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*Research Paper*

# Length weight relationship and condition factor of Nile Tilapia *Oreochromis niloticus* (Trewavas, 1983) in the southern part of Jebel Aulia Dam, White Nile, Sudan

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A total number of 298 specimens of Nile Tilapia (*O. niloticus*) were collected from the southern part of Jebel Aulia Dam Reservoir during the period November 2012 to July 2013. Length-weight relationship and condition factor were determined for *O. niloticus* with the regression coefficient 'b' = 3.03357 indicating isometric growth pattern. Mean values of condition factor (K) ranged from 2.97-3.94 for the combined sexes, and varied monthly from 2.18 to 3.65, reflecting good condition and well-being of the fish.The results can be used to fill a gap in the knowledge about this species and provide useful information in the management and conservation for this popular food fish species in the White Nile waters in Sudan.

**Key words**: Condition factor, Jebel Aulia Dam, Isometric growth, Length-weight relationship, Regression coefficient

## INTRODUCTION

The Nile Tilapia (*Oreochromis niloticus,* T.) occurs throughout the year in the man-made lake created by construction of the Jebel Aulia Dam on the White Nile, about 45 km south of Khartoum State, Sudan. It is one of the most popular fishes in Sudan due to its value as a commercial and subsistence fishes for most of the inhabitants living along the White Nile in Sudan (Adam, 1986).

Length-weight relationship of fish is an important tool in fishery management and has been frequently used to estimate weight from length. It is known that weight of fish increases as a function of length (Hadi, 2008). LWR data is important for fish stock assessment, especially to estimate fish biomass (Kochzius, 1997) and for comparative growth studies in fisheries management (Mendes *et al*. 2004). When the value of regression coefficient (b) equals (3) this indicates isometric growth of fish, and when the value is less than (3) this shows algometric growth (Sparre and Venema, 1992).

Condition factor, on the other hand, serves as an indicator of fatness, and general well-being of the fish, based on the assumption that a heavier fish of a given length is in better condition (Kumolu-Johnson and Ndimele, 2010). It represents how fairly deep bodied or robust fishes are (Wooton, 1998).

Previous work carried out on *O. niloticus* in the White Nile, particularly the northern part of Jebel Aulia Dam Reservoir focused mainly on seasonal abundance,

sex structure, reproductive biology and estimation of biomass of some commercially important fish species (Mahdi *et al*., 1973, Ibrahim, 1977, Babiker and Ibrahim, 1979, Babiker, 1984 and 1986, Asma, 1985, Bashir, 2007 and Obeida *et al*., 2013). More recently, Obeida *et al*., (2016) studied the length-weight of three commercial fish species, including O. niloticus in the northern part of Jebel Aulia Reservoir, Sudan.

The objective of the present study was to determine the length-weight relationship and condition factor of *O. niloticus* collected from the southern part of the Jebel Aulia Dam Reservoir to form a base-line data which can be used for future development and management of the fisheries of this commercially important fish species in the White Nile in Sudan.

## MATERIALS AND METHODS

### Description of the study area

The Jebel Aulia Dam was built in 1937 across the White Nile about 45 km south of Khartoum State, Sudan. The dam is located between Longitude 032°29´E and Latitude 15°14´ N at an altitude 377.4 m above sea level (Belleman and Khalid, 1998). The construction of the dam resulted in the formation of a large shallow lake covering an estimated area of about 12,000 hectares, the influence of which is felt over 500 kilometers upstream.

During the rainy season, the level of water in the lake starts to increase gradually in July and reaches its highest level (about 10.5 m) in September, coinciding with the high flood period. The water level in the lake starts to fall from February until April and reaches its minimum level (about 5.0 m) in May, when the reservoir is emptied to a normal river level (Adam, 1977).

The dam stores about 3.5 milliard cubic meters of water with a maximum effect in the last 100 kilometers above the dam. Maximum current speed ranging from 0.4- 0.5m per second was observed in the southern- most portion of the reservoir between Renk and Kosti. However, the current dwindles down to approximately 0.2 m/sec as one approaches the dam and becomes visible only in the main course of the river (Rzoska , 1968).

### Collection of and identification of samples

Specimens of Nile Tilapia (*O. niloticus*) were collected from the catches of artisanal fishermen using gill-nets and beach seines during the period November 2012 to July 2013. Samples were identified according to Abu, (1984) and Bailey, (1994). Fish total length (mm) was measured using a standard measuring board from the tip of the snout to the end of the upper lobe of the caudal fin; while weight was measured to the nearest 0.1g using Sartorius weighing balance (model 1106, Texas, USA ).

### Determination of length-weight relationship

The length-weight relationship (LWR) was estimated by using to the formula

$W = a L^b$ (Ricker, 1975), which when transformed into logarithmic linear function gives:

$\log W = \log a + b \log L$

Where, W = fish body weight (g)
L = fish total length (mm).
The parameters (a) and (b) are functional relationship between length and weight and estimated by using the logarithmic linear function according to (Sparre and Venema, 1992);
where
a = the intercept of the regression.
b = is the slope or regression coefficient.

### Determination of condition factor

Condition factor (K), on the other hand, was computed using the formula: K=100W/L3 (Pauly, 1983);

where
K is condition factor
W = weight of a fish in (gm),
L= total fish length in (mm),

## RESULTS

A total number of 298 specimens of *O. niloticus* were collected from the southern part of Jebel Aulia Dam Reservoir between Kosti and Doeim by using gills nets and seine nets during the period November 2012 to July 2013. The number of sampled fish (n), length and weight ranges and parameters (a) and (b) are given in Table 1.
The length-weight relationship of the combined sexes of *O. niloticus* was calculated as:
$\log W = - 4.58213 + 3.03557 \log L$

The value of regression co-efficient “b” (3.03557) calculated from the length-weight relationship suggests an isometric growth pattern for *O. niloticus* in the southern part of Jebel Aulia Dam Reservoir

The condition factor ‘K” recorded for the combined sexes ranged from 2.97- 3.94, with highest value of “K” (3.94) recorded for fishes ranging in size from 431- 480 mm. while the lowest value (2.97) was obtained for fishes of size 231- 280 mm (Table 2).
Seasonal variation of the condition factor of *O. niloticus* is shown in Table 3. Values of “K” varied widely from 2.18 to 3.65 during the study period. The highest value of “K’ (4.35) was obtained during July, while the lowest value (2.18) was recorded in April (Table 3).

**Table 1.** Number of sampled fishes, length range and LWR parameters of *O. niloticus* in the southern part of Jebel Aulia Dam Reservoir during the period November 2012- July 2013.

| n | Length (mm) | | | Length-weight parameters | | | | |
|---|---|---|---|---|---|---|---|---|
| | min | max | mean | a | b | S.E (b) | 95% CL (b) | $r^2$ |
| 298 | 61.0 | 480.0 | 25.6 | - 4.582 | 3.035 | 0.052 | 2.85 | 0.83 |

n: Sample size; min: minimum; max: maximum; a and b: regression coefficients, SE (b); standard error of (b); CL: 95% confidence limit; r: coefficient of determination.

**Table 2.** Number of sampled fishes, length range, mean length and mean condition factor (K) of *O. niloticus* in the study area.

| n | Length range (mm) | Mean length (mm) | Mean (K) | SD | SE |
|---|---|---|---|---|---|
| 50 | 61- 130 | 111.0 | 3.26 | 1.32 | 0.19 |
| 72 | 131- 180 | 155.0 | 3.23 | 0.73 | 0.09 |
| 93 | 181- 230 | 210.0 | 3.38 | 0.82 | 0.09 |
| 46 | 231- 280 | 256.0 | 2.97 | 0.99 | 0.14 |
| 18 | 281- 330 | 312.0 | 3.79 | 1.00 | 0.24 |
| 11 | 331- 380 | 363.0 | 3.17 | 0.62 | 0.19 |
| 5 | 381- 430 | 400.0 | 3.44 | 0.73 | 0.32 |
| 3 | 431- 480 | 443.0 | 3.94 | 0.50 | 0.29 |

(n= sample size; SD = standard deviation; SE= standard error of the mean).

**Table 3**. Seasonal variation of condition factor of *O. niloticus* during the period November 2012 and July 2013.

| Month | n | K | SD | SE |
|---|---|---|---|---|
| Nov., 2012 | 12 | 3.29 | 0.36 | 0.11 |
| Dec., 2012 | 44 | 2.97 | 0.62 | 0.09 |
| Jan., 2013 | 21 | 2.41 | 0.77 | 0.17 |
| Feb., 2013 | 54 | 3.03 | 0.64 | 0.09 |
| Mar.,2013 | 16 | 2.89 | 0.70 | 0.18 |
| Apr.,2013 | 5 | 2.18 | 0.88 | 0.39 |
| May.,2013 | 8 | 2.35 | 0.63 | 0.22 |
| Jun.,2013 | 88 | 3.14 | 1.03 | 0.00 |
| Jul., 2013 | 10 | 3.65 | 0.40 | 0.06 |

(n= sample size; SD = standard deviation, SE= standard error of the mean).

## DISCUSSION

In the present study, the value obtained for the regression coefficient (b) was b=3.03557 revealing an isometric growth pattern of *O. niloticus* in the study area. However, Ahmed (1989) worked in an area close to the Jebel Aulia Dam, reported values of the regression coefficient (b) for males and females of *O. niloticus* of 2.915 and 3.016, respectively. Similarly, Bashir (2007) reported values of the regression coefficient (b) of the combined sexes of *Oreochromis niloticus* in the northern part of Jebel Aulia Dam Reservoir as b = 3.13. Recently, Obeida *et al*. (2016), studied length-weight relationship of O*. niloticus* in three localities in Gebel Aulia Reservoir and reported values of (b) ranging from 2.67- 3.07 for the combined sexes. These values agree favorably with the results obtained in the present study (3.0355 7), suggesting that the local conditions in the study area were suitable for the growth of *O. niloticus.*

Values of condition factor (K) for the combined sexes ranged from 2.18 to 3.65. These values coincided with the periods of the lowest (April- May) and highest (July-September) water levels in the reservoir. The observed seasonal variation in condition factor may be influenced by environmental factors, availability of food supply, full development of gonads, (Anibeze, 2000). However, environmental conditions in the study area were generally favourable for the growth of *O. niloticus*. Surface water temperature ranged from 16.0- 31.0 0C (mean 25.68 °C), pH ranged from 7.4- 8.6, dissolved oxygen concentration ranged from 4.12- 10.8 mg/ l (average 6.6 mg/l), water transparency ranged from 12.5- 52.0 cm and water conductivity from 160- 330 µs / cm (Asma, 1985).

Condition factor (K), on the other hand, is an important

tool in understanding the condition and general well-being of the fish, based on the assumption that a heavier fish of a given length is in better condition (Kumolu-Johnson and Ndimele, 2010). The high values of condition factor recorded for *O. niloticus* reflect that the environment conditions in the study area were favorable for the growth and survival of the fish.

## Conclusion

In the present study, *O. niloticus* exhibited isometric growth pattern (b=3.03357), indicating that the local environment was favorable for their growth. The results of this study agree favorably with those obtained by other workers who studied the length-weight relationship of this species in the northern part of Jebel Aulia dam Reservoir. Condition factor (K) of the combined sexes of *O. niloticus* ranged from 2.97- 3.94 ± 0.21. Seasonal variations of (K) were also observed during the study period, with values ranging from 2.18 ± 0.88 in April to 3.65 ± 0.40 in July.

## 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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