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Research Article

Length-weight Relationship and Condition Factor of *Notopterus afer* (Günther, 1868) and *Lates niloticus* (Linnaeus, 1762) in river Jong, Sierra Leone

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ABSTRACT

The well-being of fish in the environment where they grow is evaluated often with the length-weight relationship and condition factor. In this study, the length-weight relationships and condition factor 'K' of 46 specimens of *Lates niloticus* (Linnaeus, 1762) and 92 specimens of *Papyrocranus* (=*Notopterus) afer* (Günther, 1868) were studied for 6 months (August, 2016 - February, 2017). The formula LogW = - 1.5089 + 2.6634TL and LogW =-1.7988+ 2.7005LogTL were used to determine length and weight of the fish samples. A positive 'r^{2}' of 0.7904 exists between the length and weight of *Lates niloticus* while that for *Notopterus afer* was 0.6995.The 'b' value of *L. niloticus* was 2.66 while that of *N. afer* was 2.70 and were not significantly different from 3 (P > 0.05). The 'b' value for the two species showed negative allometric growth. *L. niloticus* exhibited positive allometric growth in weight (b>3) in the dry and rainy season while for the length it was negative allometric growth (b<3). A similar result was obtained for *N. afer* in both dry and rainy season. Condition factor (K) of 0.575 and 0.520 was recorded for *N. afer* during the rainy and dry season while K values of 1.23 and 1.03 were recorded for *L. niloticus* in the dry and rainy seasons respectively. In both seasons for the species, growth appeared to correlate positively with condition factor (K). All the water quality parameters monitored excepting turbidity fell within recommended range for the growth and survival of tropical fishes.

INTRODUCTION

The length – weight relationship and condition factors of two commercially important fish species *Notopterus afer* and *Lates niloticus* in River Jong, Sierra Leone was investigated. River Jong also known as Taia and Pampana at its different stretches originates in the Sula mountain in the Northeast of Sierra Leone (09^{o} $15^{'}$ N, 11^{o} $30^{'}$ W). The origin is a small lake (Lake Sonfon) in Diang chiefdom, Koinadugu District, Northern Sierra Leone. Lake Sonfon is the only natural lake in the interior of Sierra Leone (Clarke, 1969). According to Clarke (1969), River Jong is approximately 249 km long; it enters the sea at Mattru, and its drainage basin covers an area of approximately 7500 km^{2}. River Jong receives anthropogenic wastes along its stretches especially domestic wastes, agricultural effluents and tailings from gold, diamond and rutile mines. These wastes are believed to have negative consequences on the productivity of the river`s fauna and flora. Many assessment studies have been carried out in recent times on the river`s fauna and flora but information on the length–weight relationship and condition factor of fish species from the river is scanty if any at all. Length-Weight relationship and condition factor are important tools used by fisheries scientists to determine the growth pattern of fish and the conditions in which the growth takes place. The growth of any fish is related to the prevailing environmental conditions. Many authors have explained the importance of condition factor as a useful tool for assessing fish growth rate, age and feeding intensity (Abowei, 2006; Oribhabor *et al.*, 2011; Abu and Agarin, 2016; Kumolu-Johnson and Ndimele, 2010; Onimisi and Ogbe, 2015). Enetimi *et el.*,(2016) noted that the K of fish diminished when the food availability in one area decreased. The aim of this study is to evaluate the length-weight relationship and condition factor of two important fish species from River Jong, Sierra Leone. Information provided by this study will serve as a baseline for further research on fish species in the river.

MATERIALS AND METHODS

River Jong where the study was carried out originates in the Sula Mountain in the Northeast of Sierra Leone ($09^0$15' N, $11^0$30' W). The Jong is approximately 249 km long, entering the sea at Mattru, and its drainage basin covers an area of approximately 7500 km^2 (Clarke, 1969). The predominant soi1 type in this area is Laterite, overlying granite (Odell *et al.*, 1974). Fish sample collection was done during the months of August 2016 to January 2017 at three different locations along the stretches of the River – Pampana (upper reach), Njala (middle reach) and Mattru Jong (lower reach). During the rainy season (August to October 2016) and dry season (November 2016 – January 2017), 46 specimens of *L. niloticus* and 92 specimens of *N. afer* were collected monthly from fisher folks at the three sampling locations. Gillnets, hook and line and beach seine were the fishing gears used by the fisher folks. Specimens collected were kept in ice-chilled boxes to reduced spoilage. Total length (TL) was measured from the tip of the snout to the extended tip of the caudal fin to the nearest 0.1cm, with corresponding weight measured to the nearest 0.1g. The total lengths and fish weight were taken with measuring board and an electronic balance respectively. The relationship between the length (L) and weight (W) of the two fish species was calculated using the cube law suggested by LeCren (1951). The values of the combined growth exponent were used for the calculation of condition factor $K=100W/L^b$

RESULTS AND DISCUSSION

Length-Weight relationship was determined for 46 specimens of *Lates niloticus;* the regression equation for the fish was expressed as LogW=-1.508+2.6634LogTL (Figure 1) with r^2 = 0.7904. For the *N. afer* 92 specimens were determined with regression equation expressed as LogW=-1.7988+2.7005Log TL and r^2 = 0.6995 (Figure 2).

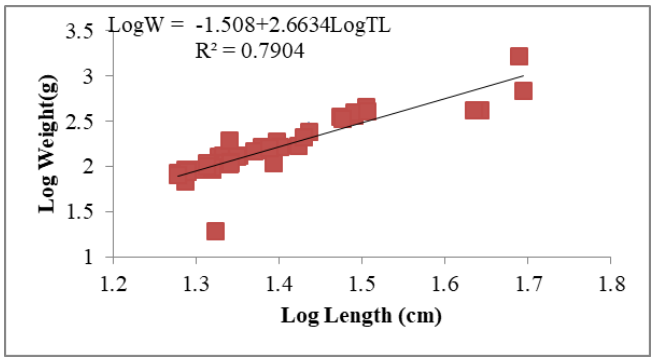

Fig. 1: Length-weight relationship of *L. niloticus*

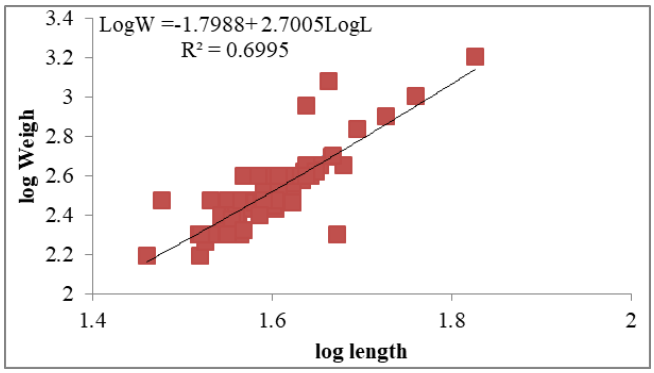

Fig. 2: Length-weight relationship of *Notopterus afer*

The growth exponent b for *L. niloticus* and *N. afer* was 2.6634 and 2.7005 with r^2 values of 0.7904 and 0.6995 respectively. This trend connote a strong positive correlation between length and weight but a negative allometric growth pattern for the two species. The t-test analysis showed that the b values for the two species were not significant ($p>0.05$) as they do not differ significantly from 3. The results of this study was similar to that of Sadiku and Oladimeji (1991) where a b value of 2.660 was obtained for the sudy conducted in Zaria dam, nothern Nigeria. Du-Feu and Abioun (1998) also recorded a b value of 2.935 in Lake Kainji, Nigeria, while Laleye (2006) obtained a b value of 2.984 in Oueme River Basin, Benin. Similar results were observed by King (1996) in Ikpa River, Nigeria with b value of 2.663 and Konan *et al.*,(2007) in River Bia, Ivory Coast with a b-exponent of 2.922.

Table 1 summarized the relationship that exists between the Length, weight and condition factor (Kn) for *L. niloticus* and *N. afer* in River Jong. There is little correlation between length and weight for the *N. afer* species compare to *L. niloticus* species in this study. Length-weight relationship of fishes offers a couple of information including their pattern of growth and stages of life cycle. This statistical data is often important to determine their population structure and their interaction with the habitat where they are living. The results of this study are also in agreement with the work of Ahouanson *et.al*. (2009) on the length-weight relationship and condition factor of the Nile perch (*Lates niloticus)* in the Pendjari River, West Africa.

Table 1: Length-weight relationship parameters and condition factor (Kn) in *L. niloticus* and *N. afer* of the Jong River.

Species	N	a	b	r^2	Growth type	CF (overall mean)
L. niloticus	46	-1.5089	2.66	0.7904	Negative Allometric	1.1± 0.264
N. afer	92	-1.7988	2.7005	0.6995	Negative Allometric	0.542± 0.139

Where: N = sample size, r² = coefficient of determination, a (intercept) and b (slope) = estimated parameters of the length-weight relationships and CF= condition factor.

The result of the condition factor for the combined sexes of *N. afer* ranged from 0.422 – 0.754 while for *L. niloticus* it was 0.538 – 1.265. The lowest condition factor was recorded in the month of January while the highest value was obtained in August for *N. afer* (Figure 3). Condition factor was lowest for *L. niloticus* in the month of September and highest in January (Fig. 3). It is obvious that the K values for *L. niloticus* in this study was better than that of *N. afer*, which is an indication that river Jong provides a better environment for their growth. This can be explained by the fact that *L. niloticus* have better access to food materials especially in the dry season when the water volume is low and thus easily capture it preys. In the rainy season when the water volume is high, the preys for *L. niloticus* become sparse as they move into the tributaries of the river. Condition factor (K) is a useful measure to determine the well-being of the fish as well as other variables such as growth pattern, reproductive maturation, ecosystem health, climatic variations etc. K values has also been reported to be used as a parameter to estimate the characteristics of fish body structures, such as b values for a certain fork length (Jin *et al.*, 2015). Empty stomachs and

health problems especially in large fish according to Percin & Akyol (2009) have the ability to induce decreasing K values.

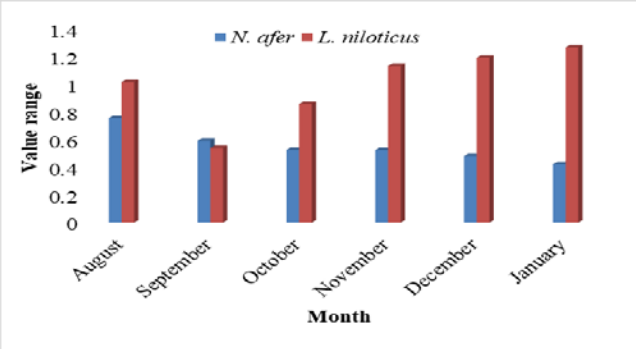

Fig. 3: Mean monthly condition factor for *N. afer* and *L. niloticus*

Stenseth *et al.*, (2002) reported that the increasing sensitivity to ambient surroundings for larger/older and premature fish might cause a decrease in their K values. In this study, the mean condition factors obtained for the two fishes were above 0.50, which is an indication that the environment in which the fishes thrives is favorable. The results of this study was in agreement with the findings of Kembenya *et al.*, (2014) who reported mean condition coefficient (K) of 1.02 ± 0.04 and 1.12 ± 0.02 for males and females *O. niloticus* respectively in Kenya. The result was also in agreement with Olurin and Aderibigbe (2006) especially the K value obtained for *L. niloticus*, which was close to 1.14 in males and 1.08 in females reported for juvenile *O. niloticus*. Bennet (1970) stated that fishes with condition factor value above 0.56 are considered to be in good condition; while Ayode (2011) opined that condition factor higher than one suggests good fish health condition. Variations in the condition factor of many fishes is believed to be related to their reproductive cycle (Narejo *et al*, 2002), feeding rhythms, physio-chemical factors of environment, age, physiological state of fish or some other unknown factors (Dar *et al.*, 2012).

Water quality parameters measured included temperature, dissolved oxygen (DO), conductivity, turbidity, pH, total dissolved solids (TDS) and biological oxygen demand (BOD). The results of the water quality parameters monitored with the exception of turbidity (13.7±4.5 – 21.3±4.0) were within the recommended range for the culture of tropical fish species (Omitoyin, 2007). Gold mining activities at the upper reach of the river (Pampana) where little or no fishing activities takes place could be responsible for the high turbidity recorded in this study (Table 2).

Table 2: Mean monthly water quality parameters in River Jong

Parameters	Months					
	August	**September**	**October**	**November**	**December**	**January**
Temperature	26.75±0.05	27.05±0.05	26.85±0.15	26.6±0.4	26.55±0.15	25.75±0.75
Dissolved Oxygen	6.4±0.4	6.6±0.4	6.65±0.65	7.05±0.05	5.8±0.2	4.8±0.6
Conductivity	20.0±1	21.5±1.5	17.0±1	19.0±1	18.0±1	22.5±1.5
Turbidity	19.3±4.5	20.8±3	21.3±4	17.5±2.5	17±3.8	13.7±4.5
pH	6.7±0.015	6.7±0.1	6.8±0.05	7.0 ±0.06	6.9±0.1	6.5±0.025
TDS	20.8±2	19±1.7	24±1.7	23.5±3.5	20.7±3	24.3±4.1
BOD	2.5±0.5	2.3±0.05	2.5±0.21	2.7±0.4	2.2±0.36	2.6±0.3

This table shows the pooled mean water quality parameters monitored for the three reaches of river Jong.

CONCLUSION

This paper provides information for the first time on the length-weight relationship and condition factor (K) of selected fish species in river (Jong). The study confirmed that the length of a fish has a close relationship with its weight. It was evident from the study that the b-exponent and condition factor of *L. niloticus* were higher in the dry season, but higher for *N. afer* in the rainy season. The high values of b- exponent and condition factor (K) obtained indicate that the two selected fish species regardless of seasons were in robust condition. So many reasons have been adduced for this, notably the availability of food and favourable growth environment. One can based on the results, conclude that river Jong is favourable to the fishes it harbours, but it is important to advise that there is a need for constant monitoring of the river, especially the upper course (Pampana) where gold and sand mining activities are taking place unabated. The results of this study will not only be useful as a baseline for future fishery research on Jong, but will inform policy decisions by the Ministry of Fisheries and Marine Resources (MFMR) on inland water fishery resources management

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