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Original Article

Ichthyofauna of Gibe Sheleko National Park and some morphometric relationships of fish of the tributary rivers, Southern Ethiopia

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Abstract
Understanding of Ichthyofaunal diversity is a major gateway for the conservation of waterbodies in the world. Ethiopia has a rich Ichthyofaunal diversity, although they are poorly known. This study was carried out in two tributary rivers (Gibe and Wabe) of Gibe Sheleko National Park to investigate Ichthyofaunal diversity and morphometric characteristics of fish. By using monofilament gill-nets, fish were collected, identified and measured their morphometric. A total of 10 species were identified, dominated by *Synodontis schall*, followed by *Labeobarbus nedgia* and *Labeobarbus intermedius*. According to the Index of Relative Importance, *S. schall* was also first (49.13%), followed by *L. intermedius* (15.49%). Gibe River had a higher number of species than Wabe River. The Shannon Diversity Index in Gibe River was also higher (2.09) than Wabe (1.84) during the dry season, but lowest in the wet season (1.52 and 1.57 respectively). *Synodontis schall* had the largest girth, but *Clarias gariepinus* had the largest eye diameter and body weight. *Heterobranchus longifilis* was first in total, fork and standard body length. Generally, differences in sampling habitats and fishing effort might have contributed to discovered variants findings. Fishery development should be implemented in the Park to use the fish resource sustainably.

Keywords: Diversity; fauna; fishery; freshwater; national park

1 | INTRODUCTION

Ichthyofauna is assemblage or variety of fish species in a waterbody or zoogeographic region. Over 40% of global fishes live in freshwater ecosystems which is one quarter of global vertebrate diversity (Lundberg *et al.* 2000). In East Africa, Ethiopia is the water-tower and endowed with several water bodies that contain a high diversity of fish (Golubtsov and Mina 2003; Golubtsov and Darkov 2008) but they are poorly known (Awoke 2015). Studies indicate that the number of species could be over 200 (e.g. Awoke 2015; Awoke *et al.* 2015) of which about 38 species and two sub-species are endemic to Ethiopia (Getahun 2007).

The understanding of fish faunal diversity is a major gateway for the exploitation of freshwater habitats (Chaki *et al.* 2014; Naik *et al.* 2014; Galib *et al.* 2016). Although Ethiopia has a high production potential and diversity of fish fauna, during the last few decades, the fish biodiversity of the country has been declining rapidly due to different factors such as anthropogenic (e.g. overfishing, urbanisation, damming, abstraction of waters for irrigation and power generation and pollution), lack of stakeholders' follow-up and governmental support and climate change (Tesfaye and Wolff 2014; Temesgen and Getahun

2016). These factors have subjected the natural water bodies in general and rivers in particular to severe stress with devastating effects on fish diversity in the country (Golubtsov and Darkov 2008; Temesgen and Getahun 2016).

The knowledge of Ethiopian fish fauna diversity is far from complete (Golubtsov and Mina 2003; Kebede *et al.* 2017). Notable fishery investigations have been carried out only in a few of the numerous freshwater bodies (Temesgen and Getahun, 2016), especially in the rivers that are not exhaustively explored (Getahun 2007). Limited works have been carried out regarding an estimation of the potential of the fish diversity profile of Ethiopian rivers, which are supposed to be economically important, including for a large number of small or medium rivers, such as the ones explored in this study location Gibe River (Golubtsov and Mina 2003; Awoke 2015; Tesfaye and Wolff 2014). Before this study, for the present study area of Gibe Sheleko National Park (GSNP), the tributaries were still unexplored and no literature on fish fauna were available at the national park office. It is believed that this study was the first investigation of the ichthyofauna diversity, including some morphometric measurement of fish in GSNP.

Descriptions of species diversity and abundance are important to obtain information on the quality and quantity of the available habitats (Begon *et al.* 1990; Gebremariam *et al.* 2002; Tesfaye and Wolff 2014). Fish have an essential role as an indicator of ecological integrity of running waters. Under this concept, there is an increasing emphasis on gathering biological data to serve a broad-spectrum of environment objects and plans, such as the protection of endangered and threatened species and effective management and conservation of fish and fisheries have not been given much consideration in the management of fish fauna of GSNP. Gebe Sheleko National Park has not been given due attention regarding fish and fisheries. Therefore, the absence of information about the park riverine fisheries triggered the necessity to conduct this study. The study on morphometric characters in fish is important because they can be used for taxonomic resolution and are able to spot differences between fish population growth parameters (Nagelkerke 1997; Alam *et al.* 2012). Therefore, this study was carried out to identify fish diversity, to determine the relative abundance of fish species and to examine some morphometric measurements of the dominant fish of the GSNP to improve the Park and riverine fisheries management.

2 | METHODOLOGY

2.1 Study Area

The study was conducted in Gibe Sheleko National Park (Figure 1), located in the Gurage Zone of Southern Ethiopia. It is 170 km south west of Addis Ababa. The altitude of the area ranges from 1050 to 1835 m above sea levels. The park covers 248 km^2 bounded by three districts namely Cheha, Abeshigie and Enemorenaener. It is characterised by a heterogeneous landscape, flora, fauna and habitat types and it is dissected by deep gorges of the Gibe, Deriee and Wabe rivers (Figure 1). Gibe Sheleko National Park has viable populations of mammalian species and viable groups of fauna species to diversified flora and also involves varieties of bird species, reptiles and amphibians, as well as insects also being found (Amare 2015; Tilahun *et al.* 2017).

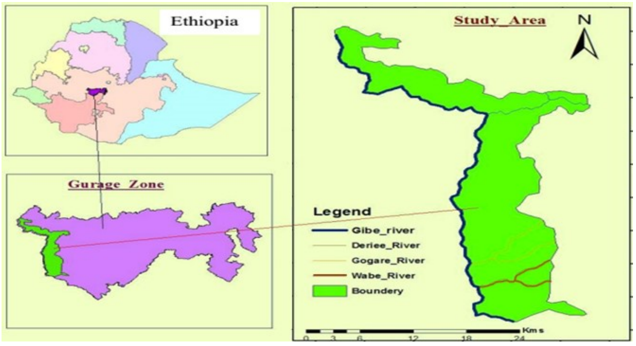

FIGURE 1 Map of Gibe Sheleko National Park (modified from Tilahun *et al.* 2017).

2.2 Site selection and field sampling

Based on information from local fishermen and a previous survey, we selected a total of eight sampling sites along the Gibe and Wabe Rivers (Table 1). Sampling sites were selected by considering the nature and velocity of the rivers, accessibility, substrate type and human interference in the river sections. The coordinates of the sampling sites were determined using GPS. Data were collected both in a dry season (January to March) and a wet season (April 16 to June) in 2019.

2.3 Fish sampling and identification

On a monthly basis (January to June 2019), fish samples were collected using monofilament gill-nets of varying mesh size (5 – 55 mm), a panel length of 25 m and depth of 1.5 m. Hooks and locally-available traps were also used during fish sampling. Some specimens were also obtained from fishermen. Immediately after capturing the fish, morphometric measurements were recorded and all specimens were preserved in plastic jars containing 4% formalin and labelled with all necessary information of fishes. In the laboratory, the preserved specimens were soaked in tap water for 5 days to wash the formalin away and then transferred to 75% ethanol for conservation and further study. All specimens were identified to species level using taxonomic keys developed by Habteselassie (2012).

2.4 Morphometric measurements

Total length (TL), fork length (FL), standard length (SL), girth (G), weight (W), eye diameter (ED) and the distance between eyes (DBE) of fish specimens were measured using digital calipers, ruler and digital balance. Total length was measured from the tip of the snout to the tip of the caudal fin, i.e. the greatest distance between the most anterior projecting parts of the head and the posterior most tip of the caudal fin. Standard length was measured from the tip of the snout to the base of the caudal fin. It was a straight distance from the anterior most part of the head to the end of the vertebral column/caudal peduncle. Fork length was measured from the tip of the snout to the end of the middle caudal fin rays. Girth was width of body. Eye diameter was distance from the anterior to the posterior rims of the eye in the longitudinal axis. Distance between eyes was distance between both eyes. Weight was the total weight of body.

TABLE 1 Sampling sites with their codes, GPS coordinates and habitat type in Gibe and Wabe tributaries.

Fishing site	Altitude (m)	Habitat	Coordinates
Gibe River			
G1	1067	Rocky and sandy	08°13′91′′N, 037°34′41′′E
G2	1079	Rocky and sandy	08°13′99′′N, 037°34′30′′E
G3	1082	Rocky and sandy	08°13′81′′N, 37°34′85′′E
G4	1086	Rocky and sandy	08°13′86′′N, 37°34′64′′ E
G5	1084	Rocky and sandy	08°13′93′′N, 37°34′44′′ E
Wabe River			
W1	1673	Turbid muddy and rock gravel	08°14′85′′N, 037°45′41′′ E
W2	1669	Turbid muddy and rock gravel	08°14′78′′N, 037°45′39′′E
W3	1647	Turbid muddy and rock gravel	08°14′65′′N, 37°45′30′′E

2.5 Species diversity and relative abundance

Relative abundance of fish was estimated by the contribution of each species to overall catch. To evaluate relative abundance and diversity of fish, we used the Index of Relative Importance (IRI) and Shannon Diversity Index (H') (Getahun *et al.* 2020). The IRI is a measure of relative abundance or commonness of the species, based on number and weight of individuals in catches, as well as their frequency of occurrence. IRI gives a better representation of the ecologically-important species rather than the weight, number or frequency alone (Sanyanga 1996).

$$\%\mathrm{IRI} = \frac{(\%Wi + \%Ni) \times \%Fi}{\sum_{j-1}^{Z-1}(\%Wj + \%Nj) \times \%Fj} \times 100$$

Where, $\%Wi$ and $\%Ni$ are percentages weight and number of each species of total catch respectively. Whereas, $\%Fi$ is a percentage frequency occurrence of each species in total number of settings. $\%Wj$ and Nj are percentage weight and number of total species in total catch. Fj is percentage frequency of occurrence of total species in total number of settings.

The Shannon diversity index is a measure of species weighted by the relative abundance (Begon *et al.* 1990). H' is calculated as follows $H' = \sum \text{pi} \ln \text{pi}$; where, pi is the proportion of individuals in the *i*th species. The H' is used to indicate diversity of fishes at different sampling sites. A high value indicates high species diversity (e.g. Galib *et al.* 2013).

2.6 Data analysis

Descriptive statistics were used to analyses the mean value of the biomass weight during wet and dry seasons and also the mean, range and standard error of the species length frequency. The significant difference of species relative abundance during wet and dry season was analysed using the *t*-test and Chi-square test. One-way ANOVA was used to determine the significant difference of species diversity between sites using SPSS (version 21).

3 | RESULTS AND DISCUSSION

3.1 Fish species composition and relative abundance

A total of ten species belonging to four orders and seven families were identified from Gibe and Wabe Rivers of GSNP in dry and wet seasons (Tables 2 and 4). The fish fauna contained a mixture of Nilo Sudanic: *Mormyrus kannume* Forsskål, 1775, *Bagrus docmak* (Forsskål, 1775) and *Labeo forskalii* (Rüppell, 1835); and highland East African forms: *Labeobarbus intermedius* (Rüppell, 1835), *L. nedgia* (Rüppell, 1835), *Clarias gariepinus* (Burchell, 1822) and *Oreochromis niloticus* (Linnaeus, 1758). The species richness was lower than those reported from certain other rivers of Ethiopia. For example, the reports mentioned 23 fish species belonging to seven families and five orders from the Beles and Gilgel Beles Rivers (Getahun *et al.* 2020), 13 species (belonging to three families from the in Gilgel Abay and Andassa Rivers (Aynalem *et al.* 2018) and Oumer *et al.* (2011) reported the occurrence of 17 species in the head of the Blue Nile River.

The less diversity in the present study might be due to the length of the sampling periods (i.e. this investigation was carried out in two seasons over relatively short periods of time) and fishing gear used have a high selective effect (Galib *et al.* 2009; Parvez *et al.* 2017; Limbu *et al.* 2018). The second reason might be the effect of flow variability on fish assemblage, for example, high flows could destroy fish habitat and wash away the fish eggs released and deposited within the study stretch. The other reason might due to the fact that fish diversity decreases drastically in the upper parts of the rivers as in other Ethiopian basins (Golubtsov and Mina 2003). However, other researchers have reported less diversity of fish in other water bodies compared to the diversity of Gibe and Wabe Rivers of GSNP, such as Urga *et al.* (2017) identified five species with one family in Debbis River and Melaku *et al.* (2017) identified nine species of fin-fish representing seven genera and four families from Geba and Sor rivers.

TABLE 2 Fish species composition of the Gibe and Wabe rivers tributaries in the Gibe Sheleko National Park during the dry and wet season. Presence and absence are indicated by + and – signs respectively.

Order and family	Scientific name	Local name	Gibe River		Wabe River	
			Dry	Wet	Dry	Wet
Osteoglossiformes						
Mormyridae	*Mormyrus kannume* Forsskål, 1775	Mutmut	+	-	+	-
Cypriniformes						
Cyprinidae	*Labeobarbus nedgia* Rüppell, 1835	Tseyimat	+	+	+	+
Cyprinidae	*Labeobarbus intermedius* Rüppell 1835	Tseyimat	+	+	+	+
Cyprinidae	*Labeo forskalii* Rüppell, 1835	Tseyimat	+	-	-	-
Siluriformes						
Clariidae	*Clarias gariepinus* Burchell, 1822	Ambaza	+	+	+	+
Clariidae	*Heterobranchus longifilis* Valenciennes, 1840	Zemetu	+	+	-	-
Mochokidae	*Synodontis schall* Bloch and Schneider, 1801	Qeqe	+	+	+	+
Malapteruridae	*Malapterurus electricus* Gmelin, 1789	Korenti assa	+	-	+	-
Bagridae	*Bagrus docmak* Forsskål, 1775	Keniya assa	+	-	+	-
Perciformes						
Cichlidae	*Oreochromis niloticus* Linnaeus, 1758	Birqe	+	+	+	+

Cyprinidae was the predominant family representing three species which contributed 30% of the fish diversity in the Park, followed by Clariidae with two species (Table 2). The members of these families are distributed in freshwater habitats all over the world (Mohsin *et al.* 2009; Nikam *et al.* 2014; Joadder *et al.* 2015). Cyprinidae was the dominant family consistent with the earlier findings (e.g. DeGraaf 2003; Melaku *et al.* 2017; Urga *et al.* 2017; Aynalem *et al.* 2018; Getahun *et al.* 2020). The presence dominance of the few families in this study gave the impression that these cyprinid fishes, being riverine origin, are specifically segregated or adapted in the Gibe-Omo Basin and its tributaries in Ethiopia. The fish species compositions between Gibe and Wabe River might be due to special adaption of the riverine cyprinids. Cyprinids are the dominant family; especially *L. intermedius* and *L. nedgia* were common in most of the Ethiopian inland water bodies (DeGraaf 2003; Oumer *et al.* 2011; Mequaninnet *et al.* 2014). *Synodontis schall*, *L. nedgia*, *L. intermedius*, *C. gariepinus* and *O. niloticus* were common in both seasons at Gibe and Wabe Rivers (Figure 2). However, *Heterobranchus longifilis* and *L. forskalii* were found only in Gibe River, in both sampling seasons.

A total of 249 fish specimen belonging to 10 species were collected from eight sampling sites during the study period (Table 4). Of the total specimens collected, 179 were caught during the dry season and 70 specimens were caught during the wet season. There was significant difference in the mean number of fish specimens collected in the dry season (t = 3.943 df = 9, p = 0.003). However, there were obvious statistical differences in the mean number of specimens between rivers in the wet season total catch (t = 2.923, df = 9, p = 0.017). Moreover, the total catch of fish that were collected during the study period were statistically different between dry and wet season (t = 3.94, df = 9, p = 0.003). In this study, *S. schall* was the most abundant species in number, both in wet and dry seasons, followed by *L. nedgia*, *L. intermediu* and *C. gariepinus* and they contributed 28.52%, 18.88%, 14.06% and 10.44% of the total catch respectively. *Malapterurus electricus* was only collected as two specimens and was the least abundant fish species (Table 4).

In all sampling sites, the number of fish was higher during the dry season than the wet season (Table 4, Figure 3). The reason for such variations could be probably due to the high turbidity of the river water, velocity of the water and low temperature during wet season which may have attributed to the less number of fish caught (DeGraaf 2003). During wet season, there was also higher water discharge; fish could have highly dispersed in the large volume of water in this season as compared to the dry season, making them more difficult to catch (Tesfaye and Wolff 2014). In addition, the variation in catches between wet and dry seasons might be due to the efficiency of the gill-net and time of fishing net deployment. Wood logs, leaves, roots and grasses which were brought by flooding during the sampling period, could have decreased the efficiency of gill-nets during the wet season.

Generally, the fish diversity in both rivers was not the same in wet and dry seasons; similar results also reported by Melaku *et al.* (2017) in Geba and Sor rivers and Tewabe *et al.* (2010) in Ayima, Guang, Shinfa and

Gendwuha rivers where fish diversity was higher in the dry season than the wet season. High density in shallower pools in the dry season and the ease of their collection using the available fishing gear could be a reason for the high diversity (Oumer *et al.* 2011; Mequaninnet *et al.* 2014; Tewabe *et al.* 2010).

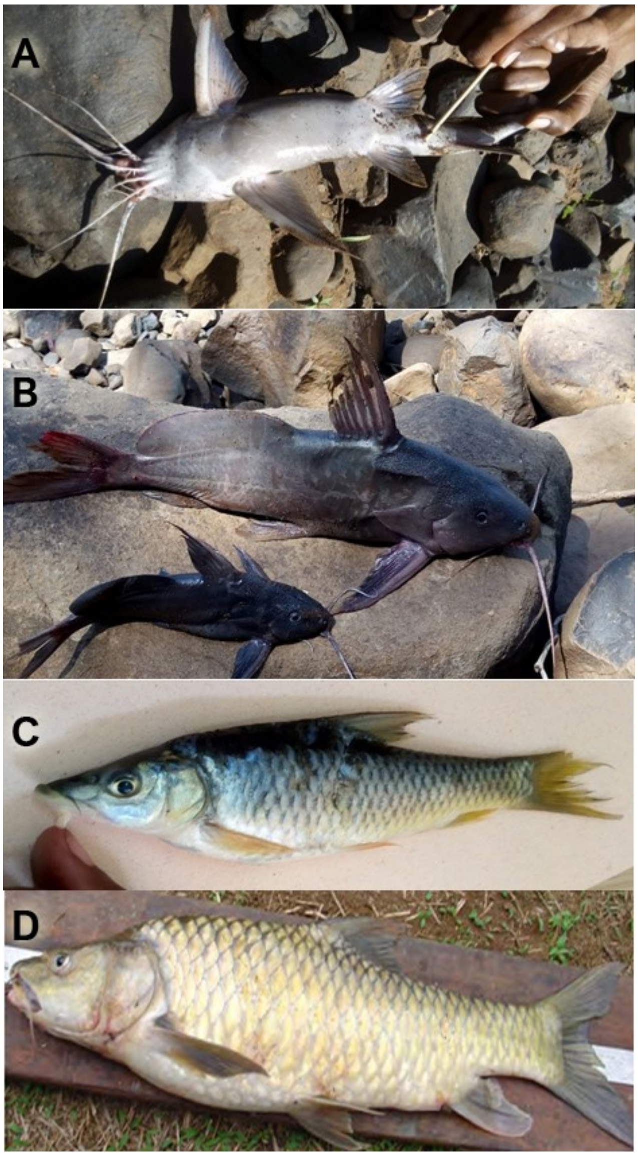

FIGURE 2 Fish species identified from Gibe Sheleko National Park Tributary. *A* and *B*, ventral view and lateral view of *Synodontis schall*; *C*, *Labeobarbus nedgia*; *D*, *Labeobarbus intermedius*.

Number of fish across the sites in each river for both seasons is indicated in Figure 3. In both the Gibe and Wabe rivers, the number of fish caught in the dry season was higher than during the wet season. In the Gibe River, the numbers of fish in all sites was higher in the dry season than the wet season, but in the Wabe River at site one, there were fewer fish than during the wet season.

Gibe River had higher species diversity in both sampling seasons (dry: ten species; wet: six species) than Wabe River (dry: eight species; wet: five species) (Figure 4, Table 5). There might be several reasons for variation in abundance between tributaries. Variation in available nutrients and habitats, temperature, fishing effort, fish behaviour, size and life history stages of fishes and others might have contributed to the variation in abundance of the catches (Begon *et al.* 1990; Stiassny and Getahun 2007).

TABLE 4 Total catches of fishes and percentage (%) of composition in dry and wet seasons. Some species were not found in wet season (–).

Fish species	Seasons		Number	
	Dry	Wet	*n*	%
Synodontis schall	51	20	71	28.52
Labeobarbus nedgia	32	15	47	18.88
Labeobarbus intermedius	21	14	35	14.06
Clarias gariepinus	16	10	26	10.44
Oreochromis niloticus	14	9	23	9.23
Bagrus docmak	18	-	18	7.23
Labeo forskalii	10	-	10	4.02
Heterobranchus longifilis	7	2	9	3.61
Mormyrus kannume	8	-	8	3.21
Malapterurus electricus	2	-	2	0.80
Total	179	70	249	100

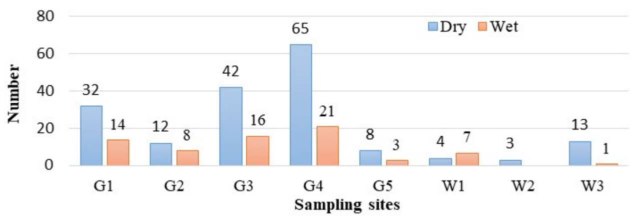

FIGURE 3 Total number or abundance of fishes recorded in eight sampling sites at Gibe (G1 to G5) and Wabe (W1 to W3) river sites in dry and wet seasons.

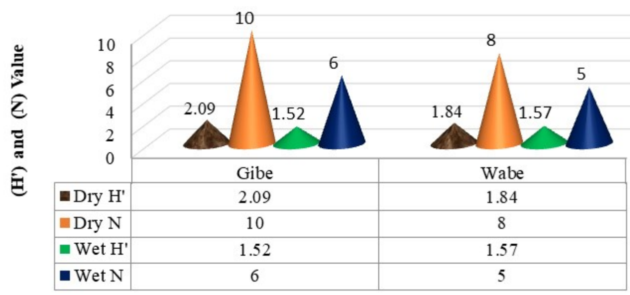

FIGURE 4 Shannon diversity index (*H*′) and number of fish species (*N*) in Gibe and Wabe River of Gibe Sheleko National Park during wet and dry season.

The Shannon Diversity Index (*H*′) was used to evaluate species diversity of sampling sites and rivers. It also explains both variety and the relative abundance of fish species (Naesje *et al.* 2004). Accordingly, *H'* was the highest in Gibe River with a value of 2.09 than Wabe River (*H'* = 1.84) during the dry season. However, in wet season, *H'* was the highest in Wabe River (1.57) than Gibe River (1.52). Moreover, both the number of species (*N*) and *H'* were not statistically different between the Gibe and Wabe rivers (both $p > 0.05$). Similarly, between dry and wet seasons there were no statistical differences in *N* and *H'* values (both $p > 0.05$).

The species composition of all catches, both in dry and wet seasons, were analysed and ranked, based on the IRI. According to IRI, the most important species in the total catches were *S. schall* (49.13%), *L. intermedius* (15.49%), *C. gariepinus* (11.70%) and *L. nedgia* (9.97%). However, there was no significant differences between fish species of IRI values ($\chi^2 = 90.0$, $df = 81$, $p = 0.231$). However, differences in sampling habitats, fishing effort, type of gear and gill-net efficiency, sampling seasons and altitude may contribute to the variation in the catch rates and species diversity (Awoke 2015; Awoke *et al.* 2015; Abera *et al.* 2018).

As mentioned earlier, there might be several reasons for variation in abundance between wet and dry seasons. Variation in available nutrients and habitats, temperature, fishing effort, fish behaviour, size and life history stages of fishes and others might have contributed to the variation in abundance of the catches. Moreover, water level (Karenge and Kolding 1995) and turbidity of water may also affect abundance (DeGraaf 2003; Galib *et al.* 2018). Flow variability might also have an effect on fish assemblages. For example, high flows could destroy fish habitat and wash away any spawned fish eggs. Differences in sampling habitats (river width, substrate type, source distance and depth), fishing effort, type of gear and gill-net efficiency, sampling seasons and altitude might have contributed to the variation in the catch rates and species diversity (Karenge and Kolding 1995; Gebremariam *et al.* 2002; DeGraaf 2003).

TABLE 5 Number (*N*) and index of relative importance (*IRI*) of fishes in the study area. *%Wi* and *%Ni* represents percentages in weight and number of each species of total catch. *%Fi* is the percentage frequency occurrence of each species in total number of settings. *%Wj* and *Nj* are percentages in weight and number of total species in total catch. *Fj* is the percentage frequency of occurrence of total species in total number of settings).

Fish species	*N*	*%N*	*W*	*%W*	*F*	*%F*	*IRI*	*%IRI*
Synodontis schall	71	28.52	119244.5	40.50	14	20.0	1380.4	49.13
Labeobarbus intermedius	35	14.06	33519.5	11.38	12	17.14	435.04	15.49
Clarias gariepinus	26	10.44	44548.4	15.13	9	12.86	328.83	11.70
Labeobarbus nedgia	47	18.88	40927.6	13.90	6	8.57	280.02	9.97
Oreochromis niloticus	23	9.23	15173.1	5.15	7	10.0	143.80	5.12
Bagrus docmak		18	7.23	17780.4	6.04	6	8.57	113.72
Labeo forskalii	10	4.02	6948	2.36	7	10.0	63.8	2.27
Heterobranchus longifilis	9	3.61	8075.7	2.74	4	5.71	36.26	1.29
Mormyrus kannume	8	3.21	7302.4	2.48	3	4.29	24.41	0.87
Malapterurus electricus	2	0.80	945.6	0.32	2	2.86	3.20	0.11
Total	249	100	294465.2	100	70	100	2809.48	100

3.2 Morphometric measurements

Clarias gariepinus have large eye diameter (8.4 mm) followed by *S. schall* (8.3 mm) and *O. niloticus* (7.5 mm), but *L. intermedius* have the smallest eye diameter (3.8 mm) (see Table 6). In the present study, *H. longifilis* was the first ranked fish, based on body length of fish which measured an average of 64.7 cm, 64.7 cm and 59.8 cm total, fork and standard length respectively. However, based on body girth, *S. schall* was the largest (23.1 cm), followed by *B. docmak* (21.7 cm) and *C. gariepinus* (20.3 cm). Similarly, the body of *C. gariepinus* had a measured mean of 1713.4 g weight and was also the largest, followed by *S. schall* (1679.5 g) and *B. docmak* (987.8 g).

Fishes showed statistical differences between their eye diameter and the distance between eyes ($t = -5.18$, $df = 9$, $p = 0.001$). Similarly, body weight and girth were statistically different ($t = 7.56$, $df = 9$, $p < 0.001$). The pairwise comparison *t*-test also showed that the total length was significantly different from the fork length ($t = 3.533$, $df = 9$, $p = 0.006$), standard length ($t = 5.54$, $df = 9$, $p < 0.001$), weight ($t = -7.37$, $df = 9$, $p < 0.001$) and girth ($t = 4.131$, $df = 9$, $p = 0.003$).

However, observed differences in morphometric characteristics measured in the present study, when compared with those obtained by other authors, are likely due to differences in the number of specimens examined, differences in the utilised length ranges or differing study seasons, food availability, feeding rate, gonad development and spawning period (Teferi *et al.* 2002; Tewabe *et al.* 2010).

3.3 Fishery activities

The fishermen in the study area have been involved in fishing for 6 – 15 hours a day and there are seasonal fishermen who fish from the river only for consumption. Fishing in the study area is mainly artisanal and fish are sold at the local market. The commercially-important species are *S. schall*, *L. nedgia*, *L. intermedius*, *C. gariepinus* and *O. niloticus*. The fisher folk use locally-available gear, such as single hook and line and mosquito net (Figure 5). In addition, Birbira (*Milletia ferruginea*) seed powder was also used to anaesthetise and collect the fish. Worldwide, a variety of traditional fishing methods have been used, with varying efficiencies (Parvez *et al.* 2017).

TABLE 6 Mean morphometric measurements of identified species.

Fish species	Eye diameter (mm)	Distance b/n eye (mm)	Total length (cm)	Fork length (cm)	Standard length (cm)	Girth (cm)	Weight (g)
Labeo forskalii	5.7	7.2	33.4	27.6	24.8	17.3	694.8
Labeobarbus intermedius	3.8	8.1	56.6	52.3	49.7	17.2	957.7
Labeobarbus nedgia	4.5	10.4	39.4	37.6	33.8	16.8	870.8
Heterobranchus longifilis	5.8	12.3	64.7	64.7	59.8	18.4	897.3
Bagrus docmak	7.4	12.7	47.8	44.3	42.6	21.7	987.8
Synodontis schall	8.3	14.1	41.5	30.5	27.5	23.1	1679.5
Mormyrus kannume	5.8	9.7	42.3	38.6	37.1	17.5	912.8
Oreochromis niloticus	7.5	9.1	19.2	18.8	16.9	15.7	659.7
Malapterurus electricus	4.8	5.6	14.7	11.0	10.2	9.8	472.8
Clarias gariepinus	8.4	9.4	18.7	17.3	16.4	20.3	1713.4

FIGURE 5 Fishing activity in the study area by using single hook.

4 | CONCLUSIONS

Ten fish species belonging to five orders and six families were identified from Gibe and Wabe River of GSNP. The fish diversity of GSNP is dominated by Cyprinid fish species. *Synodontis schall*, *L. nedgia*, *L. intermediu* and *C. gariepinus* were the dominant fish species in GSNP tributaries. Gibe River has more species diversity in both dry and wet seasons. The diversity index considered in this study (*H'*) was also higher in the dry season than the wet season in both sampling tributaries. Based on IRI results, the most important species in the total catches were *S. schall*, *L. intermedius*, *C. gariepinus* and *L. nedgia*.

We recommend further detailed study in the upper streams of both rivers, year-round data on the reproductive biology, food and feeding behaviour of fish. However, fishery development activities should be implemented in both Rivers to use the fish resource sustainably without affecting its current production. In addition, training should be given for local people living in adjacent areas of the rivers on using legal fishing gear and fish dish preparations. However, the development of aquaculture and other related alternative fisheries should be encouraged to reduce the pressure on the natural system. Finally fish sport activities should be introduced in the Park to attract tourists.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHORS' CONTRIBUTION

SM & **AH** equally conceived, designed the investigation and collected the data. **SM** analysed the data and prepared the manuscript. **SM** & **AH** read and approved the final manuscript for publication and agreed to be held accountable for the work performed therein.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author.

REFERENCES

Abera L, Getahun A, Lemma B (2018) Changes in fish diversity and fisheries in Ziway-Shala Basin: the case of Lake Ziway, Ethiopia. Journal of Fisheries & Livestock

Production 6(1): 1000263.
Alam MM, Galib SM, Islam MM, Flowra FA, Hussain MA (2012) Morphometric study of the wild population of pool barb, *Puntius sophore* (Hamilton, 1822) in the River Padma, Rajshahi, Bangladesh. Trends in Fisheries Research 1(2): 10–13.
Amare A (2015) Conservation challenges of Gibe Sheleko National Park, Southwestern Ethiopia. Natural Resources 6: 286–289.
Awoke T, Mingist M, Getahun A (2015) Abundance and species compositions of fishes in Blue Nile River, Ethiopia. International Journal of Fisheries and Aquatic Studies 2(6): 334–339.
Awoke TM (2015) Fish species diversity in major river basins of Ethiopia: a review. World Journal of Fish and Marine Sciences 7(5): 365–374.
Aynalem Y, Mingist M, Getu A (2018) Diversity, relative abundance, species composition and some biological aspects of fishes in Gilgel Abay and Andassa rivers, Blue Nile Basin, Ethiopia. Fisheries and Aquaculture Journal 9(1): 1000241.
Begon M, Harper JL, Townsed CR (1990) Ecology: individuals, population and communities, 2nd Edition. Blackwell Scientific Publication, Boston. 945 pp.
Chaki N, Jahan S, Fahad MFH, Galib SM, Mohsin ABM (2014) Environment and fish fauna of the Atrai River: global and local conservation perspective. Journal of Fisheries 2(3): 163–172.
DeGraaf M (2003) Lake Tana's piscivorous barbus (Cyprinidae, Ethiopia): ecology, evolution and exploitation. Wageningen University, Wageningen. 256 pp.
Galib SM, Mohsin ABM, Parvez MT, Lucas MC, Chaki N, ... Islam MN (2018) Municipal wastewater can result in a dramatic decline in freshwater fishes: a lesson from a developing country. Knowledge and Management of Aquatic Ecosystems 419, 37.
Galib SM, Naser SMA, Mohsin ABM, Chaki N, Fahad MFH (2013) Fish diversity of the river Choto Jamuna, Bangladesh: present status and conservation needs. International Journal of Biodiversity and Conservation 5(6): 389–395.
Galib SM, Rashid MA, Chaki N, Mohsin ABM, Joadder MAR (2016) Seasonal variation and community structure of fishes in the Mahananda River with special reference to conservation issues. Journal of Fisheries 4(1): 325–334.
Galib SM, Samad MA, Kamal MM, Haque MA, Hasan MM (2009) A study on fishing gears and methods in the Chalan Beel of north-west Bangladesh. Journal of Environmental Science & Natural Resources 2(2): 213–218.
Gebremariam Z, Kebede-Westhead E, Desta Z (2002) Long-term changes in chemical features of waters of seven Ethiopian rift-valley lakes. Hydrobiologia 477: 81–91.
Getahun A (2007) An overview of the diversity and conservation status of the Ethiopian freshwater fish fauna. Journal of Afrotropical Zoology special issue: 87–96.
Getahun A, Bereie Z, Dejen E (2020) Diversity of fishes in Beles and Gilgel Beles Rivers, Abay basin, Ethiopia. International Journal of Aquaculture and Fishery Sciences 6(3): 68–73.
Golubtsov AS, Darkov AA (2008) A review of fish diversity in the main drainage systems of Ethiopia. In: Pavlov SD, Dgebuadze YY, Darkov AA, Golubtsov SA, Mina VM (Eds) Ecological and faunistic studies in Ethiopia. KMK Scientific Press, Moscow. pp. 69–102.
Golubtsov AS, Mina J (2003) Fish species diversity in the main drainage systems of Ethiopia: current state of knowledge and research prospective. Ethiopian Journal of Natural Resources 5: 281–318.
Habteselassie R (2012) Fishes of Ethiopia: annotated checklist with pictorial identification guide, 1st edition. Ethiopian Fisheries and Aquatic Science Association (EFASA), Addis Ababa, Ethiopia. 250 pp.
Joadder MAR, Galib SM, Haque SMM, Chaki N (2015) Fishes of the river Padma, Bangladesh: current trend and conservation status. Journal of Fisheries 3(2): 259–266.
Karenge L, Kolding J (1995) Inshore fish population and species changes in Lake Kariba, Zimbabwe. In: Pitcher T, Hart PJB (Eds) The impact of species changes in African lakes. Fish and Fisheries Series, volume 18. Chapman and Hall, London. pp. 245–275.
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): 1–8.
Limbu JH, Shrestha OH, Prasad A (2018) Ichthyofaunal diversity of Bakraha River of Morang district, Nepal. International Journal of Fisheries and Aquatic Studies 6(5): 267–271.
Lundberg JG, Kottelat M, Smith GR, Stiassny M, Gill AC (2000) So many fishes, so little time: an overview of recent ichthyological discovery in continental waters. Annals Missouri Botanical Garden 87: 26–62.
Melaku S, Getahun G, Wakjira M (2017) Population aspects of fishes in Geba and Sor rivers, White Nile System in Ethiopia, East Africa. International Journal of Biodiversity 2017: 1252604.
Mequaninnet D, Mingist M, Getahun A, Anteneh W (2014) Spawning migration of *Labeobarbus* species of Lake Tana to Gilgel Abay River and its tributaries, Blue Nile Basin, Ethiopia. African Journal of Fisheries Science 2(9): 176–184.
Mohsin ABM, Hasan MM, Galib SM (2009) Fish diversity of community based fisheries managed oxbow lake (Bookbhara Baor) in Jessore, Bangladesh. Journal of Science Foundation 7(1): 121–125.

Naesje TF, Hay CJ, Nickansor N, Koekemoer JH, Strand R, Thorstad EB (2004) Fish population, gillnet catch and gillnet selectivity in the Kwando River. Namibia. Norwegian Institute for Nature Research. Tungasletta 2(7485): 1–64.

Nagelkerke LAJ (1997) The *Barbus* of Lake Tana, Ethiopia: morphological diversity and its implication for taxonomy, trophic resource partitioning and fisheries. PhD thesis, Agricultural University, Wageningen, the Netherlands. 298 pp.

Naik ASK, Kumar J, Benakappa S, Somashekara SR, Anjanayappa HN, Manjappa N, Mahesh V (2014) Ichthyofaunal diversity of Chulkinala Reservoir. Animal Science Reporter 8(2): 48–60.

Nikam DS, Shaikh AL, Salunkhe PS, Kamble AB, Rao KR (2014) Ichthyofaunal diversity of Ashti Lake, Tal. Mohol, Dist. Solapur (M.S.). The Global Journal of Pharmaceutical Research 3(12): 4–5.

Oumer M, Mingist M, Dejen E (2011) Diversity and relative abundance of fishes in the head of Blue Nile River, Ethiopia. Ethiopian Journal of Biological Sciences 10(2): 207–212.

Parvez MT, Mohsin ABM, Chaki N, Galib SM (2017) Risking lives for living: a study on underwater fishing in the Padma River, Bangladesh. Journal of Fisheries 5(3): 525–530.

Sanyanga RA (1996) Variation in abundance of *Synodontis zambezensis* (Pisces: Mockokidae) Peters 1852, in the shore fishery of lake Kariba. Fisheries Research 26: 171–186.

Stiassny M, Getahun A (2007) An overview of labeon in relationship and the phylogenetic placement of the Afro-Asian genus *Garra* Hamilton, 1922 (Teleostei: Cyprinidae), with the description of the five new species of *Garra* from Ethiopia, and a key to all African species. Zoological Journal of the Linnean Society 150: 41-83.

Teferi Y, Admassu D, Mengistu S (2002) Length-weight relationship, Body condition and sex ratio of tilapia (*Oreochromis niloticus*) in Lake Chamo, Ethiopia. SINET: Ethiopian Journal of Science 25(1): 19–26.

Temesgen MK, Getahun 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.

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.

Tewabe D, Getahun A, Dejen E (2010) Fishing activities in Gendwuha, Guang, Shinfa and Ayima rivers in Tekeze and Abbay basins, Ethiopia: preliminary study. Ecohydrology and Hydrobiology 10(24): 333–340.

Tilahun B, Abie K, Feyisa A, Amare A (2017) Attitude and perceptions of local communities towards the conservation value of Gibe Sheleko National Park, Southwestern Ethiopia. Agricultural and Resource Economics: International Scientific E-Journal 3(2): 65–77.

Urga KT, Prabhadevi L, Tedesse Z (2017) Diversity and biology of fishes in the river Debbis, Ethiopia, International Journal of Aquaculture 7(20): 126–133.

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