Length-Weight Relationships and Condition Factor of 33 Freshwater Fish Species in the Recently Impounded Soubré Reservoir in Côte d'Ivoire (West Africa)

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ABSTRACT

Catches of artisanal fishers using a variety of fishing gears were analyzed in the recently filled Soubré Reservoir in southwestern Côte d'Ivoire from August 2019 to July 2021. The length-weight relationship (LWR) and condition factor (K) were estimated for the 33 most abundant fish species. To estimate the parameters of these relationships, 8,194 specimens representing 14 families were used. Fish sizes ranged from 5.4 cm SL (8 g body weight) in *Brycinus imberi* (Peters, 1852) to 107.5 cm SL (14,500 g body weight) in *Lates niloticus* (Linnaeus, 1758). The allometric coefficient (b) of the LWR showed a range from 2.5 for *Mormyrops anguilloides* (Linnaeus, 1758) to 3.22 for *B. imberi* (Peters, 1852), with a mean value of 2.88. The median and modal values of b were 2.91 and 2.64, respectively. The r^2 value ranged from 0.87 in *Petrocephalus bovei* to 0.99 in *Heterotis niloticus* (Linnaeus, 1758). The condition coefficient (K) ranged from 0.7±0.062 (*Hepsetus odoe*) to 4.14±0.52 (*Coptodon zillii*). The highest values of the coefficient K were found for three species of the family Cichlidae. Moreover, the value of K for 28 of the species sampled (84%) in Soubré Reservoir was greater than one (1), indicating the wellbeing of the majority of fishes in this water body. In addition, the study provides the first reference regarding the length-weight relationship for *Hydrocynus forskahlii* (Cuvier, 1819) living in this region.

Keywords: Fisheries management, Hydroelectric dam, Morphometric parameters, Small-scale fishery, Soubré Reservoir

INTRODUCTION

Small-scale fisheries play a significant role in Africa due to their contribution to food security and by helping to alleviate poverty in rural areas (Gourène *et al*., 1999; Laë, 1999). In West Africa, inland fisheries production is mainly supported by hydroelectric dams, with lakes and rivers in the entire region being significant providers of protein and micronutrients (Pauly, 2017).

Since 2012, in order to increase electricity production capacity, the government of Côte d'Ivoire has initiated numerous hydropower projects in the Sassandra basin, which is known for its high hydropower potential (Tractebel Engineering, 2014). In this way, the Soubré hydropower project led to the formation of the man-made lake of Soubré in April 2017. Before the Soubré project, four main hydroelectric dams provided hydropower in the country. These are Ayamé I (1959), Kossou (1978), Taabo (1979) and Buyo (1980), which also represent the majority of the area used by inland fisheries in the Côte d'Ivoire (Da Costa and Dietoa, 2007; Tah *et al*., 2009). The total landings of fish on these reservoirs have been estimated as roughly

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8,000 t·year^{-1} (Failler *et al*., 2014), and their fisheries are exclusively artisanal. Many studies on bio-ecological characteristics, fishery statistics, population parameters and morphometric parameters have been carried out for fish populations in these four reservoirs (Gourène *et al*., 1999; Tah *et al*., 2009; Goli Bi *et al*., 2019). Among bio-ecological characteristics, length-weight relationship (LWR) of important freshwater species are well described in Côte d'Ivoire for Lakes Ayamé I, Buyo and Taabo (Tah *et al*., 2012; Aliko, 2013; N'dri *et al*., 2020; Kamelan *et al*., 2021).

The rational fisheries management of aquatic resources most often requires the knowledge of the length-weight relationship (LWR) and the condition factor of the different fish populations present. Indeed, the LWR constitutes a key ecological factor, which is used for the evaluation of fish and fisheries welfare (Haimovici and Velasco, 2000; Da Costa and Araàjo, 2003). The length and weight provide information on stock composition, life span, mortality, growth and production (King, 1996). They allow comparison between different populations of the same species, living in similar or different ecosystems (Stergiou and Moutopoulos, 2001; Odat, 2003; Thomas *et al*., 2003). The condition coefficient (K) reflects the well-being of the fish. It is a measure of the quality of the trophic relationship between each fish and its habitat (Kumolu-Johnson and Ndimele, 2010).

The purpose of present study is to provide basic information on the length-weight relationship and condition factor of the main exploited fishes in the newly impounded Soubré Reservoir. The LWR keys can be used by inland fishery managers for adequate regulation of fish stocks. Moreover, the quantitative parameter of condition factor can help to determine the state of well-being of fishes for management and conservation of these natural freshwater populations. In addition, our results should be the first biological data on fish stocks of this artificial reservoir in Côte d'Ivoire.

MATERIALS AND METHODS

Study areas

Soubré Reservoir in Côte d'Ivoire (5°48' 16"N, 6°39'22"W) is the result of the construction of the most recent hydroelectric dam on the Sassandra River. The climate of the area is subequatorial, characterized by four seasons: two rainy seasons (April-July and October-November) and two dry seasons (December-March and August-September) (ENVIPUR, 2014). This lake has an average surface area of 17.3 km^2, with an average length and width of 12 and 2.5 km, respectively, and can hold nearly 83,000,000 m^3 of water (Ci Energies, 2021). After the dam was impounded in April 2017, this water body was closed to all fishing activities for a period of 18 months. In October 2018, fishing activities officially began on the new lake, following the prefectural decree of September 2018, authorizing the opening of fishing. On this lake, the fishermen are almost exclusively 'Bozo' (ethnic fishermen coming from Mali). At all times and in all areas of the lake, they use a variety of fishing gear especially gillnets (or '*djo*'), hawknets ('*fridjo*'), harpoons, lines, longlines ('*gangari*'), and traps (Konan *et al*., 2021).

During the prospection phase, carried out in July 2019, three localities near the lake were identified, from upstream to downstream, for the collection of data on fishing activities (Figure 1). These selected villages are also characterized by the presence of catch control points set up as landing stages by the continental fishing services (Office of Aquaculture and Fishing, OAF) of the town of Soubré. Table 1 describes some characteristics of the stations of the lake.

These three stations are in fact the main landing points for fishing on Soubré Reservoir. The water body is characterized by numerous dead trees and almost entirely covered by invasive aquatic plants, especially *Eichhornia crassipes*.

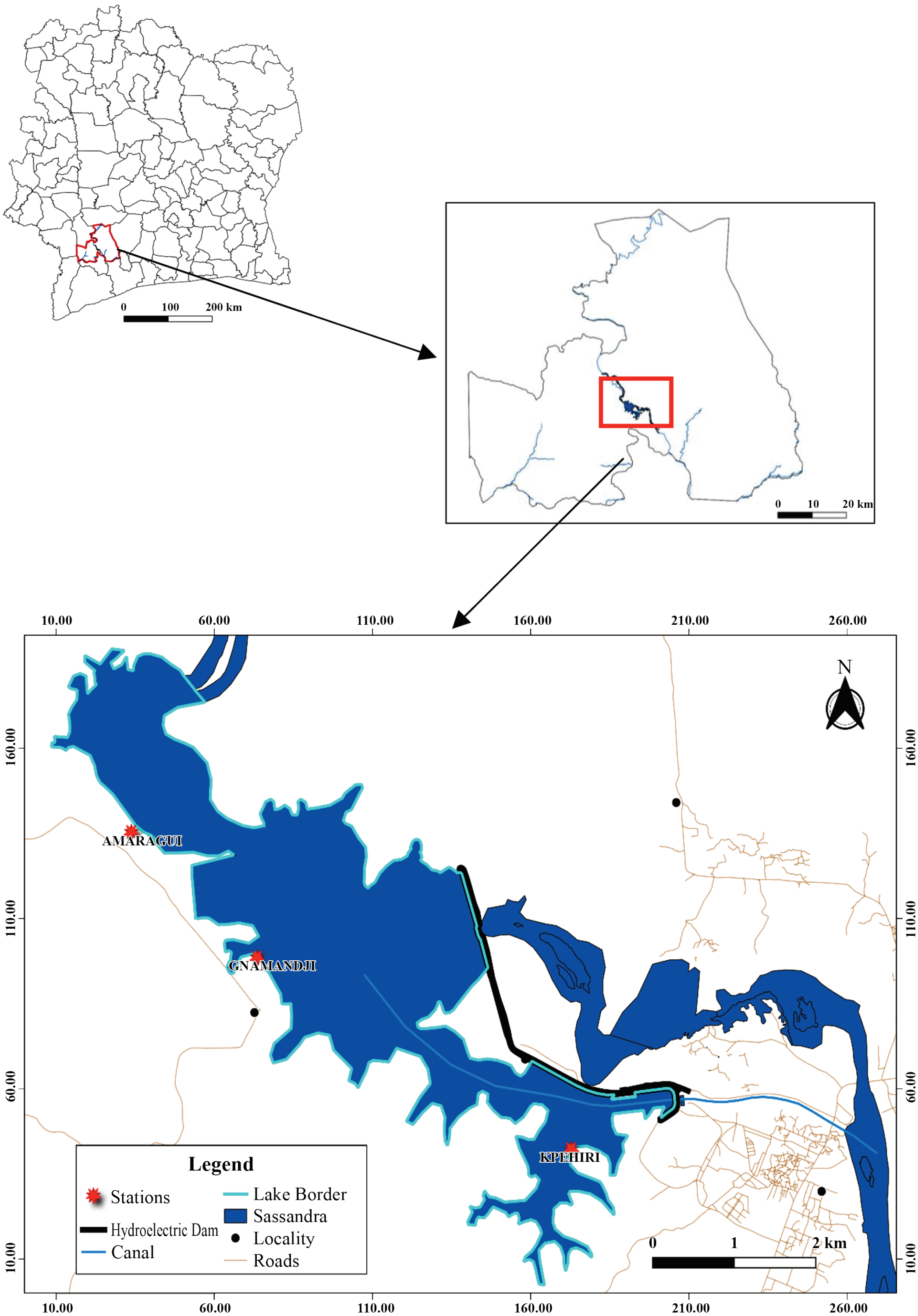

Figure 1. Location of Soubré Reservoir and sampling sites.

Table 1. Some characteristics of the sampling stations of Soubré Reservoir.

Stations	Latitude and Longitude	Characteristics of station
Amaragui	05°48'46.2" N and 06°41'39.3" W	Upstream, corresponding to the river-lake transition zone.
Gnamandji	05°48'00.0' N and 06°40'49.2' W	Located in the middle part with the most active landing of the water body.
Kpéhiri	05°46'49.5" N and 06°38'44.1" W	Downstream, located near the dike.

Data collection and analysis

The three selected sampling stations were visited monthly, from August 2019 to February 2020 and from March 2021 to July 2021. Because of the COVID-19 pandemic, no sampling was done during the period from February 2020 to March 2021. Artisanal fishers' catches were directly examined to collect fish for the study. Many different fishing gears were used by fishers such as gillnets of different sizes (15 to 60 mm stretched mesh), traps, and cast nets. The fish collected were identified by the keys of Paugy *et al*. (2003a; 2003b). For the species collected, only standard length (SL) in cm and total weight (W) in g were recorded. Furthermore, the most representative species in terms of abundance (>20 individuals) were considered (Lalèyè, 2006; Ye *et al*., 2007).

According to Le Cren (1951), fish length and weight generally correspond to an exponential equation:

$$W = aL^b$$

where W is body weight (g), L is standard length (cm), a is a coefficient related to body form and b (growth parameter) is an exponent coefficient indicating the growth type (Beverton and Holt, 1957). Parameters a and b were estimated using linear regression of the least squares after log transformation of the relationship in form:

$$\log10\ W = \log10a + b\log10L$$

The coefficient a is the intercept and b is the slope of the linear regression (Zar, 1999).

For each species, log-log plots of standard length and weight (corresponding to length-weight relationships) were performed from the regression to identify and exclude outliers (Froese, 2006). Then, the data were validated (Andrade and Campos, 2002; Ecoutin and Albaret, 2003) and the coefficient of determination (r^2) indicating the degree of association between the variables was assessed.

The Student's t-test was used to check if the calculated slope b was significantly different from three (3). According to Sokal and Rohlf (1987), this test is expressed by the equation:

$$ts = \frac{b-3}{SE}$$

where ts is the value of the t test, and SE is the standard error of slope b. For the allometric coefficient (b), the following three growth types were indicated: (1) when b = 3, the growth type was isometric: the size of the specimens was proportional to their weight, during their growth; (2) when b>3, the type of growth was positive allometric: the specimens grew in height or width more than in length; and (3) when b<3, the growth type was negative allometric: the specimens changed form to become longer, or the small specimens were in improved nutritional status at the time of sampling (Froese, 2006). All statistical analyses were performed using Statistica software (version 7.1, StatSoft 2006), with a significance level of 5% ($p<0.05$).

For condition factor K, the formula used to calculate this factor is the composite condition coefficient of Kartas and Quignard (1984).

$$K = \frac{W}{SL^3} \times 100$$

where W is the body weight of a fish (g) and SL is its standard length (cm).

RESULTS

A total of 8,194 specimens comprising of 33 species in 14 families were collected for the present study. The best represented family was Mormyridae with six species, followed by Alestidae, Clariidae, and Mochokidae (four species each). Claroteidae and Cichlidae were represented by three species each, and Cyprinidae by two species. The remaining seven families, namely Arapaimidae, Distichodontidae, Hepsetidae, Schilbeidae, Malapteruridae, Latidae and Channidae, each were represented by a single species in the catches.

The most abundant species, numerically, was *Chrysichthys nigrodigitatus* (Lacepède, 1803) with 1,033 individuals, whereas *Hepsetus odoe* (Bloch, 1794) was least common, with only 26 specimens. Fish sizes ranged from 5.4 cm SL (8 g body weight) in *Brycinus imberi* (Peters, 1852) to 107.5 cm SL (14,500 g body weight) in *Lates niloticus* (Linnaeus, 1758). Only three species, namely *Petrocephalus bovei* (Valenciennes, 1847), *B. imberi* (Peters, 1852) and *Hemichromis fasciatus* (Peters, 1852), were described with a size class interval lower than 10 cm. The estimates of LWR for 33 freshwater fish species are given in Table 2, along with several descriptive statistics and morphometric parameters.

For studied species, the value of the coefficient of determination (r^2) varied from 0.87 in *P. bovei* to 0.99 *Heterotis niloticus* (Linnaeus, 1758) (Figure 2). Overall allometric coefficient (b) ranged from 2.5 for *Mormyrops anguilloides* (Linnaeus, 1758) to 3.22 for *B. imberi* (Peters, 1852), with a mean value of 2.88. The median and the mode of allometric coefficient were 2.91 and 2.64, respectively (Figure 3). The growth type indicated that two species (6%), *H. forskahlii* and *Schilbe mandibularis* (Günther, 1867), showed an allometric coefficient equal to 3 (Student's t-test: $p = 0.29$ and $p = 0.18$, respectively), attesting isometric growth (Table 2). The 31 other species had an allometric coefficient different from 3 (Student's t-test: $p<0.05$). Among them, six species (18%), namely *Distichodus rostratus* (Günther, 1864), *Alestes baremoze* (Joannis, 1835), *H. odoe, B. imberi, Labeo parvus* (Boulenger, 1902) and *Synodontis punctifer* (Daget, 1965), showed positive allometric growth ($b>3$). The remaining 25 (76%) species showed negative allometric growth ($b<3$) (Table 2).

The condition coefficients K of the 33 main species ranged from 0.7±0.06 (*H. odoe*) to 4.1±0.52 (*Coptodon zillii*) (Table 2). Based on this parameter, the species can be categorized into three groups - the first with 16 species (48.6%) having K greater than 2, the second group with 12

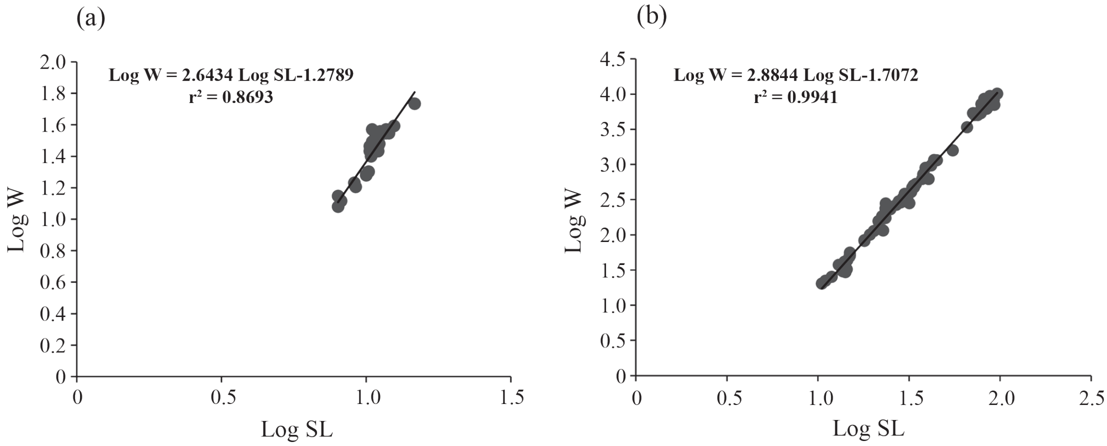

Figure 2. Logarithm form of length-weight regression of (a) *Petrocephalus bovei* with the lowest r^2 and (b) *Heterotis niloticus* with the highest r^2 among the 33 studied species sampled from the newly impounded Soubré Reservoir from August 2019 to July 2021; W = weight; SL = total length; r^2 = coefficient of determination

Table 2. Descriptive statistics and LWR parameters for 33 freshwater species collected from the newly impounded Soubré Reservoir from August 2019 to July 2021.

Family/Species	n	Standard length (cm)	Weight (g)	Parameters of length-weight relationships					t	p	Growth	K
		Min-Max	Min-Max	a	b	SE(b)	LC 95%(b)	r^2				Mean±SD
Arapaimidae												
Heterotis niloticus (Cuvier, 1829)	78	10.5-96.5	20-10000	0.02	2.88	0.0053	2.87-2.89	0.99	21.65	<0.0001	A-	1.43±0.34
Mormyridae												
Marcusenius senegalensis (Steindachner, 1870)	627	10-38.3	13-500	0.02	2.85	0.002	2.84-2.85	0.94	68.92	<0.0001	A-	1.39±0.24
Marcusenius furcidens (Pellegrin, 1920)	104	13.2-81	36-2740	0.02	2.81	0.005	2.80-2.81	0.97	37.81	<0.0001	A-	0.98±0.22
Marcusenius ussheri (Günther, 1867)	135	10.5-33	13-406	0.02	2.83	0.006	2.82-2.84	0.90	27.97	<0.0001	A-	1.33±0.19
Mormyrops anguilloides (Linnaeus, 1758)	376	12.5-75.5	23-2000	0.04	2.50	0.005	2.49-2.50	0.96	139.71	<0.0001	A-	0.71±0.16
Mormyrus rume (Valenciennes, 1847)	461	11.1-81	14-3994	0.01	2.92	0.003	2.92-2.93	0.96	29.06	<0.0001	A-	0.93±0.15
Petrocephalus bovei (Valenciennes, 1847)	33	8-14.7	10-50.0	0.05	2.64	0.010	2.63-2.64	0.87	50.80	<0.0001	A-	2.23±0.32
Distichodontidae												
Distichodus rostratus (Günther, 1864)	99	13.5-60.0	45-5200	0.02	3.10	0.008	3.09-3.12	0.98	13.08	<0.0001	A+	2.21±0.30
HEPSETIDAE												
Hepsetus odoe (Bloch, 1794)	26	9.6-30	9-380	0.01	3.05	0.008	3.04-3.07	0.98	6.30	<0.0001	A+	0.7±0.062
Alestidae												
Alestes baremoze (Joannis, 1835)	69	9.5-31.9	12-342.0	0.02	3.03	0.011	3.01-3.05	0.93	2.55	0.01	A+	1.30±0.34
Brycinus imberi (Peters, 1852)	36	5.4-13	8-66.0	0.01	3.22	0.016	3.23-3.28	0.96	16.30	<0.0001	A+	2.57±0.31
Brycinus macrolepidotus (Valenciennes, 1850)	319	8-29.5	11-527.0	0.03	2.88	0.006	2.88-2.89	0.94	39.52	<0.0001	A-	2.14±0.34
Hydrocynus forskahlii (Cuvier, 1819)	57	9.8-53	11-2000.0	0.01	2.99	0.010	2.97-3.01	0.96	1.05	0.29	I	1.37±0.25
Cyprinidae												
Labeo parvus (Boulenger, 1902)	51	9.5-23.5	17-312.0	0.02	3.14	0.009	3.12-3.15	0.96	15.36	<0.0001	A+	2.34±0.26
Labeo coubie (Rüppel, 1832)	306	10.5-50.5	26-2670.0	0.04	2.85	0.003	2.84-2.85	0.98	59.91	<0.0001	A-	2.37±0.29
Claroteidae												
Chrysichthys nigrodigitatus (Lacepède, 1803)	1033	8.6-48.5	11-1758	0.05	2.70	0.002	2.69-2.70	0.96	159.89	<0.0001	A-	1.91±0.31
Chrysichthys maurus (Valenciennes, 1840)	194	10.5-55	27-2250	0.07	2.57	0.004	2.56-2.58	0.95	113.85	<0.0001	A-	2.02±0.32
Chrysichthys auratus (Geoffroy Saint-Hilaire, 1809)	82	10.0-25.0	21-277.0	0.06	2.57	0.013	2.56-2.59	0.91	48.43	<0.0001	A-	2.06±0.30

Table 2. (Continued)

Family/Species	n	Standard length (cm)	Weight (g)	Parameters of length-weight relationships					t	p	Growth	K
		Min-Max	Min-Max	a	b	SE(b)	LC 95%(b)	r^2				Mean±SD
Schilbeidae												
Schilbe mandibularis (Günther, 1867)	315	8.7-32.5	7-470.0	0.01	2.99	0.005	2.99-3.00	0.96	1.32	0.18	I	1.09±0.14
Clariidae												
Clarias anguillaris (Linnaeus, 1758)	152	19-60.5	68-2580.0	0.01	2.92	0.003	2.92-2.93	0.97	23.43	<0.0001	A-	1.11±0.13
Clarias gariepinus (Burchell, 1822)	69	20-61.0	89-2570.0	0.02	2.82	0.004	2.81-2.83	0.98	43.29	<0.0001	A-	1.07±0.12
Heterobranchus longifilis (Valenciennes, 1841)	33	13-55	25-1670	0.02	2.96	0.009	2.94-2.98	0.97	7.94	<0.0001	A-	1.30±0.17
Heterobranchus isopterus (Bleeker, 1863)	54	11.3-76.0	17-4800	0.01	2.98	0.005	2.97-2.99	0.97	5.29	<0.0001	A-	1.25±0.19
Malapteruridae												
Malapterurus electricus (Gmelin, 1789)	140	10.5-37.6	31-960	0.07	2.64	0.007	2.62-2.65	0.89	53.47	<0.0001	A-	2.21±0.39
Mochokidae												
Synodontis bastiani (Daget, 1948)	650	7-30.0	7-558	0.02	2.99	0.003	2.98-2.99	0.91	3.39	0.0007	A-	2.07±0.34
Synodontis schall (Bloch et Schneider, 1801)	593	7-25.0	9-382.0	0.02	2.98	0.003	2.97-2.98	0.93	6.71	<0.0001	A-	2.32±0.35
Synodontis koensis (Pellegrin, 1933)	292	6.5-17.5	7-105.0	0.03	2.85	0.005	2.84-2.86	0.87	29.87	<0.0001	A-	2.42±0.37
Synodontis punctifer (Daget, 1965)	125	7.6-23.1	11-300.0	0.02	3.05	0.005	3.03-3.06	0.96	8.44	<0.0001	A+	2.28±0.29
Latidae												
Lates niloticus (Linnaeus, 1758)	387	8.5-107.5	13-14500	0.03	2.91	0.003	2.90-2.92	0.97	26.68	<0.0001	A-	1.96±0.25
CHANNIDAE												
Parachanna obscura (Günther, 1861)	34	20.5-34.5	116-460	0.02	2.92	0.006	2.91-2.93	0.92	12.85	<0.0001	A-	0.79±0.12
Cichlidae												
Hemichromis fasciatus (Peters, 1857)	49	7.9-13.7	15-91.0	0.07	2.64	0.013	2.62-2.67	0.90	27.90	<0.0001	A-	3.03±0.39
Coptodon zillii (Gervais, 1848)	784	7-29.0	11-730.0	0.07	2.82	0.003	2.81-2.82	0.94	65.91	<0.0001	A-	4.14±0.52
Oreochromis niloticus (Linnaeus, 1758)	431	7-40.0	17-2302.0	0.05	2.94	0.003	2.93-2.94	0.97	20.47	<0.0001	A-	4.08±0.46

Note: n = sample size; Min = minimum; Max = maximum; a and b the parameters of length-weight relationship; SE = standard error; r^2 = the coefficient of determination; t = t test value (absolute value); p = p-value (significant when $p<0.05$); +A = positive allometric; -A = negative allometric; I = isometric; SD = standard deviation.

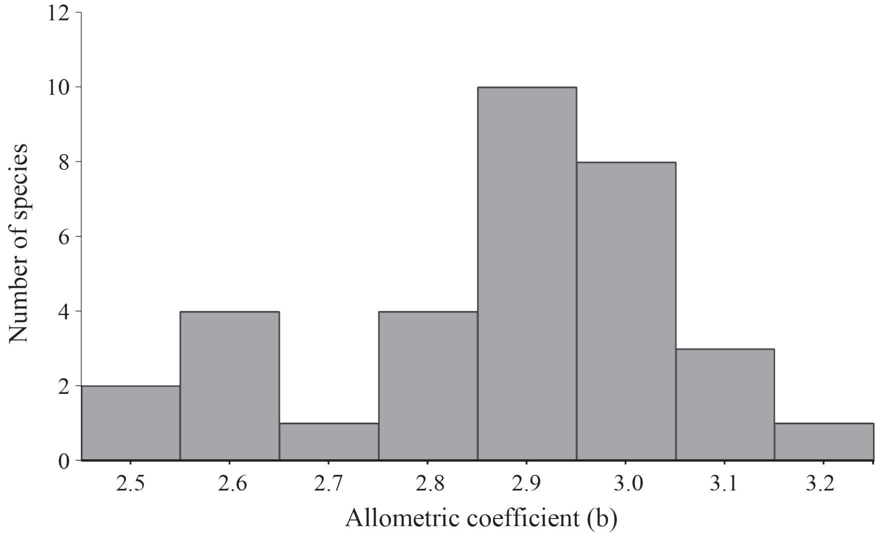

Figure 3. Frequency distribution of the allometric growth coefficients (b) for 33 freshwater species collected from the newly impounded Soubré Reservoir from August 2019 to July 2021.

species (36.4%) having K between 1 and 2, and the third group where the condition factor K is less than 1 and is represented by five species (15.2%), consisting of *H. odoe, M. anguilloides, Parachanna obscura* (Günther, 1861), *Mormyrus rume* (Valenciennes, 1847) and *Marcusenius furcidens* (Pellegrin, 1920).

Moreover, the three species in the family Cichlidae (*H. fasciatus, Oreochromis niloticus* and *C. zillii*) are noteworthy for having the highest values of the K coefficient.

DISCUSSION

The LWR parameters in the present study are highly significant: r^2>0.90 for 28 species (85%) and ≤0.90 for 5 species (15%). The allometric coefficients (b), from 2.50 for *Mormyops anguilloides* to 3.22 for *Brycinus imberi*, are within the range for this index of growth (2–4) generally encountered in fisheries (Bagenal and Tesch, 1978). Similar allometric coefficients for freshwater fish have been reported by numerous works in lacustrine environments in Côte d'Ivoire. In Lake Ayamé I, Tah *et al*. (2012) and Kamelan *et al*. (2021) reported allometric coefficients from 2.17 to 3.47 and from 2.40 to 3.20, respectively. Recently, a study carried out on Buyo Reservoir (upstream of Soubré Reservoir in the Sassandra River) showed values of b for 24 species ranging from 2.14 to 3.31 (N'Dri *et al*., 2020).

The allometric coefficient equal to 3 for *Hydrocynus forskahlii* and *Schilbe mandibularis* in Soubré Reservoir indicates isometric growth for these species. In these two fish populations, the body shape does not change during growth. For the 31 remaining studied fish species, the allometric coefficient was either smaller or larger than 3, which means that the body weight does not change proportionally with length.

There were 18 and 16 fish species reported by Tah *et al*. (2012) and N'Dri *et al*. (2020), respectively, from Buyo Reservoir; all of the species were also found in this study from Soubré Reservoir. Regarding LWR parameters, different growth patterns were recorded for seven species by Tah *et al*. (2012). These include a shift from isometric to positive allometry (I vs. A+) in *Distichodus rostratus* and *Labeo coubie* and negative allometry (I vs. A-) in *Chrysichthys nigroditatus* and *Synodontis schall* in this study; also from negative to positive allometry (A- vs. A+) in *Alestes baremoze* and *S. punctifer*; and finally from positive to negative allometry in *Hepsetus odoe* (A+ vs. A-). Also, the LWR parameters obtained in this study differ from the results of N'Dri *et al*. (2020) for four species. These are *B. imberi* and *D. rostratus*, from isometric to positive allometric growth, *Marcusienus ussheri*, from isometric to negative allometric growth, and finally *S. mandibularis*, from positive allometry to isometric growth. Considering that fish populations of the two studied lakes (Buyo and Soubré) are similar because of their location on the Sassandra River, differences in LWR parameters recorded among studies could be mainly due to difference in sample size, size classes of the collected samples, or a combination of the two factors (Ye *et al*., 2007). It is admitted that a sufficiently large number of individuals/species is required to be representative of the fish population in the study area, and small sample size could result in biased LWR estimates. The size classes of the samples also affects LWR. In fact, the collected samples should cover all size classes, but the samples collected by fishing gears are always biased towards large size due to commercial reasons and/or fishery management measures. Consequently, gear selectivity eliminates certain size classes in the catch, particularly the smallest (Li *et al*., 2013).

Furthermore, the intense fishing pressure on Buyo Reservoir (N'dri *et al*., 2020) compared to the recently impounded Soubré Reservoir could explain the different growth patterns observed for similar species.

For the species *H. odoe, A. baremoze, B. imberi, Labeo parvus, S. punctifer* and *D. rostratus*, positive allometric growth was observed ($b>3$, $p<0.05$, Student's t-test) in this study, which is contrary to the works of Tah *et al*. (2012) and N'dri *et al*. (2020). Indeed, these fish were at some sizes significantly heavier than those observed by Tah *et al*. (2012) and N'dri *et al*. (2020). This result reflects the existence of optimal growth conditions for these fish in their environment (Lévêque, 2017). The creation of reservoirs generally results in the submersion of the surrounding vegetation. This results in the availability of a large quantity of nutrients for the fish (Lauzanne, 1988). The 25 remaining species showed a generally negative allometry ($b<3$, Student's t-test), which reflects relatively slow growth.

These low values of the allometric coefficient (b) could be the result of ecosystems subjected to overexploitation of fishery resources (Minoungou *et al*., 2020). In Soubré Reservoir, fishery resources are exploited by professional fishermen who use a variety of gears in their activities (Konan *et al*., 2021). LWR parameters a and b depend on a variety of factors such as season, habitat, gonadal maturity, sex, diet and stomach fullness, health, conservation methods and annual differences in environmental conditions (Froese, 2006). The fishes with a low number of individuals collected in this study (*Petrocephalus bovei, Hemichromis fasciatus, Brycinus imberi, Heterobranchus longifilis, Parachanna obscura* and *Hepsetus odoe*) (Table 2) are generally small species, commercially not important and considered as supplementary species in the fishermen's catches. In particular, *H. odoe* is difficult to capture in gillnet mesh because of its fusiform shape. Concerning *H. longifilis* and *P. obscura*, their relatively low number in the catches is mainly due to their benthic habitat that makes them difficult to access for most of the gears used, especially the gillnet.

The present study provides the first data on LWR for *H. forskahlii* (Cuvier, 1819) in the region. No references concerning this species were previously available in FishBase (Froese and Pauly, 2022).

Condition factor has generally been used to help assess fish health and productivity (Froese, 2006). According to Alhassan *et al*. (2015), $K \geq 1$ expresses the "well-being" of a population during various stages of its life cycle, whereas $K<1$ means that the fish is not comfortable in its biotope. The value of for 28 species (84%) in this study was greater than 1, indicating a favourable well-being for these populations in Soubré Reservoir. In this study, the generally high values of K can be explained by the use of standard body length (SL), as recommended in the formula of Kartas and Quignard (1984).

The lowest average condition factors were generally observed for the elongated freshwater fishes, namely *H. odoe, M. anguilloides and P. obscura*. In contrast, the highest values of K (4.14, 4.08, and 3.03) were encountered in the cichlids *Coptodon zillii, Oreochromis niloticus* and *H. fasciatus,* respectively. According to Telvekar *et al*., 2006, the highest values of K in a period seem to reflect preparation for reproductive activities. The K parameters in this study are similar to those obtained from fish populations in Buyo Reservoir (N'Dri *et al*., 2020) situated upstream in the Sassandra River. High condition factor values for members of the cichlid family also indicate the good adaptation of these species in freshwater environments. Indeed, the Cichlidae have a widely varied diet and present ecological and behavioral adaptations, which explain their abundance in lake environments. These characteristics allow them to tolerate a wide range of environmental conditions, in contrast to the Mormyridae (*Mormyrus rume, Marcusenius furcidens, Mormyrops anguilloides*) with a K<1 (Beyeler and Dale, 2001).

Lower values of K (K<1) could be due to habitat modification and new living conditions. Indeed, it was reported by several authors that the creation of reservoirs such Soubré results in large changes in the range of food resources that were present in the rivers before the creation of the reservoirs by their impoundment (Lewis, 1974; Lauzanne, 1988; Minoungou *et al*., 2020). In addition, various factors can influence the condition coefficient including gonad size, sex, interannual variability of precipitation, and periodic high and low water alternations that have a major impact on the biology, physiology, and ecology of fish populations (Albaret 1999; Hossain *et al*., 2006; Lévêque, 2017).

CONCLUSION

This study has reported the length-weight relationship and condition factor of 33 species encountered in the newly impounded Soubré Reservoir. These indicators show that these populations show good adaptation to the new habitat. However, the current study suggests that Soubré Reservoir may be a relatively unfavorable environment for the survival and development of the Mormyridae (*Mormyrus rume, Marcusenius furcidens, Mormyrops anguilloides*), despite the good condition of most other species. Furthermore, this study provides preliminary data on LWR for *Hydrocynus forskahlii*. The results of this investigation will serve as reference data of the ichthyofauna of Soubré Reservoir and will enrich the knowledge of the ichthyological fauna of Côte d'Ivoire.

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