Length-weight relationship and condition factor of Clariid fish species in Kano Rivers, Kano State, Nigeria

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Abstract

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*Fish found in natural tropical and sub-tropical water system experience frequent growth fluctuations. The study was conducted to determine the length-weight relationship and condition factor of Clariid species (*Clarias gariepinus*, *Heterobranchus longifilis* and *Synodontis clarias*) in Kano state of Nigeria. About 177 fish samples were collected from six rivers (Thomas, Ghari, Tiga, Duddurun-Gaya, Karaye and Bagwai) across the length and breadth of Kano state. Body weight (BW=248.48g), total length (TL=32.74cm) and standard length (SL=26.16cm) were determined. The length-weight relationship and condition factors were also determined. The condition factors showed varying degree of well-being of fish sampled from their habitat, and ranged from $K = 0.37$ to 0.89 . The equation for the length-weight relationship for the three strains is: *C. gariepinus* = $-329.86 + 17.56TL$, *H. longifilis* = $-241.49 + 14.28TL$ and *C. clarias* = $-428.51 + 22.72TL$. Body weight and length had positive and significant relationship ($r = 0.73 TL$; $r = 0.75 SL$).*

Keywords: Length-weight relationship, condition factor (Ponderal index), Clariid species

Introduction

Fish found in tropical and sub-tropical water system experience frequency growth fluctuations due to factors such as food composition changes, environmental changes, rate of spawning and so on. Length-weight and length-length relationships can be used to assess the influence of these factors (Adeyemi, 2011). In order to estimate the biomass, it is necessary to know the length-weight relationships of the species under study. Relative weight is a suitable index for comparing condition across populations and species (Froese, 2006). Knowledge of quantitative aspects such as length-weight relationship and condition factor (K) or Ponderal index is an important tool for the study of aquatic organisms. The knowledge can be used to predict weight from length measurements made in yield assessment (Pauly, 1983). Fish can attain either isometric growth, negative allometric

growth or positive allometric growth. Isometric growth is associated with no change in body shape as an organism grows. Negative allometric growth implies the fish becomes more slender as it increase weight while positive allometric growth implies the fish becomes relatively stouter or deeper-bodied as it increase in length (Riedel *et al.*, 2007). The condition factor (K) serves as an indicator of physiological state of the fish in relation to its welfare. It also provides information when comparing two populations living under different feeding densities and climatic conditions (Weatherly and Gills, 1987). Thus, condition factor is important in understanding the life cycle of fish species and it contributes to adequate management of these species, thereby maintaining equilibrium in the ecosystem.

Length and weight are two basic components in the study of the biology of fish species at individual and population

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levels (Ekelemu and Zelibe, 2006). It is of prime importance in fish yield equations and stock assessments, estimation of biomass and in the prediction of the weight of fish from a given length in yield assessment. It is further employed in the studies of gonadal development, condition factor 'Kf' (the general well-being or relative fitness of the individual) as well as providing information on growth patterns (Ekelemu and Zelibe, 2006).

Materials and methods

Study location

Kano state is located in the semi-arid area of North-western Nigeria. It has a population of 9,383,682 comprising of 4,844,128 males and 4,539,534 females (NPC, 2006). Kano state is the commercial nerve centre of Northern Nigeria. It is located between latitude 10°33' and 12°27' north of the equator and longitude 7°34' and 9°29' east of the Greenwich meridian and as such it is part of Sudano-Sahelian vegetation zone of Nigeria. The study was conducted in six selected water bodies in Kano State, namely, River Thomas and River Ghari to the north, River Duddurun-Gaya to the east, River Kano (Tiga section) to the south, Rivers Karaye and Bagwai to the western part of the state. The first three locations were selected due to their independent flow and disconnected tributaries. The remaining three locations had the same origin as the Kano river, but the Tiga section of the river flows towards the south while the Karaye river flow towards the western part of the state.

The weight and total length of each sample was taken and recorded against their tag number. The determined total length of fish

samples was used alongside the determined weight to estimate length-weight relationship of the samples according to Ricker (1978).

The formulae $W = a \times L^b$ or $\log W = \log a + b \log L$ was used,

Where;

W = weight of fish samples,

L = total length of fish samples,

a = intercept

b = regression coefficient.

The condition factor (K) was computed according to Pauly (1983) using the formulae:

$$K = 100W/L^3$$

Where;

W = weight of fish samples

L = total length of fish samples.

Results

Condition factor of Clariid species

Table 2 shows the condition factor (Ponderal index) for the three strains of Clariid species studied. The condition factor which shows the degree of wellbeing of the fish in their habitat is expressed by 'coefficient of condition'. The condition factor of the fish species varied in all the rivers sampled. *Clarias gariepinus* in River Thomas, River Ghari and River Duddurun-Gaya had a better condition of wellbeing with 'K' values of 0.64, 0.74 and 0.67 respectively than those in River Karaye and River Bagwai with 'K' values of 0.46 and 0.37 respectively. *Heterobarnchus longifilis* were all in good condition of wellbeing in the rivers sampled with 'K' values ranging from 0.61 in River Karaye and 0.88 in River Ghari. River Tiga only harbor *Synodontis clarias* and their condition was very good with condition factor of 0.89.

Table 1: Summary statistics for the morphometric characteristics of the fish populations in the study area

Characteristics	Cg	HI	Sc	CV (%)
Body weight (g)	190.54±11.59	318.73±42.12	236.16±31.29	60.03
Total length (cm)	29.63±0.55	39.23±1.06	29.36±1.40	18.31
Standard length (cm)	26.23±0.50	29.05±1.04	23.19±1.08	17.97

Cg = *Clarias gariepinus*

HI = *Heterobranchus longifilis*

Sc = *Synodontis clarias*

Table 2: Condition factor of Clariid species in the six rivers sampled

Location	Cg	HI	Sc
River Thomas	0.64(4)	-	-
River Ghari	0.74(26)	0.88(4)	-
River Dudusin-Gaya	0.67(50)	-	-
River Karaye	0.46(25)	0.61(8)	-
River Bagwai	0.37(38)	0.62(4)	-
River Tiga	-	0.81(13)	0.89(8)

Cg = *Clarias gariepinus*

HI = *Heterobranchus longifilis*

Sc = *Synodontis clarias*

Length-weight relationship in Clariid species

Table 3 shows the length-weight relationship of the three strains of Clariid species found in Kano State. The equations indicate the pattern of growth, either isometric or allometric. From the equation, the present result showed that b (regression coefficient) was 17.56 for *Clarias*

gariepinus, 14.28 for *Heterobranchus longifilis* and 22.72 for *Synodontis clarias*, indicative of fish positive allometric pattern of growth for *Clariid* species. When the regression coefficient is 3, the growth pattern is isometric. Negative allometric growth pattern is when the regression coefficient is less than 3.

Table 3: Regression equation for the length-weight relationship in the strains of fish sampled

Strains	Prediction equation	±SE	R ²	LS
<i>C. gariepinus</i>	-329.86+17.56TL	30.11	0.69	**
<i>H. longifilis</i>	-241.49+14.28TL	30.14	0.13	NS
<i>S. clarias</i>	-428.51+22.72TL	37.55	0.98	**

LS=level of significance ; R²= coefficient of determination; ±SE=standard error; C=Clarias; H=Heterobranchus; S=Synodontis

Discussion

Fish can attain either isometric growth, negative allometric growth or positive allometric growth. Isometric growth is associated with no change of body shape as an organism grows ($b = 3$). Negative allometric growth implies the fish becomes more slender as it increase in weight ($b < 3$) while positive allometric growth implies the fish becomes relatively stouter or deeper-bodied as it increases in length ($b > 3$) (Riedel *et al.*, 2007).

The regression coefficient obtained from this study indicated positive allometric growth pattern depicting that the Clariid strains studied had stouter bodies as they increase in length. This was in agreement with Abowei *et al.* (2009), Abowei and Hart, (2009), Olurin and Aderibigbe, (2006), Dankishiya, (2013), and Suleiman *et al.* (2015) who worked with *Clarias gariepinus* from cultured environment. Also, Ibrahim *et al.* (2012) observed allometric pattern of growth in Kontagora Reservoir while Ude

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et al. (2011) made similar findings in fish species of Ebonyi River.

The condition factor which shows the degree of wellbeing of the fish in their habitat is expressed by 'coefficient of condition'. This factor is a measure of various ecological and biological factors such as degree of fitness, gonad development and the suitability of the environment with regard to the feeding condition (Alex *et al.*, 2012). When condition factor value is higher it means that the fish has attained a better condition. The condition factor for all the water bodies ranged from 0.37 to 0.89 for the Clariid species indicating the good condition and proper wellbeing of the fishes in their habitat.

Conclusion

The length-weight relationships of the sampled Clariid species revealed that the Clariid species expressed a positive allometric pattern of growth (Cube law of growth). The condition of living as revealed by Condition factor (Ponderal index) for the specie and their respective water bodies together with the estimated 'K' values indicated that the physicochemical and biotic variables in the water bodies were within acceptable limits for fish production ($K = 0.37 - 0.89$) in freshwater ecosystem. These could serve as a benchmark leading to improved policy on stocking and managing water bodies, fisheries management and sustainable management of its numerous resources in Kano State.

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