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Short Communication

Growth pattern and condition factor of seven freshwater fish species from Jebba Lake, north-central Nigeria

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Abstract: Length-weight relationship and condition factor of seven freshwater fish species from Jebba Lake (Nigeria) were investigated. A total of 576 individuals were caught with hook and line, cast and gill nets from up and downstream sections of the lake. Sampling covered dry and raining seasons spanning across April to September 2017. The growth exponent *b* values of the studied species ranged between 2.23-3.89 and the condition factor between 0.47-1.61.

Keywords: *Barbus*, *Chrysichthys*, *Hydrocynus*, Length weight relationship, *Oreochromis*.

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Introduction

Length-weight relationship (LWR) and condition factor (*K*) of fishes are fundamental morphometric parameters in fish ecology and research. They are valuable tools for investigating growth rate, age structure, feeding intensity and relative well-being of ichthyofaunal communities (Atama et al. 2013; Sossoukpe et al. 2013; Abu & Agarin 2016; Irom et al. 2017). Thus, an assessment of these parameters is useful for deducing inference on the general well-being of the fish communities (Ecoutin et al. 2005; Ayoade & Ikulala 2007).

Jebba Lake of Niger River Watershed, Jebba, Kwara State, Nigeria, is rich in fish biodiversity (Adelakun et al. 2017). To date, there are limited information on the LWRs and *K* of fish species of Jebba Lake. To advance knowledge on this, we examine the LWRs and *K* of some selected fish species from the lake, and further compare the growth pattern and *K* of fishes from up and downstream sections of the lake.

Materials and Methods

Study area: Jebba Lake is located in North-Central Nigeria between latitudes 4°34'12"-4°43'48"E. This region is characterized mainly by two seasons- dry and rainy (Adelakun et al. 2017). The maximum length and width of the lake is about 134km and 24.1km, respectively, having surface area of 1270km^2 and catchment area of 1.6×10^{6}km^2 (Obot 1989). Our study covered up and down stream sections (8.7km apart) of Jebba Lake notable for fishing.

Fish collection: We selected fish species based on its commercial importance and availability. In sum, our study includes seven commercially important fish

species namely *Auchenoglanis biscutatus* (Geoffroy Saint-Hilaire, 1809), *Barbus occidentalis* (Boulenger, 1911), *Lates niloticus* (Linne, 1762), *Citharinus citharus* (Geoffroy Saint-Hilaire, 1809), *Oreochromis niloticus* (Linne, 1758), *Chrysichthys nigrodigitatus* (Lacepede, 1803), and *Hydrocynus vittatus* (Castelnau, 1861). Samples were collected bimonthly from April to September 2017 spanning across dry and rainy seasons. For the collection of fish samples, three commercial fishing gears including gill net, hook and line, and cast net were used. Following Araoye (1999), the gears were set at the surface and bottom water. Our sampling of 576 individuals covered up- and downstream sections of the lake.

The selected specimens were preserved in a cooler with ice blocks and transported to the Laboratories in Department of Bioscience and Biotechnology, Kwara State University, Malete, Nigeria and Department of Zoology, University of Ilorin, Nigeria. Fish specimens were sorted and identified following fish identification keys of Olaosebikan and Raji (1998) and Idodo-Umeh (2003). Additional species identification and verification were sought from two trained taxonomists at the Department of Zoology, University of Ilorin, Nigeria.

Length-Weight Relationship and Fulton's Condition Factor (K): We measured the Total (TL) and Standard Lengths (SL) of each specimen to nearest 0.10cm using a measuring tape. We also assessed the body weight (BW) using a digital scale to nearest 0.10g. The equation: $W=aL^b$ was used to calculate length-weight relationship of the fishes (Bagenal 1978). Where W=the observed total weights of the fishes; L= the observed total length, *b* is the slope and *a* is the intercept on the length axis. Further, the equation above was linearised by a logarithmic transformation to give a straight-line relationship: Log W=Loga+bLogL. We plotted Log 10W against Log10L. We obtained the regression coefficient (b), and the intercept (Log a) on the Y axis.

The condition factor (*K*) was computed from the equation: $K=100W/L^3$, Where W= the observed total weight for each fish; L=the observed total length for each fish; *K*=the Condition Factor. The data was transformed into logarithm using Excel and the Log-Log graphs showing the regression analysis was perform using PAST (Hammer 2011).

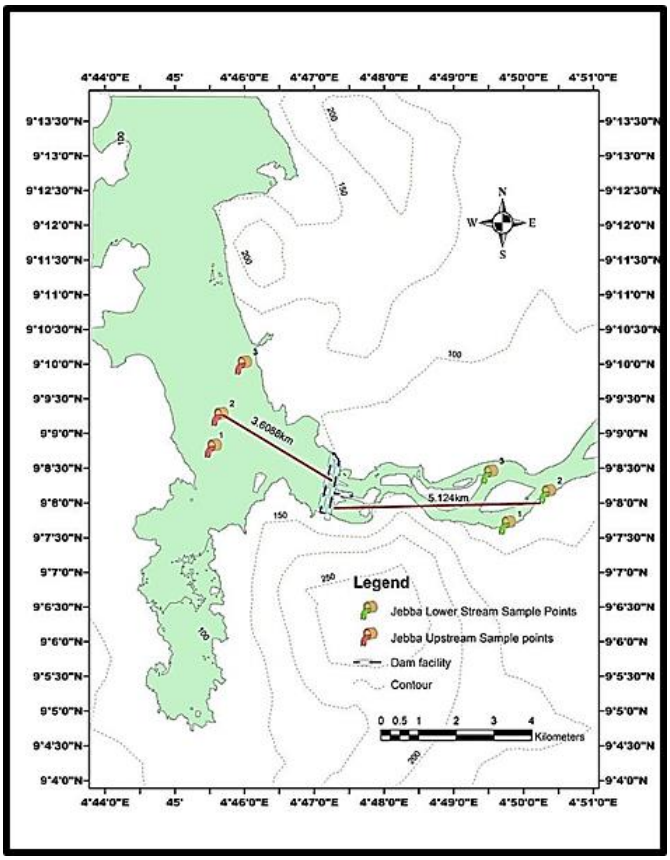


Fig.1. Map of up and downstream sections of Jebba Lake showing the sampling points.

Results and Discussion

The higher mean TL values were recorded in *H. vittatus, C. citharus* and *L. niloticus* collected from the upstream section, while in downstream, higher mean TL values were observed in *B. occidentalis*, *C. nigrodigitatus* and *A. biscutatus* (Table 1). Mean weight values of the fish specimens range between 72.90-276.70g (upstream) and 115.20-320.80g (downstream), respectively. The highest mean weight values were recorded in *L. niloticus* (upstream) and *C. citharus* (downstream). Compared to other fish species, *B. occidentalis* (upstream) and *L. niloticus* (downstream) had lower mean weight values (Table

Table 1. Morphometric, Length–Weight Relationships Parameters and Condition Factors (K) of Selected Species from Jebba Lake, North-Central Nigeria.

Species	Location	Sex	N	Length (min-max)	Length (mean±SD)	Weight (min-max)	Weight (mean±SD)	*a*	*b*	r^2	*K*
Auchenoglanis biscutatus	Upstream	M	15	16-36	23.50±1.20	333-400	149.40±23.40	-1.96	2.96	0.94	0.98
		F	22	16.5-34	22.50±1.20	39-450	154.40±19.20	-2.18	3.16	0.95	1.09
	Downstream	M	18	14-36	24.10±1.00	35-430	198.30±15.20	-1.35	2.57	0.93	1.09
		F	20	15-36	25.10±1.00	40-480	206.50±31.20	-1.60	2.78	0.94	1.26
Barbus occidentalis	Upstream	M	22	19-26	21.70±0.50	40-130	74.40±7.30	-3.75	3.18	0.90	0.68
		F	18	20-26	21.90±0.25	40-132	70.40±3.20	-3.19	3.76	0.89	0.69
	Downstream	M	21	22-35	28.50±0.70	30-280	212.60±15.40	-1.36	2.91	0.90	0.73
		F	17	24-34	30.50±0.70	30-300	215.60±15.90	-1.73	2.75	0.96	0.79
Oreochromis niloticus	Upstream	M	19	13-29	19.90±0.90	20-340	133.30±18.60	-2.18	3.26	0.90	1.48
		F	25	15-28	21.00±0.74	20-360	140.00±12.40	-2.56	3.54	0.96	1.32
	Downstream	M	18	14-24	19.80±0.80	17-250	129.20±16.90	-3.04	3.89	0.98	1.32
		F	21	13-22	16.40±0.62	15-220	104.50±10.90	-2.25	3.35	0.98	1.61
Chrysichthys nigrodigitatus	Upstream	M	21	12.0-37	19.80±0.50	23-200	68.00±5.20	-1.97	2.86	0.95	0.67
		F	20	15.5-39	22.60±1.10	27-215	72.90±8.30	-1.79	2.75	0.93	0.72
	Downstream	M	17	19-33	23.00±0.25	60-305	128.40±12.50	-0.95	3.03	0.93	0.59
		F	28	21.5-37	28.40±1.10	60-344	168.60±17.80	-0.92	3.03	0.93	0.64
Hydrocynus vittatus	Upstream	M	13	20-38	26.50±1.05	55-275	100.00±7.40	-2.64	3.22	0.99	0.47
		F	30	22-38	27.20±1.10	50-275	111.00±16.40	-2.61	3.21	0.99	0.49
	Downstream	M	22	14-37.5	25.10±2.30	20-268	119.60±14.10	-1.10	2.23	0.98	0.74
		F	31	14-40	24.00±1.25	24-260	146.60±11.20	-1.14	2.24	0.97	0.74
Citharinus citharus	Upstream	M	15	22.3-37	27.20±0.40	102-609	242.00±18.50	-3.39	3.89	0.93	0.89
		F	22	27.5-38	29.40±0.60	115-600	244.50±26.90	-2.38	3.27	0.91	1.02
	Downstream	M	15	25-40.0	25.80±0.42	118-480	278.60±16.20	-1.14	2.48	0.93	1.27
		F	23	24-37.5	28.90±1.20	118-600	320.80±36.90	-1.67	2.84	0.97	1.29
Lates niloticus	Upstream	M	17	15-42	26.50±1.22	30-740	270.20±44.50	-1.74	2.79	0.99	0.95
		F	20	15-43	26.90±1.20	30-760	276.70±66.50	-1.67	2.76	0.99	0.99
	Downstream	M	12	16-40	23.50±1.25	28-542	199.20±28.40	-2.31	3.12	0.99	0.72
		F	24	16-39	21.90±1.00	28-500	115.20±38.10	-2.02	2.93	0.99	0.76

1).

The condition factor (*K*) of species in this study ranged between 0.47-1.48. The difference in condition factor value of fish specimens collected from up- and downstream sections may be attributed to variation in living conditions such as feeding, habitat quality, climatic condition and fish density. Thus, condition factor of the fish is strongly influenced by biotic and abiotic conditions (Egbal et al. 2011). Thus, condition factor is a veritable tool for assessing the health status of the aquatic ecosystem (Abowei 2009; Ighwela et al. 2011).

Ninety-nine percent of the studied species have growth exponent *b* value ranging from 2-4 limit value. Specifically, the values of *b* varied from 2.48 in *C. citharus* to 3.89 in *O. niloticus* at the downstream section of the Jebba Lake. In the upstream, the values of *b* ranged from 2.75-3.89 with *C. nigrodigitatus* and *C. citharus* having the lowest and highest *b* values, respectively (Table 1). On our estimates on the LWRs of all fish species from Jebba Lake, the observed growth pattern in *A. biscutatus* was similar to that of *A. occidentalis* from River Rima, North-western Nigeria (Shinkafi & Ipinjolu 2010), Akata lake, Benue State, Nigeria (Ikongbeh et al. 2013) and Southeastern Caspian Sea basin (Ghojoghi et al. 2017). The LWR of *O. niloticus* indicates growth in favour of body weight. This observation was similar to growth pattern in new Calabar River, Gbedikere Lake and Anambra River, Nigeria (Ezenwaji, 2004; Adeyemi et al. 2009; Olopade et al. 2018). In contrast, the allometric growth pattern in *C. nigrodigitatus* from Jebba Lake differed markedly from previously observed growth pattern in *C. nigrodigitatus* (Fagade & Adebisi 1979; Ikongbeh et al. 2015). Thus, this difference may imply that *C. nigrodigitatus* consists of heterogeneous species complex with variations in body weight and total length.

The growth patterns in *C. citharus* and

A. baremoze observed in the downstream of Jebba Lake correlated with the previous report on *C. citharus* and *A. baremoze* from Anambra River basin, Nigeria (Ezenwaji & Ezenwaji 2009). This may be attributed to shared environmental conditions and adaptive responses to the depth and size of the river system (Ezenwaji & Ezenwaji 2009). In comparison, the regression values of 3.20 and 2.30 observed in *H. vittatus* from up- and downstream sections of the dam, respectively, were higher than the value reported in *H. forskalii* in River Benue, Nigeria (Ogbe et al. 2008) and the variance may be attributed to environmental conditions in the region (King 1994).

In conclusion, our study provides basic information on the LWRs and condition factor (*K*) of seven commercially important freshwater fish species from the up- and downstream sections of Jebba Lake. Also, the results from this study contributes to the knowledge of fish populations in Jebba Lake. In addition, we recommend further study that would involve broader sampling across different life cycles of all fish species found across the lake, to examine the growth patterns across different life stages and seasons of the year. This will assist fish scientists and managers for future studies and conservation plans, particularly for highly exploited fish populations.

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یافته علمی کوتاه

الگوی رشد و ضریب وضعیت هفت گونه ماهی آب شیرین دریاچه جبا، شمال مرکزی نیجریه

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چکیده: رابطه طول و وزن و ضریب وضعیت هفت گونه ماهی آب شیرین از دریاچه جبا (نیجریه) مورد بررسی قرار گرفت. جمعاً ۵۷۶ نمونه با قلاب، تور پرتابی و گوشگیر از بالادست و پایین دست دریاچه صید گردید. نمونه‌برداری در دو فصل خشک و بارانی از فروردین تا شهریور ۱۳۹۶ صورت گرفت. دامنه تغییرات توان رشد b بین ۲/۲۳-۳/۸۹ و ضریب وضعیت بین ۰/۴۷-۱/۶۱ بود.

کلمات‌کلیدی: رابطه طول و وزن، *Barbus*، *Chrysichthys*، *Hydrocynus*، *Oreochromis*.