeal of Nile tilapia reflects both biological and socio-economic factors; its fast growth rate, high reproductive potential, and year-round availability make it a preferred choice for producers and consumers alike.

Status of Fish in the Reservoirs

Comparable reservoir systems in Ethiopia (Gemechu et al., 2020) and across the Indo-Burma biodiversity hotspot (Akbari et al., 2020) have reported similar species compositions, with Nile tilapia and common carp emerging as dominant freshwater species. These similarities suggest a broader ecological pattern in managed and semi-natural reservoir systems, where stocking programs, environmental conditions, and species adaptability jointly shape community composition. Collectively, these studies confirm that the prevalence of Nile tilapia is not an isolated occurrence but rather part of a regional trend in freshwater aquaculture and capture fisheries, driven by ecological suitability and market-driven demand.

Seasonal variation of fish abundance

Similar patterns were reported by Fernando and Súarez (2021) and Meyer et al. (2023), who found that environmental variables such as feed availability, water temperature, dissolved oxygen levels, and light intensity exert a strong influence on fish abundance and catch variability across seasons. Their studies demonstrate that fish tend to be more active and accessible to capture under cooler, stable morning conditions when oxygen levels are higher, and visibility is optimal for net deployment. This relationship highlights the ecological sensitivity of fishing success to diurnal and seasonal fluctuations in environmental parameters.

The early morning fishing preference observed in the present study aligns with findings by Ahi et al. (2023) and Geoffroy and Priou (2020), who similarly reported that dawn fishing yields higher catches, particularly in inland and estuarine systems. This temporal pattern reflects fish behavioral rhythms linked to feeding and movement cycles, as well as fishers' strategic adaptations to optimize effort while avoiding conflicts with agricultural or community tasks. Together, these studies reinforce the conclusion that environmental and behavioral factors jointly shape fishing patterns and productivity across freshwater ecosystems.

Impact of feed on fish production

Fish are poikilothermic; their body temperature, metabolism, and digestion depend strongly on ambient water temperature. In Nile tilapia, growth performance, feed intake, and immune responses were significantly better at ~30°C than at 26°C; feeding frequency also interacted with temperature (Hamed et al., 2024). In a study on common carp, growth and protein utilization differed between summer (~25°C) and winter (~18.7°C), with different optimal protein levels (Al Sulivany et al., 2024).

Seasonal environmental constraints (temperature, daylight, and water quality) will influence how effectively feed is utilized and thus production. Matching fish feed to fish physiology emphasized that in colder seasons, fish metabolism slows, so digestibility and nutrient uptake decline; therefore, feed may need to have altered lipid/phospholipid content, emulsifiers, and more available peptides (Volkoff & Rønnestad, 2020). In winter, when feed intake is reduced, using highly digestible lipids and emulsifiers helps ensure the limited feed is used efficiently (Hossain et al., 2024). For aquaculture systems that face seasonal variation, feed manufacturers and farm managers should consider "season-tuned" formulations rather than a one-size-fits-all approach year-round.

Fishing materials used in catching fish

These findings align with those of Warren and Steenbergen (2021), Sampantamit et al. (2020), and Overå et al. (2022), who collectively emphasize that the absence of cooperative management structures, inadequate infrastructure, and limited access to modern fishing technologies significantly constrain the productivity and resilience of small-scale fishers. Warren and Steenbergen (2021) observed that when fishers operate individually rather than in organized cooperatives, resource use becomes inefficient and unsustainable because shared norms for gear use, restocking, and conservation are weak or nonexistent. Similarly, Sampantamit et al. (2020) highlighted that technological stagnation, characterized by reliance on traditional gear, manual labor, and non-motorized boats, reduces catch efficiency and limits economic returns, reinforcing cycles of subsistence dependence.

Overå et al. (2022) further demonstrated that poor infrastructure, such as inadequate transport systems and a lack of cold storage facilities, restricts fishers' access to markets and leads to post-harvest losses, ultimately lowering profitability and discouraging investment in the sector. The consistency between these studies and the present findings suggests that structural barriers, rather than resource availability alone, are the primary factors suppressing the economic potential of small-scale fisheries. Addressing these limitations through cooperative organization, technological adoption, and infrastructure development could therefore transform subsistence-oriented fisheries into more sustainable and commercially viable livelihood systems.

CONCLUSIONS

This finding discusses the community knowledge, awareness, fishing practices, and productivity in the Fincha'a, Amarti, and Nashe reservoirs. It highlights the significant role of fishing in local communities for young individuals with limited agricultural land. Men were found to be dominant in fishing activities in the study area. Nile tilapia, common carp, and catfish are the dominant species, with fish availability varying seasonally.

Capacity building through training and raising awareness about fish consumption, management, fishing equipment, marketing, and overall fishing practices is essential. To ensure sustainability, the study emphasizes the need for sustainable fishing techniques, cooperative practices, and improved market infrastructure. Community involvement and public awareness campaigns are crucial for promoting proper fish handling and increasing fish consumption in the study area and beyond. A comprehensive, community-centered strategy is essential to ensure the long-term sustainability and benefits of fish resources in Fincha'a, Amarti, and Nashe reservoirs.

Recommendations

Based on the key findings of this study, it is recommended that promoting appropriate mesh sizes in nets, engaging local communities through cooperatives, improving market infrastructure, and monitoring fish populations and habitats are of significant importance to ensure sustainable fish production in Ethiopia.

CRediT Authorship Contribution Statement

Firisa Woyessa: Writing—Original Draft, Conceptualization, Methodology, Software.
Geremew Bultosa: Validation, Formal analysis, Supervision **Diriba Diba:** Visualization, Project administration **Tilahun A. Teka:** Resources, Funding acquisition, Writing—Review & Editing

Declaration of competing interest

The authors declare that there is no conflict of interest.

Ethical approval

Informed consent was obtained from all subjects and/or their legal guardian(s).

Data availability

The compiled or raw data used for this research is available upon request from the corresponding author.

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