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Research Paper

Length -weight relationships of three commercial fish species in Jebel Aulia reservoir, Sudan

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The aim of this study was to record the length-weight relationship of three commercial fish in Jebel Aulia Reservoir, Sudan. This study was conducted during a period from March 2008 to February 2009 on the three main fisheries sites of Jebel Aulia dam (45 Km South of Khartoum State), El hashaba, Kosti and El nuzul. Length weight relationships (LWR) of 1269 fish population covering three commercial fish species (Lates niloticus, Linnaeus, 1758; Oreochromis niloticus, Linnaeus, 1758 and Labeo niloticus Forskål, 1775) were measured and weighted. The parameters (a) and (b) of the length-weight relationship of the form W = a Lb are presented for three fish species. The values of the exponent (b) in the length-weight relationships were (2.98-3.05) Lates niloticus, (2.76-3.07), Oreochromis niloticus and (2.54-2.71) for Labeo niloticus. The coefficient of determination (r^2) was very significant for all three commercial fish species.

Key words: Length – weight, commercial fish species, Jebel Aulia Reservoir.

INTRODUCTION

Jebel Aulia Dam was constructed in 1937 across White Nile River, situated 45 km South of Khartoum State, Sudan. The dam is situated between Longitude 032°29´ E and Latitude 15°14´ N and altitude 377.4 m above sea level and surface area of the dam reservoir extending over 1246 Km^2, mean depth range between 2.3- 6 m and maximum depth 12 m and design capacity is 3.5 mm^3 (Belleman and Khalid, 1998).The length-weight relationship is one of the fundamental parameters in the field of fishery management. It is known that the weight of a fish increases as a function of length (Hadi, 2008). The value regression coefficient (b) when equal 3 indicates that the fish growth is isometric growth, where values less than 3 indicate allometric growth (Sparre and Venema, 1992). Length-weight relationship data are important for fish stock assessment, especially to estimate fish biomass (Kochzius, 1997). The length weight relationship of *Lates niloticus* in Lake Victoria was $W = 0.000006.T.L^{3.17}$

reported by (Mosille *et al.,* 1987). The length-weight relationship of *Lates niloticus* in Nyanza Gulf (Lake Victoria) is calculated $W= 0.0078L^{3.12}$ (Asila and Ogari, 1987).

The values of regression coefficient of length-weight relationship (b) of *Oreochromis niloticus* were found to be 2.915 for male, 3.016 for female and (b) values for *Lates niloticus* 3.00 for male, 3.092 for female, in Jebel Aulia dam reservoir (Ahmed, 1989). Bashir (2007) recorded that, the values of (a) and (b) in Jebel Aulia Reservoir was 1.67 and 3.13 of *Oreochromis niloticus*, 1.4213 and 2.8128 of *Lates niloticus* and 1.2662 and 2.6364 of *Labeo niloticus*. The values of regression coefficient (b) in White Nile for males and females of *Oreochromis niloticus* were 2.6988 and 2.7429, respectively. Values of correlation (r) were 0.9915 and 0.9878, equation for both males and females were: $W = 0.0905\ S.L^{2.6988}$ and $W = 0.07275\ S.L^{2.7429}$ (Salih, 2000). The values of (b) of length weight relationship of *Labeo niloticus* for both male and female at Al kalakla were 2.9770 ± 0.8971 and 3.0401 ± 0.1428, respectively, correlation coefficient (r) 0.9970 for male and 0.9970 for female. The equation of length weight relationship at Al kalakla for both male and female were $W=-4.6640 + L^{2.977}$ and $- 4.5700 + L^{3.0401}$. The regression coefficient (b) of the length -weight relationship of *Labeo niloticus* at Umshaba for both male and female were 2.8480 ± 0.0835, correlation coefficient (r) 0.9990 and 0.9980, respectively mentioned by Ahmed (1978).

MATERIALS AND METHODS

Data collection

A total fish samples 1269 (*Lates niloticus*; *Oreochromis niloticus* and *Labeo niloticus*) belonging to three families Centropomidae; Cichalidae and Cyprinidae were collected randomly from main landing sites in Jebel Aulia Reservoir. Collection data was conducted once monthly on the three main fisheries sites in Jebel Aulia Reservoir (El hashaba 032° 12'E to 14 ° 18' N; Kosti 032°40'E to 13°10'N and El Nuzul 032° 47' E to 12° 37'N (Figure 1). Fishes were caught by using beach seine nets. Total length measured (cm) of each fish was taken from the tip of the snout (mouth closed) to the extended tip of the caudal fin using a measuring board. Body weight was measured to the nearest gram using digital balance (SF-400), large size more than 10Kg were weighed by spring balance (100 Kg).

Length- Weight Relationship

The Length weight relationship (LWR) was estimated by using the equation:

$$W=aL^{b} \quad (1)$$

Where:
W: Weight (g).

The parameters (a) and (b) are functional relationship between standard length and weight was estimated by converting the Logarithmic linear function (Sparre and Venema, 1992).

$$\text{Log10 } W_i = \text{Log } (a) + b \text{ Log } L_i$$

$$\text{Log}(W)=\log(a)+b\log(L) \quad (2)$$

Log (a) and (b) were estimated using least square regression according to (Sparre and Venema, 1992).
Slope (b): is the regression coefficient.
Intercept (a): the intercept of the regression.

Data analysis

The 95% confidence limit of parameters (a) and (b) and the confidence of determination r^2 were also calculated. Statistical analysis was made by using PAST 2007. Version 1.68 (Paleontological Statistics Software Package for Education and Data analysis: paleontological Electronic 4 (Sparre and Venema, 1992).

RESULTS

A total of 1269 specimens of three commercial fish were collected from the fishing grounds beach seine White Nile waters during the present study.The number of individuals sampled (n), the length and weight ranges, parameters (a) and (b) of the length-weight relationships, the standard error of (b) value and the determination coefficient (r^2) for the three species are given in Table 1. In this study the exponent (b) for length-weight relationships of all caught in Jebel Aulia Reservoir species were within the range of 2.54-3.07.

DISCUSSION

In this study, length-weight relationships were determined of *Oreochromis niloticus* in the three sampling stations. According to Sparre and Venema (1992) the values of intercept (a) and regression coefficient (b) were calculated as shown in (Table 1) with high values of (r) range from 0.947-0.929 both in Kosti and El hashaba and 0.885 in El nuzul. These values agree with Kara (1999) who worked on the same species in Rossiers dam reservoir, who found that the values of r^2 = 0.996 and 0.996 for males and females, these values indicate strong positive correlation. On the other hand, Kara (1999) and Bashir (2007) had measured the values of regression coefficient (b) of *Oreochromis niloticus* they found (b = 3.0355 and 3.13) these values of parameter (b) were in close agreement with present study (b = 3.194) indicated that the growth is isometric growth (b = 3),

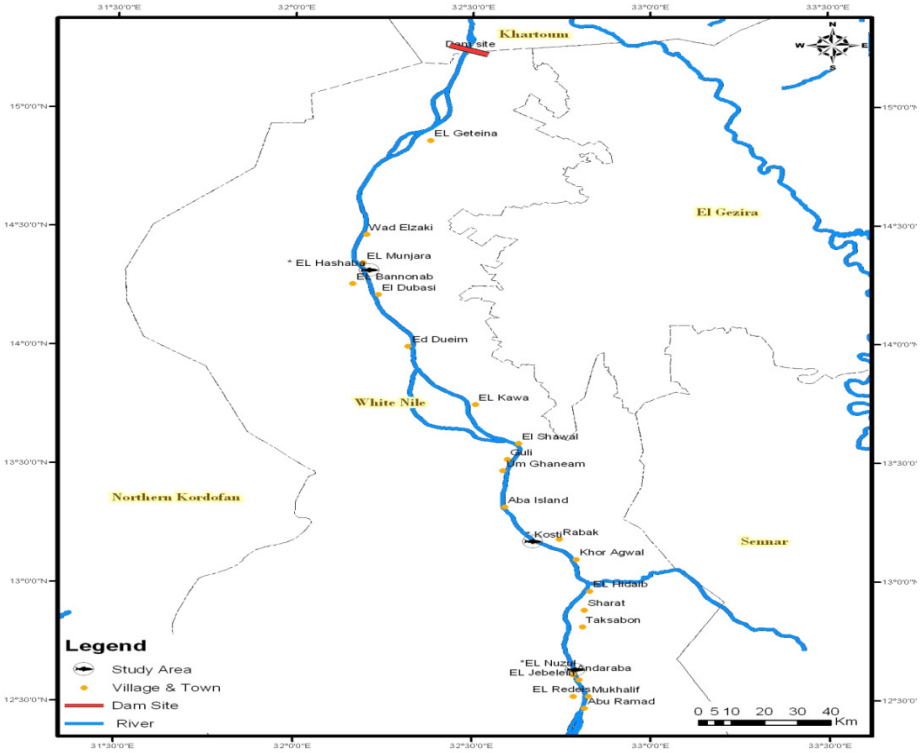

Figure 1. Location of fish sampling in Jebel Aulia Reservoir.

Table 1. Descriptive statistic and length weight relationships parameters of for commercial fish species in Jebel Aulia Reservoir during the period 2008 – 2009.

Family/species	Station	Length (cm)					LWR parameters and statistics						
		n	Mean	S.E	Min	Max	a	S.E(a)	95%CL(a)	b	S.E(b)	95%CL(b)	r^2
Lates niloticus	El nuzul	133	34.1	1.30	17.5	92.5	1.98	0.087	-2.18	3.05	0.130	2.84	0.89
	Kosti	146	26.1	0.88	12.7	71.5	-1.86	0.214	-2.31	2.98	0.154	2.85	0.61
	El hashaba	76	22.8	0.60	13.8	40.2	-1.72	0.152	-2.12	2.88	0.114	2.61	0.88
Oreochromis niloticus	El nuzul	271	20.1	0.41	11.4	471	1.77	0.053	-190	3.02	0.041	2.91	0.94
	Kosti	235	23.4	0.37	13.2	49	-1.86	0.108	-2.11	3.07	0.080	2.90	0.84
	El hashaba	234	19.1	0.33	10	32.1	-1.44	0.078	-1.57	2.76	0.061	2.65	0.88
Labeo niloticus	El nuzul	102	33.38	0.82	15.7	64.1	-1.61	0.146	-1.98	2.71	0.097	2.55	0.87
	Kosti	35	32.8	0.95	19.6	44.1	-1.61	0.235	1.94	2.54	0.034	2.49	0.72
	El hashaba	37	27.8	0.68	17.3	33.9	2.81	0.195	2.60	2.70	0.140	2.47	0.92

n: Sample size; S.E: Standard error; Min: Minimum; Max: Maximum; a and b: Parameters of equation W = a Lb; CL 95%: Confidence limit; r2: Confidence of determination.

Table 2. Type of growth for three commercial fish species of the Jebel Aulia Reservoir.

Family/ Species	Location	n	b	Growth type
Lates niloticus	El nuzul	133	3.05	Isometric
	Kosti	146	2.98	Isometric
	El hashaba	76	2.88	Isometric
	El nuzul	271	3.02	Isometric
Oreochromis niloticus	Kosti	235	3.07	Isometric
	El hashaba	234	2.76	Isometric
	El nuzul	102	2.71	Isometric
Labeo niloticus	Kosti	35	2.54	Isometric
	El hashaba	37	2.70	Isometric

this means that the area offers good condition to the population of *Oreochromis niloticus*. Ahmed (1989) also observed the values of (b) for both males and females of *Oreochromis niloticus* (b = 2.915 for males and b = 3.016 for females). It was revealed that the growths of males were allometeric (b≠3) and of females agrees with present result. Although Ahmed (1989) studied the area in the northern part of White Nile extending 25 Km south of barrage and the present study covered three areas at different environments. Salih (2000) calculated (b) of the same fish species in White Nile; he found that it's allometeric growth [(b) range 2.698 – 2.7429 for males and females]. In general, (b) values indicated allometeric growth compared to present results indicating isometric growth. Njiru et.al. (2006) who reported that there is isometric growth of *Oreochromis niloticus* in Lake Victoria they mentioned that the (b) value was 3.08-3.32 for males and 3.07-3.22 for females these were closer to the (b) value in the present study. In the present work, the values of regression coefficient (b) were found to be 4.216 in El nuzul and 3.656 in El hashaba (isometric growth), 2.944 in Kostia allometeric growth agree with Hughes (1984) who stated similar value for the same species in Gulf Nyanza, Lake Victoria, in spite of different ecosystems. The values of (b) also indicate allometeric growth in agreement with Bashir (2007) who mentioned that b = 2.8128.

Asila and Ogari (1987) and Dadebo *et al.* (2005) calculated the (b) values range between 3.12 and 3.27 are in agreement with the present results.

The values of regression coefficient (b) of *Labeo niloticus* were in the present study range from 3.594 to 3.246 in El nuzul and Kosti (isometric growth) compared to the values of (b=3.0461) reported by Ahmed (1989). The values from the study area showed strong correlation (r = 0.939, 0.929 and 0.706), similar to the value of (r = 0.996 and 0.9980 for males and females) reported by Ahmed (1989).

Conclusion

The present study provided the basic information on the-weight relationships for three commercial fish length species from Jebel Aulia Reservoir, Sudan which would be useful for fishery managers.

AUTHORS` DECLARATION

We declare that this study is an original research by our research team and we agree to publish it in the journal.

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